



Departamento de Fundamentos de Análisis Económico

Universidad de Santiago de Compostela

THESIS DOCTORAL:

**The Impact of Rising Food Prices in Tajikistan:
Evidence from Estimations of Food Demand
Systems**

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*“I have not asked for life. But I try to accept whatever life brings without surprise.
And I shall depart again without having questioned anyone about my strange stay here on
earth.”*

(Omar Khayyam)

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“Be happy with all these moments. These moments are your life.”

Abstract

This PhD dissertation aims to examine household consumption patterns in Tajikistan and their response to changes in food prices and other factors. The research is carried out through estimations of the food demand system.

Chapter 1 briefly describes the socio-economic situation in Tajikistan over the period of independence since 1991, considering the transition of the Tajik economy from central planning to a market-based system, and describing its socio-economic reforms and challenges, in particular those related to agriculture and the rural areas.

Chapter 2 investigates the extent and speed of price transmission from international to local food markets, using vector error correction models (VEC) and threshold co-integration models to analyse the price transmission mechanism. The results are interpreted in the context of the discussion on effects of agricultural and trade policies on food security in Tajikistan.

Chapter 3 estimates a Quadratic Almost Ideal Demand System (QUAIDS) model of the food demand system for Tajikistan using the microdata from Tajikistan Living Standard Measurement Survey (LSMS) of 2003, 2007 and 2009, for seven aggregate food products. The estimation employs the two-step approach of Shonkwiler and Yen, (1999), to account for zero values in consumption expenditure. The results provides precise information about household food consumption behavior taking into account the effects of the various socio-economic characteristics on which the Tajik households are heterogeneous.

Finally, **Chapter 4** analyses the seasonal food consumption pattern of Tajik households using a complete demand system based on quarterly data from the *Household Budget Survey of Tajikistan* of 2013-2014. The main contribution of this chapter is the use of household longitudinal data and a QUAIDS model to take into account both yearly and seasonal food consumption behaviour on the part of the Tajik households.

Resumen

Esta tesis doctoral tiene como objetivo examinar los patrones de consumo de las familias en Tayikistan y su respuesta a variaciones en los precios de los alimentos y otros factores. La investigación se desarrolla realizando estimaciones del sistema de demanda de alimentos.

El capítulo 1 describe brevemente la situación socioeconómica en Tayikistan a partir de 1991, teniendo en cuenta su transición desde la planificación central hacia un sistema de mercado, y describiendo su proceso de reformas, en particular las relacionadas con el sector agrícola y las áreas rurales.

El capítulo 2 investiga la transmisión de los precios de los alimentos desde los mercados internacionales hasta los locales, utilizando modelos vectoriales de corrección de errores (VCE) y modelos de co-integración con umbrales. Los resultados se interpretan en el contexto del debate sobre los efectos de las políticas comerciales y agrarias sobre la seguridad alimentaria en Tayikistan.

El capítulo 3 estima un sistema cuadrático casi ideal de demanda (QUAIDS) para la demanda de alimentos de Tayikistan, utilizando los microdatos de la Encuesta de Medición de Estándares de Vida (LSMS) de 2003, 2007 y 2009, para siete grupos de alimentos. Se emplea el enfoque en dos etapas de Shonkwiler y Yen (1999) para resolver el problema de los valores nulos en el consumo. Los resultados proporcionan información acerca del consumo de alimentos por parte de las familias, teniendo en cuenta su heterogeneidad respecto de una serie de características.

Finalmente, el capítulo 4 analiza los patrones estacionales de consumo de alimentos de las familias tayikas utilizando un sistema de demanda estimado a partir de datos trimestrales de la Encuesta de Presupuestos Familiares de Tayikistan para 2013-2014. La principal contribución es el uso de datos longitudinales y un modelo QUAIDS para tener en cuenta el comportamiento estacional por parte de las familias tayikas.

Resumo

Esta tese doutoral ten como obxectivo examinar os patróns de consumo das familias en Tayikistan e a súa resposta a variacións nos prezos dos alimentos e outros factores. A investigación desenvólvese realizando estimacións do sistema de demanda de alimentos.

O capítulo 1 describe brevemente a situación socioeconómica en Tayikistan a partires de 1991, tendo en conta a súa transición dende a planificación central ata un sistema de mercado, e describindo o seu proceso de reformas, en particular as relacionadas co sector agrícola e as áreas rurais.

O capítulo 2 investiga a transmisión dos prezos dos alimentos dende os mercados internacionais ata os locais, utilizando modelos vectoriais de corrección de erros (VCE) e modelos de co-integración con umbrais. Os resultados interprétanse no contexto do debate sobre os efectos das políticas comerciais e agrarias sobre a seguridade alimentaria en Tayikistan.

O capítulo 3 estima un sistema cuadrático casi ideal de demanda (QUAIDS) para a demanda de alimentos de Tayikistan, utilizando os microdatos da Enquisa de Medición de Estándares de Vida (LSMS) de 2003, 2007 y 2009, para sete grupos de alimentos. Emprégase o enfoque en dúas etapas de Shonkwiler y Yen (1999) para resolver o problema dos valores nulos no consumo. Os resultados propocionan información sobre o consumo de alimentos por parte das familias, tendo en conta a súa heteroxeneidade respecto dunha serie de características.

Finalmente, o capítulo 4 analiza os patróns estacionais de consumo de alimentos das familias tayikas utilizando un sistema de demanda estimado a partires de datos trimestrais da Enquisa de Presupostos Familiares de Tayikistan para 2013-2014. A principal contribución desta análise é o uso de datos lonxitudinais máis un modelo QUAIDS para ter en conta o comportamento estacional por parte das familias tayikas.

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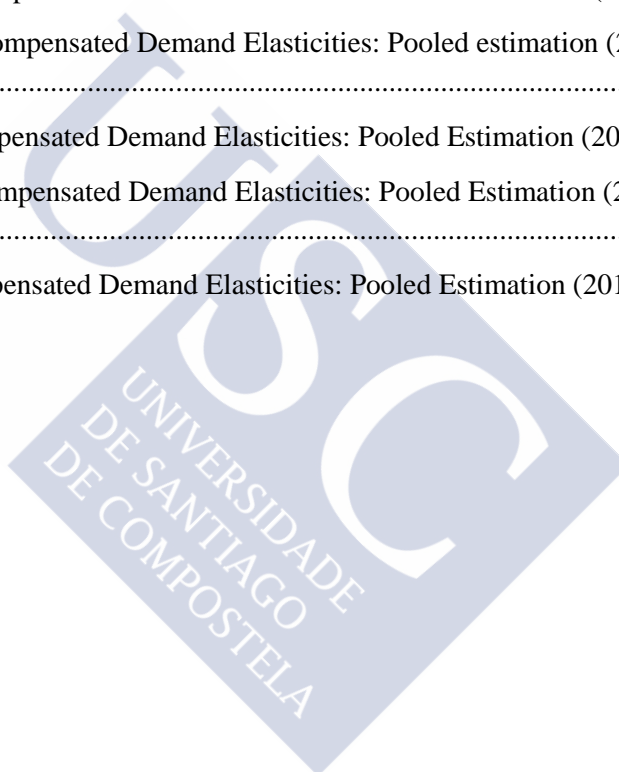
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General Introduction



General Introduction

The studies of food consumption pattern in Tajikistan received specific priority attention among the researchers and policymakers as the collapse of traditional production linkages and trading partnership systems with the break-up of the Soviet Union in 1991 and the subsequent 1991-1997 civil war, resulted in sharp economic deterioration in Tajikistan. As a result, the demand for food and dietary patterns as a whole in Tajikistan have undergone severe upheavals, with drastic declines both in quantitative and qualitative terms (see Table A1 in the Appendix). Therefore, households have started to spend on average more than 80% of their revenues on food consumption (Taj STAT, 2014); in particular, the number of insecure households whose food consumption largely relies on international humanitarian aids and on home food production increased considerably. Because 74% of the Tajik people are living in rural areas, the country has embraced agricultural production, employing the majority of the labour force in this sector (66% according to Taj STAT, 2014), leaving most of households depending typically on their own production for their food supply.

Since the year 2000, the country has grown at an impressive average annual growth rate of 8.8%. Agricultural production, accounting for 24% of the GDP on average in this period (Taj STAT, 2014), contributed crucially to the development of the post-civil war households' well-being, food diet composition and nutrition levels, especially in rural areas. The increase in agricultural production was a response to expanding demand for food after the political situation stabilized, and the government of Tajikistan could implement several economic and institutional reforms.

Nevertheless, remittances from migrants have become the decisive income source for the majority of Tajik households in this period, reaching levels estimated at 49.7% of GDP in 2013 (WDI, 2013). A high unemployment rate and widespread poverty are the main reasons behind the steady out-migration inflow from Tajikistan, in particular to the Russian Federation (Olimova and Bosc, 2003). As the experience of the last two years show, this a very volatile basis for sustaining households' consumption. Due to the economic slowdown and the steep currency depreciation in Russia, the cash sent home by migrants declined dramatically (World Bank Group, 2015). According to the statistical evidence from the Central Bank of Russia, the money transfers to

Tajikistan by Tajik migrants have been reduced to a third of their former level (CB of Russia, 2016).

Consequently, Tajikistan is now facing financial instability via devaluation of the national currency, the *somoni* (TJS), which directly influences food supplies and food prices, mainly through the increase in the prices of food imports in a country where the dependence on food imports is more than 50 % (FAOSTAT, 2013). On the other hand, domestic food prices are subject to price transmission from world to domestic markets. Since, Tajikistan is a net food importing country, the likely welfare effects of rising world food prices will be negative.

The magnitude of the effect of rising food prices on household welfare and poverty rates was investigated by Ivanic and Martin (2011) for several developing countries including Tajikistan. According to the empirical results of the study in the case of Tajikistan, the total average effect of the food price spikes of 2007-08 was quite high in the short-term while slightly lower in the longer term, because both producers and consumers gradually adjust to higher food prices (Ivanic and Martin, 2011).

Furthermore, the evidence available about prices of agricultural food commodities in Tajikistan shows that they are highly sensitive, quickly reacting to any external or internal shocks.¹ The increases and volatility of food prices and their effects on household well-being are currently a crucial question for the Government of Tajikistan and its international development partners (donors) such as the World Bank, IMF, FAO, and WFP etc. In spite of several government efforts to stabilize food prices in the domestic market, they remain quite high, causing problems of food insecurity, as the majority of Tajik households redirect their consumption into cheap food products and risk undernourishment.

The current decline in the external and internal incomes of Tajik households has put them in a position where one-third of them were not able to buy enough food in May 2015, according to World Bank data (L2TJK, April 2016).² Overall, both lower remittances and terms of trade

¹ We provide annual current prices for selected food items in **Table A2** in the Appendix..

² Since May 2015, the World Bank Poverty team rolled out the “*Listening to Tajikistan*” survey (L2TJK) to monitor the impact of emerging trends throughout the country at high frequency. The fieldwork for L2TJK that commenced in May 2015, is currently ongoing, and is funded through June 2016. The survey generates evidence on wellbeing, employment and income patterns, the migration process and other household characteristics useful for targeted policy-making.

Source available at: <http://www.worldbank.org/en/country/tajikistan/brief/listening2tajikistan>

effects are causing a deterioration of economic growth in Tajikistan, limiting the growth of household consumption and reducing their purchasing power in a way that threatens the sustainability of recent gains in poverty reduction and shared prosperity (World Bank Group, 2015). Therefore, the investigation of the food demand system in Tajikistan and its response to shocks is currently a crucial issue for policy-makers.

1.1 Motivation of the research

The motivation for conducting this study stems from the facts described above and from the absence of any empirical studies on the estimation of a complete food demand system for Tajikistan. The design of social security programs requires substantial quantitative knowledge about households' annual and seasonal food demand and its response to income and price changes, in order to be able to effectively protect the households which are subject to substantial risks affecting their livelihood. For instance, knowledge about demand elasticities can help the government in its search for self-targeting mechanisms of the safety-net programs, such as those based on subsidies to "inferior" commodities (Camara, 2013), that may entail prohibitively high costs (Timmer and Alderman, 1979) for a poor country like Tajikistan.

The consumption behaviour of households may vary according to different factors like households' income levels, seasonal food accessibility, consumption habits of the household and its demographic characteristics, or the overall conditions of each region. (geographical features, geographical location, socio-economic performance, and so on). Consequently, the present study examines the household food consumption patterns taking into account potential sources of demand variation, like socio-economic conditions, seasonality, and the demographic characteristics of household.

1.2 Research objectives

The general objective of the present study is to examine household consumption patterns in Tajikistan and their response to changes in food prices, income and other factors. The study also considers the effects of relevant socio-economic characteristics on the food demand behaviour of Tajik households. Since Tajikistan is a net food importing country, the question of

the integration between international and domestic markets will be considered. Likewise, the study is based on the hypothesis that the household food consumption in Tajikistan shows a seasonal component.

The specific objectives of the present study are:

- i. To examine the size, speed, and nature of pass-through (transmission) of world agricultural commodity prices to domestic agricultural prices. As Tajik households spend a large share of their income on food and the country is highly reliant on food imports, this price transmission significantly affects both consumers and producers in Tajikistan.
- ii. To estimate a household food demand system for Tajikistan taking into account the effects of demographic and socioeconomic characteristics.
- iii. To determine how food consumption patterns of Tajik households are affected by their geographical location in one of the five regions of Tajikistan, by the rural or urban character of their environment, as well as by other demographic characteristics of the households.
- iv. To describe seasonality in household consumption patterns relative to seasonal changes in food prices and in households' real income.
- v. To estimate price and expenditure (income) elasticities of demand for aggregated food groups as well as to analyse their variations across regions, seasons, rural and urban households, and household income classes.

1.3 Methodology and estimation approach

The main contribution of our research is to fill the gap in the empirical literature by estimating a complete food demand system for Tajikistan in order to obtain quantitative estimations of the (income/expenditure and price) demand elasticities of aggregated groups of food products. The methodological approach we use can be described by the following stages:

First, we use cointegration techniques, such as a vector error correction models (VEC) to analyse the price transmission mechanism from international to local food markets. We test the stationarity of the time series using unit root tests (the augmented Dickey-Fuller test and the Phillips-Perron test). For estimation, we use unique monthly price data for selected agricultural commodities traded in Tajikistan and in world markets.

Second, we employ an extended form of the *Quadratic Almost Ideal Demand System*- (QUAIDS) model (Banks et al., 1997) to estimate the households' food consumption patterns in Tajikistan. The QUAIDS model is estimated using the microdata taken from the *Tajikistan Living Standards Measurement Survey* conducted during the years 2003, 2007 and 2009. In order to deal with censored zero expenditure values, we apply a two-step estimation approach following Shonkwiler and Yen, (1999), using simulation based on maximum likelihood univariate probit regression.

Third, we estimate a seasonal- QUAIDS model using the quarterly microdata derived from the *Household Budget Survey of Tajikistan*, covering 5 quarters over the years 2013-2014.

We estimate the QUAIDS models applying a modified version of the *Nonlinear Seemingly Unrelated Regression* (NLSUR) and *Feasible Generalized Least Squares* (FGLS) estimators implemented in the STATA software package, developing our own codes to incorporate a two-step estimation approach including household socio-demographics variables, as well as to include the intercepts representing seasonality behaviour in the seasonal QUAIDS model.³

1.4 Structure of the dissertation

The structure of dissertation is organized as follows:

Chapter 1: Overview of socio-economic circumstances in Tajikistan. In this chapter, we briefly discuss the overall economic behavior of Tajikistan, its major socio-economic challenges and its institutional development since its independence after the collapse of the Soviet Union in 1991. We consider, in particular, the consequences of land and agro-state enterprises privatization, the evolution of the rural economy and agriculture development, and their influence on food consumption and diet composition in Tajikistan.

Chapter 2: Spatial price transmission: evidences from Tajikistan. This chapter investigates the market integration between international and domestic agricultural markets in Tajikistan. More specifically, our study aims to understand the extent and speed of price transmission from international to local markets. As Tajikistan does not have good conditions for agricultural

³ We are grateful to Dr. Yolanda Pena-Boquete for her invaluable help in properly coding these procedures.

production (only 6.1 % of its land is suitable for arable crops), it has to rely on the world markets to obtain enough food.

Chapter 3: Estimation of food demand systems: evidence from LSMS data of Tajikistan.

This chapter covers the analysis of the food demand system using microdata. Given the evidence of possible non-linearity of the Engel curves, we use an extended form of the Quadratic Almost Ideal Demand System (QUAIDS) model. Specifically, we focus on a complete estimation of food demand system in Tajikistan with a proper assessment of food consumption changes including its response to various shocks in order to support both the implementation of agricultural development strategies and the design of appropriate government social security policies. Additionally, we estimate consumption patterns taking into account the marginal effects of the socio-demographic characteristics of households.

Chapter 4: Seasonality of food consumption in Tajikistan: evidence from the estimation of a non-linear food demand system. This chapter investigates the seasonal behaviour of food consumption patterns in Tajikistan. The main contribution of this chapter is the combination of household longitudinal microdata and a seasonal -QUAIDS model. Specifically, the research aims to map out the intra-quarterly variation in expenditure patterns of Tajik households and to compare the estimated demand parameters and elasticities across seasons.

Finally, we conclude with a summary and discussion of the main empirical findings of each essay that provides argumentations on policy implications and comments on the scope for future research.

Appendix to General Introduction

Table A1: Tajikistan household food consumption per capita during the period 1991-2013

(Data based on sampling observation of households; annual, in kg/per capita)

Years	Meat & meat product	Milk & milk products	Eggs	Sugar & confectionery	Bread & bakery goods	Potatoes	Vegetables & melons	Fruits, berries & grape	Vegetable oil
	kg	kg	units	kg	kg	kg	kg	kg	kg
1991	26.1	171.0	88	12.6	155.0	33.2	94.2	31.9	13.3
1992	27.8	172.0	99	8.20	186.0	33.4	98.3	25.6	12.8
1993	20.8	140.0	70	8.10	204.0	29.6	77.3	24.9	11.8
1996	4.00	50.4	11	3.60	154.0	24.0	72.0	16.8	9.60
1997	4.90	46.8	6	7.40	147.0	25.0	55.5	24.5	9.80
1998	5.10	47.2	6	5.90	152.0	22.3	59.9	19.6	7.90
1999	9.70	55.1	16	6.40	167.0	24.1	92.4	17.3	9.50
2000	4.40	64.9	26	6.70	148.0	37.8	98.5	50.8	10.2
2001	5.80	49.9	19	7.00	150.0	26.6	73.0	35.5	9.20
2002	6.50	51.2	24	8.40	157.0	28.3	82.1	36.7	10.4
2003	6.80	50.0	24	9.10	157.0	30.5	79.0	27.8	9.50
2004	7.30	48.2	24	10.0	155.0	35.3	76.7	45.0	11.4
2005	8.30	48.2	24	11.0	155.0	32.2	79.4	38.4	12.4
2006	10.2	58.8	25	12.1	159.0	33.2	75.4	48.4	13.1
2007	9.90	49.1	24	11.4	148.8	33.0	75.1	45.9	11.7
2008	11.4	54.7	32	12.6	153.0	36.7	75.4	48.9	13.2
2009	11.1	61.0	39	12.4	159.1	35.6	84.7	40.1	14.2
2010	11.0	60.9	40	12.0	160.6	35.0	70.7	33.2	14.4
2011	11.8	54.5	46	12.5	159.6	34.0	72.8	40.0	14.3
2012	11.2	58.0	60	13.6	154.1	34.7	88.1	32.9	14.6
2013	14.0	52.0	62	13.4	157.0	38.6	76.9	40.0	15.5
2014	14.9	58.7	71	14.0	153.1	33.3	76.0	33.4	16.4
<i>Basic standard food consumption norm per capita/per year*</i>	85	405	232	40	110	97	146	113	9

Source: HBS, Taj STAT, 2014 and FAOSTAT, 2013

*FAO development of the Basic standard food consumption per capita

Table A2: The trends of market food prices in Tajikistan 2010-2015 (TJS-somoni/kg)

	Year						Annual average growth
	2010	2011	2012	2013	2014	2015	
Bakery goods							
bread(kg)	2.26	2.49	2.92	3.12	3.39	3.67	8.5%
flour(kg)	1.94	2.57	2.58	2.95	2.81	3.17	11.5%
rice(kg)	8.4	8.63	9.17	9.41	10.09	10.17	3.9%
peas(kg)	6.29	6.99	9.51	9.30	8.40	8.17	5.4%
pasta(kg)	2.90	3.38	3.78	4.30	4.34	-	10.8%
potatoes (kg)	1.32	1.69	2.14	2.17	2.89	2.13	10.5%
Vegetables and melon							
onion(kg)	1.14	1.79	1.61	1.42	2.05	1.96	12.5%
carrot(kg)	1.21	1.48	1.61	1.59	1.88	1.59	5.4%
water-melon(kg)	1.07	0.97	1.21	1.72	2.41	2.17	14.6%
melon(kg)	1.70	1.65	1.79	2.62	3.83	3.76	16.1%
Fruits and berries							
apple(kg)	4.61	4.69	4.69	6.05	6.90	7.02	7.7%
pear(kg)	5.36	5.43	6.58	7.21	8.97	8.64	8.8%
apricot(kg)	2.41	2.66	2.69	3.68	4.76	7.98	24.2%
grape(kg)	6.51	4.87	7.04	8.09	9.29	8.72	7.2%
Sugar and sweet products							
sugar(kg)	4.86	6.23	5.43	5.15	4.90	5.62	3.3%
caramel(kg)	8.37	9.32	10.49	12.29	13.26	14.54	9.8%
chocolate(kg)	15.16	16.61	17.46	22.21	23.92	25.54	9.4%
Meat and Fish products							
beef meat(kg)	18.24	23.78	28.82	30.53	33.57	33.41	11.2%
sheep meat(kg)	19.94	25.79	31.52	33.09	35.83	35.80	10.8%
chicken meat(kg)	9.21	10.25	12.06	12.89	12.48	15.11	8.9%
Fish silver carp(kg)	12.58	13.90	16.12	17.80	19.56	22.31	10.2%
Fish sazan (kg)	15.99	17.35	20.46	23.24	23.56	27.71	9.8%
Milk and dairy products							
milk (Lt)	2.08	2.40	2.99	3.33	3.36	3.47	9.2%
sour cream (Lt)	11.73	12.36	14.88	15.19	15.22	17.41	7.1%
yogurt(Lt)	1.88	2.08	2.48	2.68	2.88	2.90	7.7%
cottage cheese(kg)	12.12	12.38	14.26	15.64	15.41	14.85	3.7%
Vegetable oil & margarine							
vegetable oil (kg)	6.20	9.11	8.52	8.21	8.22	9.02	7.8%
margarine (kg)	7.33	7.33	7.34	8.22	8.42	13.70	12.9%
eggs (10 unites)	5.98	6.43	6.78	6.88	6.95	6.95	2.6%
salt (kg)	0.93	0.95	0.99	1.00	1.19	1.15	3.8%
tea(kg)	7.87	8.27	13.12	16.99	18.54	20.14	18.5%

Source: Agency on Statistics under President of the Republic of Tajikistan. 2015



Chapter 1:

Overview of socio-economic circumstances in Tajikistan



Chapter 1:

Overview of socio-economic circumstances in Tajikistan

Abstract

In this chapter, we briefly discuss the socio-economic situation in Tajikistan over the period of independence since 1991. We consider the transition of the Tajik economy from central planning to a market-based system, describing its socio-economic reforms and challenges. We pay particular attention to the consequences of the privatization process (both of land and agro-state enterprises), on account of its influence on the development of living standards in Tajikistan, especially in rural areas.

Introduction

Tajikistan is a small, developing, and landlocked mountainous country located in Central Asia. It has borders with Afghanistan in the South, with Uzbekistan in the West, with Kyrgyzstan in the North and with China in the East. The total area of the country is 142,600 km² of which 93% is mountainous, with more than 50% of the country located over 3,000 meters above sea level. Only around 6.1% of the land is available for agricultural production (Taj STAT, 2015). Geography splits the country into three disparate regions, and transport difficulties between them put formidable barriers for sustainable growth and economic development.⁴

Tajikistan is administratively divided into four regions (see Map 1.1):

1. Dushanbe and RRS (Regional Republic Subordination, which consist of 13 autonomous districts), located in the central part of the country.
2. -Sughd oblast, situated in the North.
3. -Khatlon oblast, situated in the South-West.
4. -Gorno-Badagakashan, located in the Eastern part of the country.

There are 65 administrative units of districts and cities in total. The capital of the country is Dushanbe. The population reached 8.2 million in 2014, of which 74% are living in rural areas (Taj STAT, 2015). The climate in Tajikistan varies widely between cold winters and very sunny

⁴ Poor road infrastructures make road travel difficult during the winter period and complicate the situation in all road and rail travel, especially between Northern and Southern regions, and between Western and Central regions.

hot summers. The subsoil is rich with mineral resources in the form of silver, gold, uranium, mercury, brown coal, lead, zinc, antimony, tungsten, and different precious stones. In contrast to other Central Asian Countries (CAC), Tajikistan has a limited amount of oil and gas resources, whose hard accessibility and high exploitation costs make them unprofitable at present world market prices. The economy of Tajikistan is mainly agrarian and agro-industrial.

Map 1.1: The map of location and administrative regions of Tajikistan



Source: adopted from Danzer et al., 2012

This chapter is organized as follows. Section 1.2 reviews the post-Soviet Union life of Tajik people and their socio-economic and political challenges and examines the implementation of the reform programs as well as the outcomes of land reform and privatization of state-owned property. Section 1.3 presents the evolution of poverty rates. In Section 1.4 we introduce the main indicators of macroeconomic performance of the Tajik economy since independence. Section 1.5 discusses the key role of remittances inflows and revenues from the informal part of the economy on households' incomes. Finally, Section 1.6 describes the facts and policies related to the agriculture sector and the rural economy.

1.1 Post-Soviet Union Tajikistan: reforms and transition

Tajikistan was under the central-planning Soviet system more than 70 years (Nourzhanov and Bleuer, 2013; Mughal, 2007). The country was oriented to agricultural production; the agro-industrialized processes showed the typical traits of an inefficient peripheral economy where the economic structure was biased towards the needs of the Soviet Union (Mughal, 2007). It was one of the poorest Republics in the Union, with a poverty rate of 51.2% in 1989.

Tajikistan, as well as other CAC, became independent with the break-up of the Soviet Union in 1991. However, the transition towards a market economy began in Tajikistan only after the end of the civil war in 1998. During the civil war most of the fixed capital and infrastructure that survived the collapse of Soviet Union was devastated and the poverty rate reached a peak of 86% of the population in 1999.

When Tajikistan came out of its civil war, it faced enormous challenges related to its extreme socio-economic decline (poverty, electricity shortages,...), its weak institutional development (pervasive corruption and predominance of the informal economy) and the legacy of political instability bequeathed by the war. On top of all this, geography dictates that Tajikistan is a remote country, lacking access to the global transport infrastructure. The implementation of socio-economic and institutional reforms was considered as the main priority and strategic goal of Tajikistan since the first step of the transition period. The land reform and the privatization of state-owned enterprises were among the central elements of these reform programs. The focus of the reforms was on the one hand on the recovery of agricultural production and its prospective development, and on the other hand on the preservation of employment and the improvement of economic opportunities in the rural areas (Lerman and Sedik, 2008; USAID, 2004).

The process of Presidential Land distributed land to rural households in order to satisfy their essential food and subsistence needs, to stabilize food security and to improve the well-being of population. According to the survey of AAH (2003), approximately 70% of rural households had Presidential land, which averaged 0.115 Ha in area. The Presidential lands were allocated as additional household plots from the unused land of the collective state farms of the Soviet Union, which often are located far from small household plots.

The process of privatization of state-owned enterprises has been performed by the local authorities in cooperation with the World Bank under the mission of LRCSP, 2006-2015.⁵ The program was aimed to restructure the Soviet Union's cooperatives state farms, collective state and large agro-enterprises. Most of the state-owned enterprises were transformed and remodeled into individual or family 'dehkan farms'⁶, which are a model of family farming with legal rights on effective land use and independent economic activities.

Nowadays, there are four types of agro-farms in the agricultural production of Tajikistan (Shtaltovna, 2016):

- a) *Small farms as family/individual dehkan farms* –with an average extension of 5 Ha and other family/individual property on agricultural activities and agro-business;
- b) *Small household plots and Presidential Land* - with an average extension of 0.3 Ha assigned to every rural household in order to maintain the family's subsistence needs and to ensure food security and poverty reduction as a whole. The majority of people have a household plot but not every family is a dehkan farmer. Around 6% of agricultural land is currently in household plots, while in Soviet Union times they occupied just 1%.
- c) *Cooperative agricultural firms* - organized by groups of entrepreneurs and based on cooperation through the establishment of joint production, integrated labor forces and organization of other joint business activities.
- d) *Collective dehkan farms* (large agro- enterprises) - organized by members from different families on the basis of joint activity agreements and partnerships with average extension around 100-200 Ha. Some of them reach 1,000 Ha. The dehkan farms (both individual and collective) have increased in area from less than 0.5% of agricultural land in 1995 to 60% in 2007 (Lerman and Sedik, 2008).

As a result of the reform process, agricultural production by households increased steadily. Household plots hold more than 80% of the inventories of livestock and account for 40% of the production increases (World Bank Report, 2005; Lerman and Sedik, 2008). Moreover, household plots and family dehkan farms have made systematic changes in

⁵ Land Registration and Cadastral System for Sustainable Agriculture Project in Tajikistan (LRCSP, 2006-2015), In total, 54,625 "Land Use Certificates" were issued to individual and family farms in the period from January 2007 to March 2013 (World Bank Report, 2014).

⁶ The number of dehkan farms has significantly increased over the decade, reaching 30,842 in 2009 (Dehkan Farms Pilot Survey, May 2009).

agricultural production patterns, grain, and horticultural crops etc. After land reforms, most of the rural households realized that their income resources depend on an efficient use of the farmlands and on their own efforts. This allowed the obtention of good harvests by household plots and the increase of household food incomes. The increased agricultural food production gradually reduced the dependency of Tajikistan on international food aid and increased the share of agricultural production in GDP.

However, agricultural production capacities do not have yet the potential to fully substitute food imports in the domestic market. The majority of the infrastructures are still those inherited from the Soviet Union. Agricultural production is focused on extensive methods of production with high production costs and uncompetitive agricultural products of below-average quality that are not export-oriented.⁷ The majority of dehkan associations usually comprise the farmers and chairpersons of the previous state-owned farms under a new name but with the old structure and hierarchy intact (ICG Asia Report, 2003).

Of course, the process of privatization was not limited to agricultural farms. Most of the property was owned by the state in Soviet Union times, and private sector activity was generally discouraged (World Bank Report, 2005). The main aims of privatization were to recover production capacities, to develop diverse forms of ownership, to increase competitiveness and to improve the business environment. The government of Tajikistan adopted industrial policies based on the following essential components:

- Rapid privatization of small industries and commercial enterprises;
- Gradual privatization of medium-large manufacturing and commercial enterprises;
- Import replacement of consumer-food commodities;
- Promotion of new export-oriented industries.

Around 9,691 small enterprises and 1,307 medium and large enterprises were privatized in Tajikistan during the period 1991-2012 (Taj STAT, 2012). Table 1.1 shows the results of the privatization process on the different sectors of the national economy during the period 1991-2006.

⁷ Currently, the reform process is being deepened by shifting local authorities' functions away from intervening in farm activities and production decisions and towards helping farmers to modernize production patterns and to respond to price signals through the provision of information and training, and through the development of agricultural input markets and rural finance (FAO, Food Security Research Paper, 2013)

Table 1.1: State-owned enterprises and organizations privatized, by economic sector (1991-2006)

Branches of Economy	<i>Total</i>	<i>% of</i>
	<i>1991-2006</i>	Total
Industry	374	4.2%
Agriculture	1,176	13.1%
Construction	325	3.6%
Transport and communication	302	3.4%
Trade and services	4,974	55.6%
Other	1,793	20.0%
Total	8,944	100%

Source: own elaboration based on Taj STAT, 2006 and Fakerov, 2004

The gradual privatization of the state-owned manufacturing enterprises had significant consequences for price and market structures in Tajikistan, which operated through the financial sphere in three ways:

- Through their impact on the government budget due to the continuous necessity of industry subsidies;
- Through their impact on banks due to the forced provision of bank loans to a majority of farmers unable to repay them;
- Through the accumulation of inter-enterprise indebtedness among non-viable and even viable enterprises (Fakerov, 2004).

All these influences affected the budget and monetary policy of Tajikistan through the continuous inability to control money supply and inflation. In the case of wholesale and retail food markets, this situation created a constant distortion of supply and the establishment of unrealistic price structures. Wholesale and retail markets operated with high costs that then were transmitted to high consumer prices. The results of unprofitable activities of agro-industrial enterprises based on import replacement policies through an over-valued exchange rate, tariff protection, and straight-out administrative control have stimulated the growth of informal markets.

The privatization process is still ongoing and incomplete, with somewhat inefficient results. One of the main reasons is that with the loss of government control, the owners of some large agro-industry and trade enterprises have started to sell the equipment and assets of the privatized enterprises gradually, whereby destroying production infrastructures and capacities.

From the 7,973 enterprises privatized between 1991 and 2004, only 69.8% continued to be active at the end of that period.

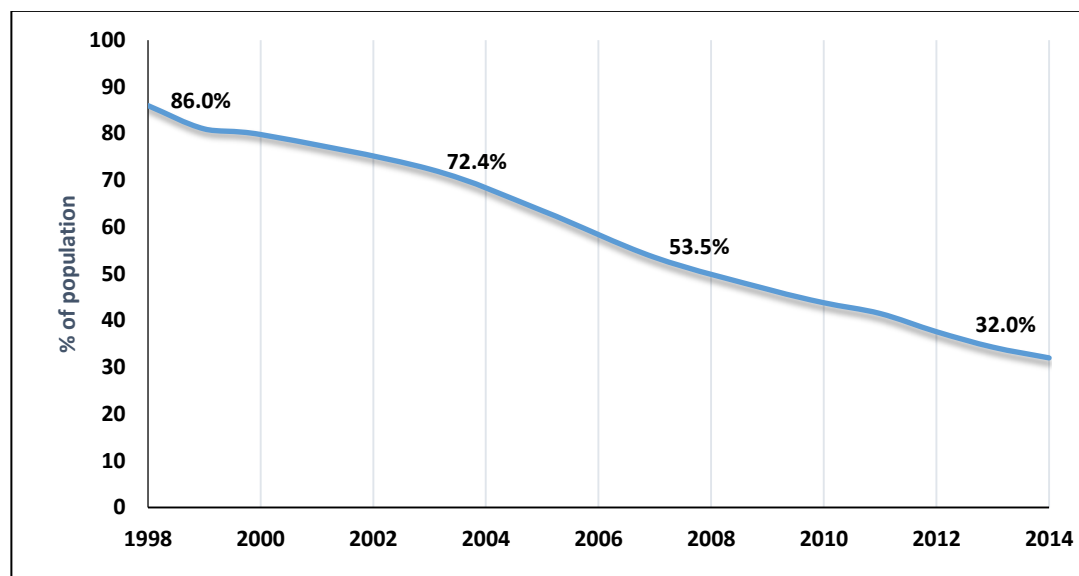
Unwise changes in the structure of trade-production patterns and in the direction of economic activities resulted in uncompetitiveness and bankruptcies. In spite of these destructive factors, the new private firms and some of the remodeled medium and small enterprises/farms were able to operate within the business environment created by the government. However, they have limited production capacity, low levels of productivity, poor production knowledge and a general lack of experience that cause serious problems in their manufacturing, trading and distributing activities.

1.2 Poverty rates

After the normalization of the political situation in 1997 the government of Tajikistan has taken measures with the aim of reducing the poverty rate. According to the estimations of the World Bank, the IMF, and Taj STAT Survey Reports, in 1997, after the civil war, four out of five Tajikistan citizens were '*poor*', a third '*very poor*' and nearly 20% were in the *extremely poor* level, with income below 1 US dollar (\$1) per day measured at Purchasing Power Parity (PPP) (Falkingham, 2000).

The estimation of the poverty line in Tajikistan is conducted through the measurement of the cost of basic demands (Ravallion, 1994) of overall consumption (at the international poverty line of PPP \$2.15 per capita/per day). The value of the food poverty line is estimated following a food consumption pattern of 2,250 Kcal/day. This approach was proposed by the World Bank (WB) and conducted through their *Living Standard Measurement Surveys (LSMS)* between 1999 and 2009. From 2010 onwards, the Agency on Statistics (Taj STAT) followed on this methodology using a national *Household Budget Survey (HBS)*. Figure 1.1 shows the steady decline of the poverty rate in Tajikistan, from 86% in 1999 to 32% in 2014, according to this measure.

Figure 1.1: Poverty reduction trends in Tajikistan, (1998 -2014)



Source: own elaboration based on Taj STAT, TLSMS 1999-2009 and HBS 2010- 2014

This reduction of poverty was reached in three waves. The first wave of poverty decline in Tajikistan occurred from 1999 up to 2003, in which the poverty rate dropped by 18 percentage points. According to IMF estimations (2003, 2006), extreme poverty rates⁸ had declined even more rapidly. The results of the first wave of poverty reduction are provided in Table 1.2.

Table 1.2: First wave of poverty reduction across regions of Tajikistan (1999 -2003)

Regions	Population (thous. of people)	Overall poverty rate (in %)				Poverty declined between 1999 and 2003	Inequality
		Total ¹	Urban	Rural	Extreme Poor ²		
GBAO	197	84	74	86	36	-13%	0.30
Khatlon	2,169	78	78	78	27	-13%	0.35
Sughd	2,123	64	59	66	16	-15%	0.32
Dushanbe	630	49	49	--	12	-12%	0.37
RRS	1,553	45	55	44	9	-26%	0.31
Total	6,672	64	60	65	18	-18%	0.35

Source: own elaboration based on data TLSS 1999 and 2003 (World Bank estimation)

1- Based on \$2.15 per day

2- Based on \$1.08 per day

⁸ Based on a food poverty line of PPP \$1.08 U.S per day (World Bank).

During the second wave (2003-2009), total poverty dropped by 17.3 percentage points, but the tendency of poverty reduction was different by regions: while some regions showed significant decreases, such as Dushanbe, GBAO and Khatlon, the decreases were lower in RRS and Sughd. The results of the second wave of poverty reduction are provided in Table 1.3.

Table 1.3: Second wave of poverty reduction across regions of Tajikistan (2003 -2009)

Regions	Population (thous. of people)	Overall poverty rate (in %)				Poverty declined between 1999 and 2003
		Total ¹	Urban	Rural	Extreme Poor ²	
<i>GBAO</i>	203	34.5	38.0	33.5	6.0	-49.5%
<i>Khatlon</i>	2,560	50.2	50.7	50.1	15.8	-27.9%
<i>Sughd</i>	2,153	52.5	44.7	57.0	17.1	-11.5%
<i>Dushanbe</i>	694	19.1	19.1	-	2.6	-29.9%
<i>RRS</i>	1,641	44.2	26.4	48.0	11.1	-0.8%
Total	7,251	46.7	36.7	50.8	13.4	-17.3%

Source: own calculation based on TLSS for 2009 (World Bank) and IMF Report, 2012

1- Based on \$2.15 per day
2- Based on \$1.08 per day

The third wave (2009-2014) reduced the national poverty rate by 14.7 percentage points. But this decline took place mainly in Sughd and Khatlon regions. In fact, the overall poverty headcount increased slightly in GBAO and in Dushanbe, and the extreme poverty headcount increased in all regions except Sughd. Table 1.4 shows the trends and poverty reduction results during the third wave.

Table 1.4: Third wave of poverty reduction across regions of Tajikistan (2009 -2014)

Regions	Population (thous. of people)	Overall poverty rate (in %)		Poverty declined between 2009 and 2014	Extreme Poverty declined between 2009 and 2014
		Total ¹	Extreme Poor ²		
GBAO	212	37.3	18.0	+2.8%	+12%
Khatlon	2,898	37.7	21.6	-12.5%	+5.8%
Sughd	2,401	23.1	10.1	-29.4%	-7%
Dushanbe	776	19.9	7.9	+0.8%	+5.3%
RRS	1,874	37.8	21.1	-6.4%	+10%
Urban	2,171	23.5	10.7	-13.2%	-0.2%
Rural	5,990	36.1	19.7	-14.7%	+5%
Total	8,161	32.0	14.3	-14.7%	+0.9%

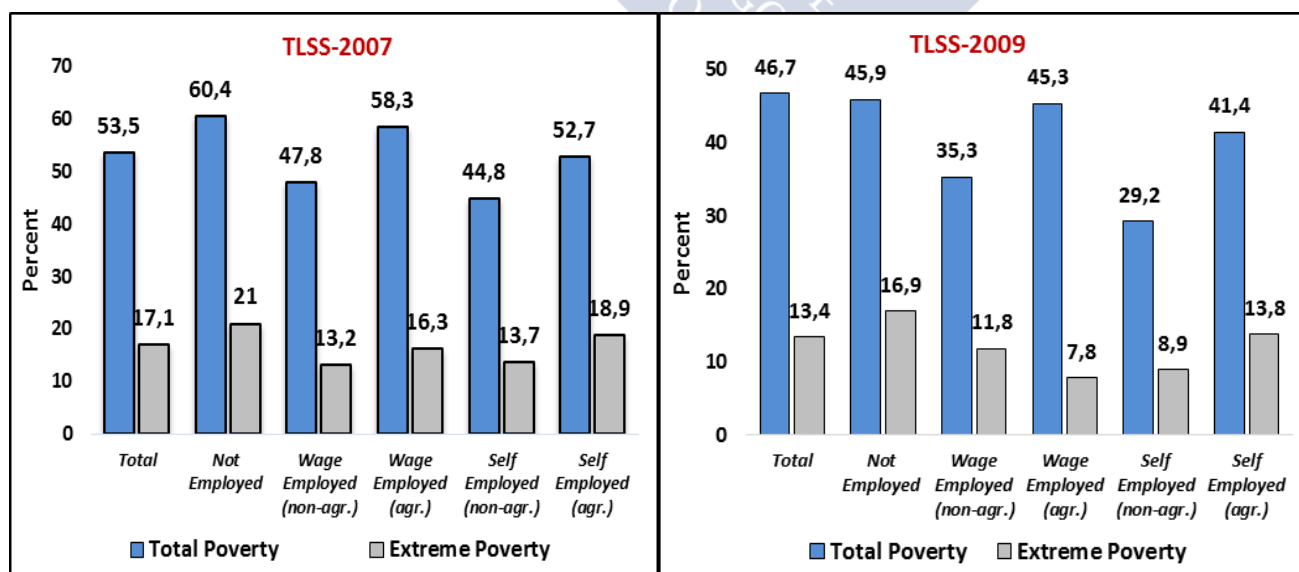
Source: own calculation based on HBS (2014) and TLSS for 2009 (World Bank).

1- Based on \$2.15 per day

2- Based on \$1.08 per day

According to WB estimations (2007-2009), in most of the poor households the head person is unemployed. Figure 1.2 indicates the poverty headcount by employment status of the household head in 2007-2009.

Figure 1.2: Poverty headcount by employment status of Household Head (2007-2009)



Source: own calculation based on TLSS 2007-2009 (overall poverty rate was estimated by WB)

Despite the improvement in the living standards of the population since the end of the civil war, the poverty rate remains an important problem for the local and state authorities and policy makers. The persistency of high poverty headcount ratios and food insecurity shows that not all the submitted goals have been properly reached. Besides, the trend of poverty reduction shows worrying signs of being exhausted, and there are factors suggesting that it will not be sustainable in the medium- and long-term.

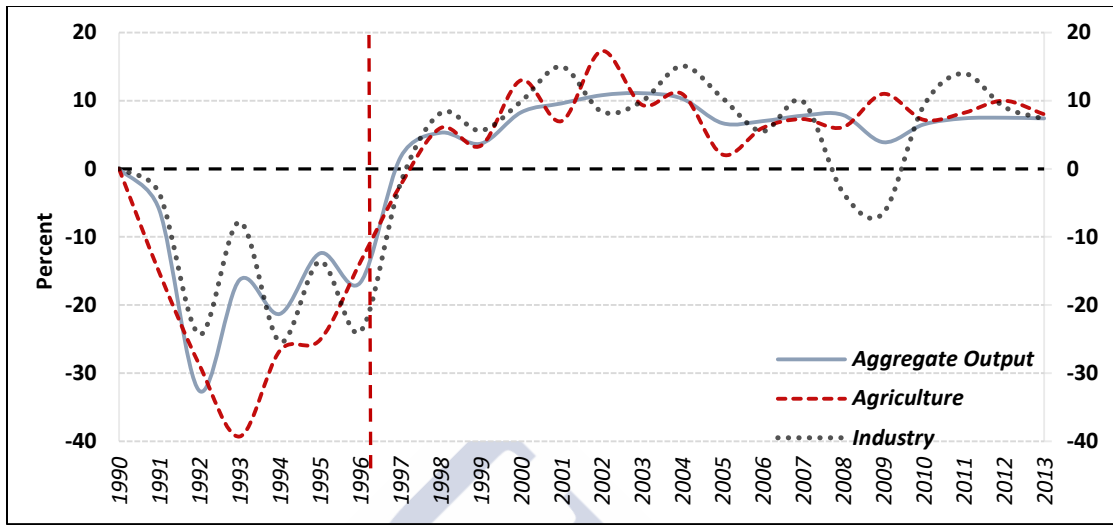
As domestic agro-food production is still not sufficiently recovered and the labor market remains in a critical situation, the majority of Tajik households are trying to hold their life through private transfers, humanitarian aid and other income sources such as the sale of assets, the rise of home food incomes, remittance inflows, family support, the increase of informal sector activities and small credits from the local and international organizations.

1.3 Macroeconomic performance: 1991-2014

Tajikistan is a low-income country ranking 152th in terms of GDP per capita (WDI, 2014) and 132th in terms of the United Nations' Human Development Index (HDI), which is estimated as 0.624 (UNDP HDI, 2014). The country suffered dramatically as a result of the breaking-up of the Soviet Union and the subsequent civil war. Industrial production collapsed, overall aggregate production declined sharply, and the country has suffered hyperinflation for almost two years in 1992-1993 (World Bank Report, 2011).

Figure 1.3 shows the overall drop and recovery process of economic growth in Tajikistan. GDP per capita reached 398 U.S dollars in 2006 and 1,043 U.S dollars in 2013, a figure, which represented an increase of 5.5 times compared to the year 2000.

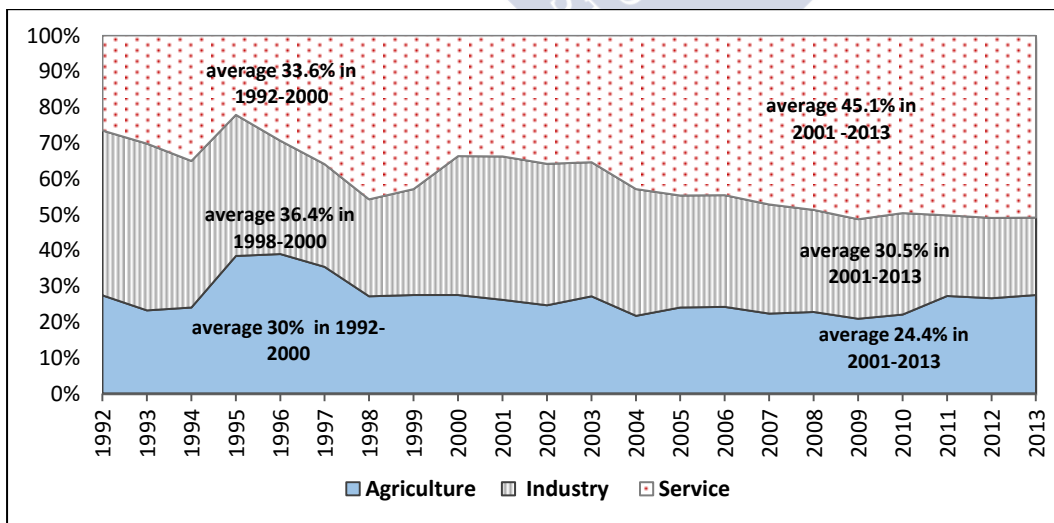
Figure 1.3: Annual average growth rate of agriculture, industry, and total aggregate production of Tajikistan, (1990 – 2013)



Source: own elaboration based on Taj STAT and WDI, 2013

GDP composition changed significantly during this period. The lack of a reliable supply of electricity, especially during the winter period, has become one of the main key factors in the decline of industry production, from 46.2% in 1992 to 24.3% in 2013. Meanwhile, the development of small-scale private activities, such as retail trade and other services drove the increase in the share of services from 26.5% in 1992 up to 50% in 2013 (Taj STAT, 2014). Figure 1.4 indicates the structural changes of GDP by sector composition over the period of 1992-2013.

Figure 1.4: Tajikistan’s GDP by sector composition, (1992-2013)



Source: own elaboration based on WDI, 2013

In spite of the increasing role of the other sectors, the agricultural sector remained the main basis of the economy, providing employment and income to most of the population. The state of the labor market in Tajikistan is hard to assess because national statistics remain unreliable (BTI, 2014). However, the United Nations estimates that up to 40% of the labor force is unemployed, and that about 40% of the country's employment is in the informal sector.

The global economic crisis of 2007-2009 did not leave Tajikistan's economy unaffected. While GDP still grew at a 3.6% of rate, industrial production declined by 6.5% (Taj STAT, 2010; WDI, 2013). A good part of the impact of the crisis was cushioned through an increase of agricultural production, thanks to better weather conditions and an excellent harvest in 2009. However, the trade situation worsened severely, due to a decline in the global prices of the main export-oriented products of Tajikistan, i.e. aluminium and cotton. The aluminum price dropped by 63% and the cotton price by 17% in the global market. Correspondingly, foreign exchange earnings were reduced. On top of that, remittance inflows from abroad were reduced by more than 32% (World Bank Report, 2011).

Overall, Tajikistan was not successful in attracting foreign direct investment (FDI) into its economy from the beginning of the transition period, due to its poor institutional development and business environment. FDI reached its highest point in 2004, amounting to 13.1% of GDP. Substantial inflows of FDI during the last several years came particularly from China. The reasons behind the very low capital formation in Tajikistan are usually quoted as rampant corruption, problems with the power supply, poor infrastructure, and a burdensome regulatory process (BTI, 2014). The picture of capital formation and the trends of FDI are displayed in [Appendix 1.1](#).

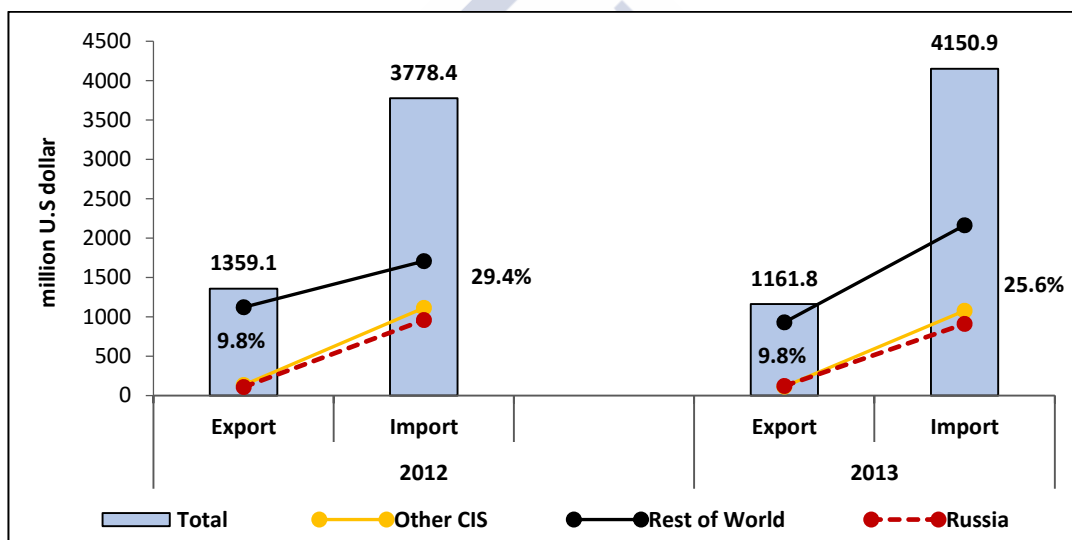
The ratio of external debt to Gross National Income was estimated at 138.4% in 2000, but then declined until reaching 41.8% in 2013 (WDI, 2013). Nowadays, over 10% of total budget revenues are represented by loans and grants from international organizations and foreign countries. The main part of the budget is financed through obligations under bilateral loans with China.

Due to its dependence on external factors, Tajikistan's economy was harmed directly by the recent global geopolitical instability and economic uncertainty through the devaluation of its national currency (World Bank, 2015a). Russia's recession affected Tajikistan's export revenues

from the whole Community of Independent States (CIS). Over 35% of Tajik’s foreign trade is with CIS states (see Figure 1.5).

The main Tajik trade partner within the CIS block is Russia, with more than 75% of the total trade turnover with CIS. The main export market for Tajik agricultural products is mostly Russia and the other CIS markets, which absorb approximately 95% of the agro-trade (World Bank, 2015a). Most of rural households generate their main income from these market sources, hence their export revenues are vulnerable to changes in the Russian markets. Tajikistan spends about 35 to 40% of its export revenues to finance food purchases from international markets (Akramov and Shreedhar, 2012) as a result of significant increases in the price of food imports.

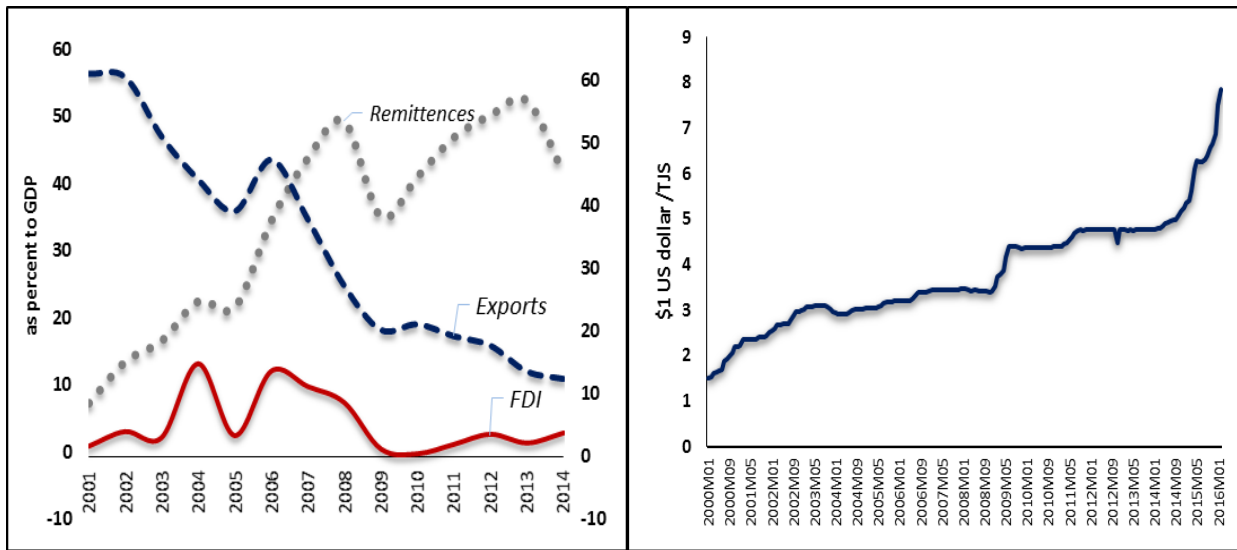
Figure 1.5: Foreign trade turnover of Tajikistan with CIS and the rest of the world (2012-2013)



Source: own elaboration based on UNCTAD, 2013

The stability of the Tajik financial markets and the banking system depends on remittances from international labour migrants, FDI and export revenues from two main commodities—aluminum and cotton (World Bank Group, 2014; ADB, 2014; EBRD Report, 2015). Between 2006 and 2014, foreign exchange inflows from remittances exceeded earnings from exports of goods and services (see Figure 1.6).

Figure 1.6: The main sources of foreign exchange revenues and the TJS/\$ exchange rate (2001-2016)



Source: own elaboration based on National Bank of Tajikistan (2016).

1.4 The role of remittance inflows and the informal economy

Tajikistan's labor markets are characterized by insufficient job creation in the formal sectors, low wage growth, uneven distribution of jobs and lack of employment opportunities (ICG Asia Report, 2013). The consequent persistence of high unemployment and poverty rates caused a significant out-migration flow from Tajikistan to other countries, mainly to Russia (Olimova and Bosc, 2003). According to the *Tajikistan Living Standards Measurement Survey (TLSMS-2009)*, over 10% of the population of Tajikistan worked abroad in 2009.⁹ Over 90% of them choose the Russian Federation as destination.

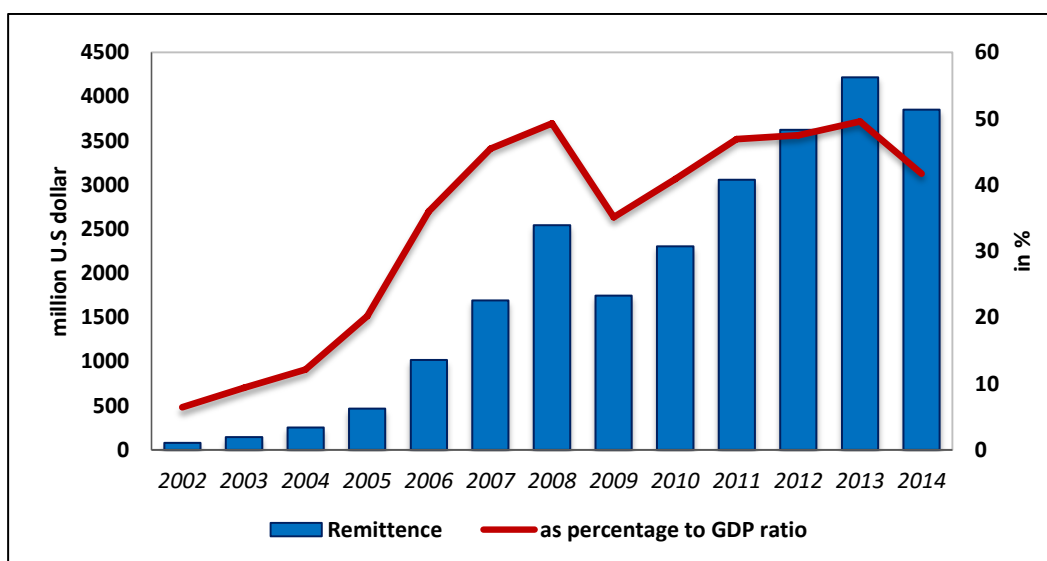
Dietz et al., (2015) noted that most of Tajik migrants are short-stay and seasonal migrants. They are typically male, of ages between 18 and 29¹⁰, and migrated directly after the completion of their secondary education with poor working skills, no specialized education, limited legal knowledge and a limited knowledge of the Russian language. Olimov and Bosc (2003) mentioned that most of Tajik migrants are engaged in the construction, agricultural and trade sectors. About 89% of them regularly send money to their relatives.

⁹ This implies that 28% of all households included at least one migrant (Danzer and Ivaschenko, 2010).

¹⁰ Department of Labor Migration, Government of the Republic of Tajikistan, 2006.

These remittance inflows are playing an enormous contribution in the development of the national economy of Tajikistan. The country is the top highest in the world in the value of remittances as a proportion of GDP (World Bank Group, 2015; Danzer and Ivaschenko, 2010). Figure 1.7 displays the trends and the volume of remittance inflows to Tajikistan and its value in % of GDP.

Figure 1.7: Remittance inflows from abroad to Tajikistan (2002 -2014)



Source: own elaboration based on WDI, 2014

Remittance incomes provide for the basic needs of more than half of Tajik people (BTI, 2014). Since Tajikistan became a country dependent on remittance inflows, numerous studies have researched them in recent years (Olimova and Bosc 2003; Clément 2011; Brown et al., 2008; Danzer and Ivaschenko, 2010; ILO 2010; Danzer et al., 2013; World Bank Reports, 2005-2015). Moreover, a survey about the picture of labor migration with particular socio-economic characteristics has been implemented by THPS (2011)¹¹. More detailed information about the process of out-migration from Tajikistan based on THPS (2011) and the estimation of (ILO, 2010) is presented in [Appendix 1.2](#).

Ogawa and Nakamuro, (2010) noted that households who are receiving remittances have more possibilities to get a better education, better health care, and better services such as home repairs, construction, and transportation. At present, remittances may be considered as the most

¹¹ By initiative and in cooperation with the Institute for East- and Southeast European Studies at Regensburg, Germany. The study re-interviewed households surveyed in the TLSS of 2007 and 2009 (Danzer et al., 2013).

important form of social protection in Tajikistan (Amir and Berry, 2012). As a result, remittances inflows to Tajikistan not only changed households' consumption and income patterns but also became essential to the livelihood strategies of many Tajik households, with the consequence of increasing the vulnerability of Tajikistan's economy.

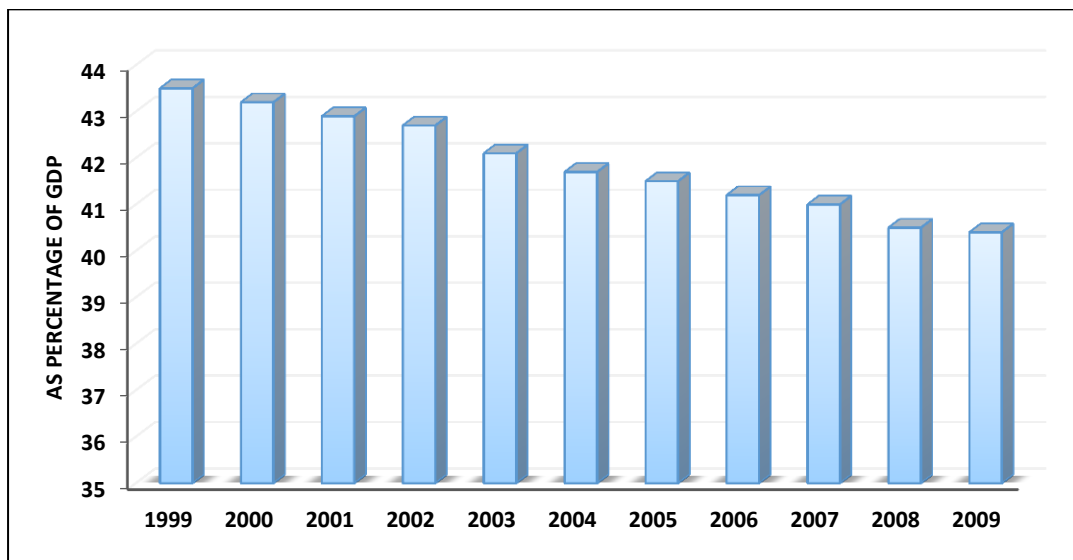
The lack of employment opportunities, the extremely low wages, and high social vulnerability that push young males to migrate out of Tajikistan also explain the supply of labor for the outsized domestic informal economy. Rahimov and Ruzmetov (2012) noted that the combination of very low wages along with the rising prices in food items pushed substantial numbers of Tajik employees from the formal sector to work part-time in the informal sector in order to generate additional income. In the formal sector of Tajikistan's economy, the minimum wage was \$50 in 2013, slightly increasing year by year from \$34.3 in 2005. The information about total employment by economic sectors and type of ownership, as well as about average and minimum wages in Tajikistan is provided in Table 1.5.

Table 1.5: Employment and wages by economic sector in Tajikistan (1991-2013)

	1991	1998	2000	2003	2006	2009	2012	2013
Total employed (miln. people)	1.971	1.796	1.745	2.090	2.137	2.219	2.292	2.308
<i>by economic sector (%)</i>								
-Industry	13	8.2	6.9	5.6	5.5	4.8	4.1	4.2
-Agriculture	44.7	60.7	65	67.6	67.1	66.7	66.3	66.1
-Construction	7.5	2.9	2.1	1.6	2.9	2.9	3.0	2.3
-Service	31.7	27.4	25.5	24	24.1	25.6	26.6	27.4
Average wages*	-	9	16	46	122	306	573	725
<i>by economic sector:</i>								
-Industry	-	26	47	115	238	492	1023	1061
-Agriculture	-	4	7	27	46	91	162	225
-Construction	-	20	40	110	318	722	1255	1552
-Service	-	7	13	36	125	317	646	803
Minimum wage*	-	1	1	5	18	60	120	250
Ownerships as (%)								
-State-owned	59.4	44.7	32	26.5	25.1	19.6	19.2	18.9
-Private	19.1	33.1	43.1	50	50.7	62.9	64.5	65.3
-Collective	20.4	23.2	23.8	22.6	23.2	16.6	15.2	15.5
<i>Source: own elaboration based on Taj STAT, 2013</i>								
<i>*Note: monthly wage on national currency somoni-TJS</i>								

Schneider and Claudio et al., (2010)¹² estimated the size of the informal economy in Tajikistan at 43.5% of GDP in 1999, slightly decreasing to 40.4% in 2009 as shown in Figure 1.8.

Figure 1.8: The size of informal economy in Tajikistan (1999- 2009)



Source: own elaboration based on Schneider and Buehn et al., (2010-2012)

For the majority of Tajik entrepreneurs the informal sector became a place to supplement "regular or alternatively" earnings during periods of economic difficulties (Abdulloev, et al., 2011), trying to avoid the distortionary effects of over-regulation and bureaucracy (Choi and Thum, 2004).¹³

Despite the fact that Tajikistan has achieved a relative success on economic-trade liberalization reforms, a poor business environment and restrictions on economic activities remain key issues for the development of entrepreneurial activity. The World Bank has conducted a survey about business environment and enterprise performance (BEEPS)¹⁴ in Tajikistan (and other transition countries). According to the results of this survey, Tajikistan was ranked 132nd out of 189 countries in the World Bank’s Doing Business 2016. According to the Heritage

¹² Using a dataset that estimated size of the shadow economy for 162 countries, including developing, Eastern European, Central Asian (Tajikistan), and high-income OECD countries.

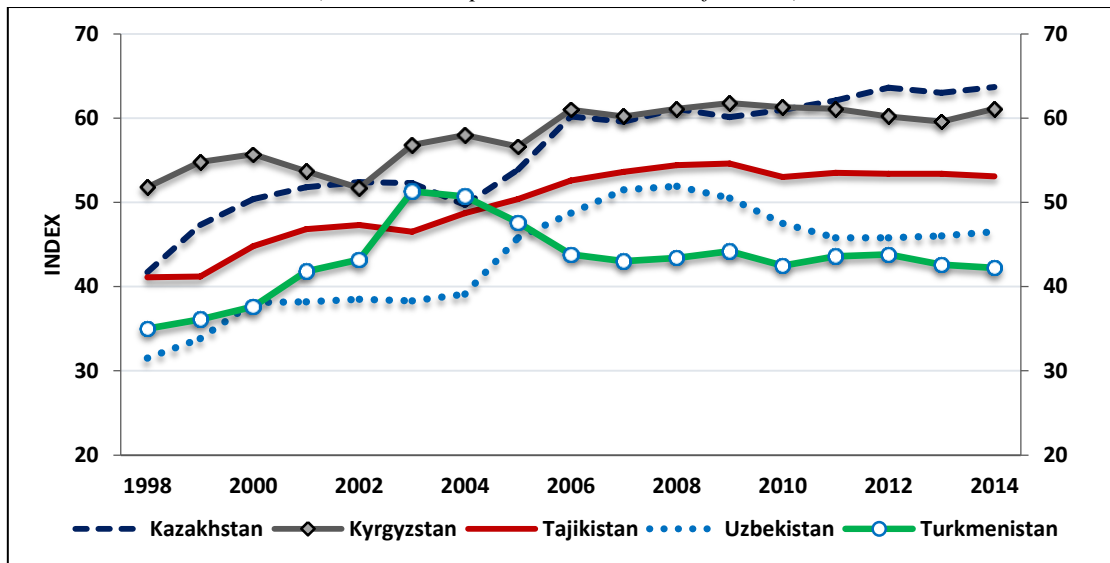
¹³ The informal sector is considered by some authors as the central factor underlying wage inequality (Arabsheibani and Staneva, 2012). However, Huber and Rahimov (2014) in a study using the Oaxaca-Blinder decomposition suggested that the main reason of the higher wages in the informal sector can be ascribed to the unobserved self-selection of the employers.

¹⁴ The Business Environment and Enterprise Performance Survey (BEEPS) – a joint initiative of the European Bank for Reconstruction and Development and the World Bank.

Foundation,¹⁵ the index of overall economic freedom in Tajikistan is considerably low (an average value of 49.84 points for the 1998-2014 period), higher than in Uzbekistan and Turkmenistan but lower than in Kyrgyzstan and Kazakhstan.¹⁶ The overall economic freedom index of Tajikistan with comparison to other CAC is depicted in Figure 1.9.

Figure 1.9: Index of economic freedom in Tajikistan and other CAC (1998-2014)

(Score: 100 represent the maximum freedom)



Source: own elaboration based on Heritage Foundation, 2014

The informal employment in Tajikistan is concentrated in small private enterprises involving mainly services, trade, transport, and construction activities, self-employed workers in collective agricultural enterprises, private subsidiary plots and family farms, and paid workers and unpaid family workers in smallish farms or commercial enterprises (Amir and Berry, 2012).

¹⁵ The Heritage Foundation index of economic freedom uses the following indicators: international trade restrictions, government spending relative to GDP, regulatory efficiency and open markets, occupational licensing requirements, private property rights, minimum wage laws and other government-controlled factors that affect people's ability to earn a living and keep what they earn. Overall economic freedom is scored on a scale of 0 to 100, where 100 represent the maximum freedom.

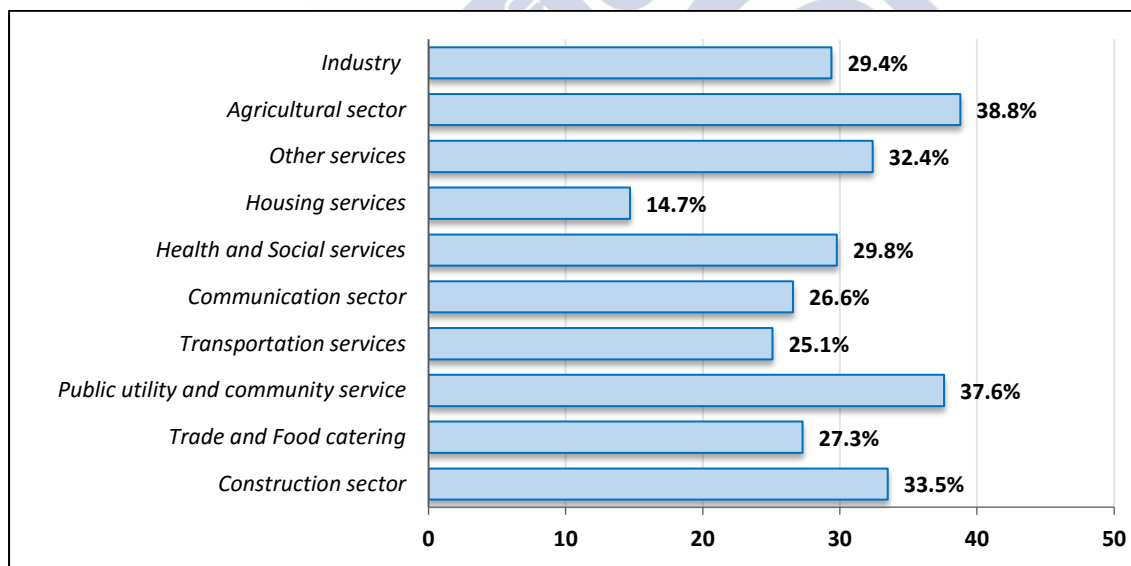
¹⁶ Gwartney et al., (1996) noted that an index of economic freedom should measure the extent to which rightly acquired property is protected and individuals are engaged in voluntary transactions and their actions do not violate the identical rights of others. Taking into account their annual report (2014), Tajikistan ranked 97th in economic freedom and 137th in freedom of trade among 152 countries.

Olimov (2007)¹⁷ classified the informal economic activities in Tajikistan into three major groups:

- i. *Unreported value added due to tax evasion*- including misreporting in financial and accounting documentation in order to avoid paying taxes, fees, social security payments and to overcome administrative regulation such as licensing and certification requirements.
- ii. *Unaccounted household income*- including home households activities on the production of goods both for selling and for own consumption which are not calculated in GDP.
- iii. *Unreported incomes from illegal and criminal activities*- including illegal activities in production, distribution, trade of goods and services, as well as the production and smuggling of drugs, prostitution, unlawful sale and production of arms etc.

Figure 1.10 presents the share of the informal sector by branch of economy in Tajikistan in 2007 according to Olimov’s estimations.

Figure 1.10: Determination the size of informal economy by branch of economy in Tajikistan (2007)



Source: own elaboration based on Olimov (2007).

¹⁷ Olimov (2007) used data from two surveys run in the summer of 2006 by SHARQ. The first Survey contains answers from managers of 500 enterprises about business environment, tax compliance, and statistical information about major indicators such as levels of output, investment, profitability, and productivity. The second survey contains the responses of 1000 households about major sources of income, payment methods, and types of employment.

Furthermore, Olimov (2007) demonstrated that home food production and services, which were estimated at 23.3 %, are an important monetary income source for households (in fact, the main income source for 16.2% of households). Home-based food production by households include production of cereals, meat, eggs, fruits and dry fruits, vegetables and honey etc., from private farms, subsidiary plots, own gardens, and from keeping livestock and breeding poultry as well.

1.5 The agricultural sector and the rural economy

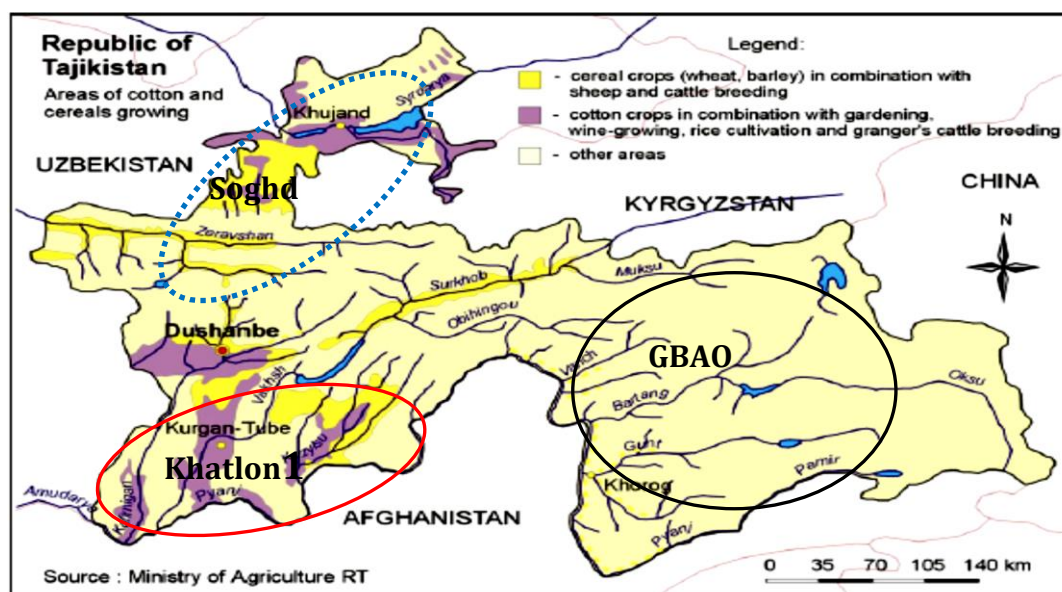
As the second largest sector of the Tajik economy, agriculture constituted a powerful support to the post-civil-war economic recovery and the consequent poverty reduction (Lerman and Sedik, 2008; FAO, 2014). Tajikistan has directed its rural development policy with a series of institutional and structural changes including price liberalization and the removal of direct government intervention, diversification of the agricultural output system, and the development of market and collective-action institutions (Rozelle and Swinnen, 2004).

The implementation of the agrarian reform slowly started to give a positive impulse into increases of the agricultural output. As a result, around 94% of the agricultural commodities were produced in household plots and by private-dehkan farmers. Moreover, the increase in home food production by households positively affected welfare levels in rural areas through the rise of household incomes and the stabilization of food consumption. Most of the agricultural areas are located in the Khatlon province, mainly in its South West part. The second largest agricultural areas are located in the North of the Sughd province (see Map 1.2).¹⁸

¹⁸ Tajikistan has a highly mountainous terrain, and most of its agricultural production is restricted to irrigated river valleys, which are broadly grouped into four valley systems as follows (Akramov and Shreedhar 2012):

- The Fergana Valley in the North along the Syr Darya (SW of Uzbekistan into Tajikistan);
- The broad Khatlon lowlands in the SouthWest, from Kulyab in the East to Uzbekistan in the West;
- The Gissar valley between Dushanbe and Tursunzade, just North of Khatlon;
- The narrow Zeravshan valley extending East to West between the Fergana and Gissar valleys.

Map 1.2: The map of regional land-use classification in Tajikistan



Source: Murodov, (2013)

Table 1.6 displays the average regional agricultural output and the proportions of agricultural land, number of livestock and cultivation areas.

Table 1.6: The agricultural potential by regions and their relative contribution to the total agricultural output in Tajikistan (by %)-in 2013

Regions	Khatlon	Sughd	RRS	GBAO	Country
Agri. Potential					
Agricultural production -(as %)	47.5	29.7	20.4	2.4	-
Agricultural lands-(as %)	38.4	20.8	24.2	16.6	-
Cultivation areas-(as %)	50.1	31.2	17.3	1.4	-
Cattle-(as %)	40.6	27.4	26.6	5.4	-
Sheep and goats-(as %)	40.1	27.5	25.3	7.1	Total: 100

Source : own calculation based on Taj STAT, 2013

The livestock sector is one of the main agricultural sub-sectors in all the regions including 2.1 million of cattle, 4.9 million of small ruminants and about 5 million of poultry (see Appendix 1.3). The grain and potato yields also increased considerably (see Appendix 1.4), but average

grain yields are still much lower than the average yields observed in other CAC (Akramov and Shreedhar, 2012). Despite the recent positive evolution, the current rates of agricultural sector growth seem to be unsustainable (World Bank Report, 2012d). Agricultural activities are still unprofitable and the sectoral risks remain to be high in the sector.

As mentioned above, Tajikistan has limited arable land and its agricultural land remained relatively constant (Lerman and Sedik, 2008). Arable lands constitute about 860,000 Ha from the 4.1 million Ha of total agricultural land. Nearly 85% of them (742,000 Ha) were irrigated but only 515,000 Ha are currently appropriate for agricultural production (World Bank Report, 2012). Irrigated crops include cotton, wheat, fruits, and vegetables and livestock production. Regional grazing resources are available by 3.3 million Ha but currently the potential of the pastures is wasted due to insufficient production of winter fodder (World Bank Report, 2012d).

The highly mountainous terrain that covers more than 90% of the territory puts special requirements to the development of land management strategies which optimize the use of agricultural resources. According to Lerman, (2013), unsustainable land management has led to large-scale land degradation in Tajikistan. The problems of erosion in the agricultural lands of Tajikistan affect 60% of irrigated lands (USAID, 2004). Fertilizer utilization declined considerably over time, and the development of a fertilizer industry is an extreme necessity in order to reduce monopoly fertilizer supply to the agricultural sector, as large cotton companies supply up to 75% of the fertilizer available in the market (Akramov and Shreedhar, 2012).

The irrigation network is poorly preserved due to inadequate financial resources and weak water resource management. About two-thirds of the irrigation comes from river-fed gravity systems supply with low cost and the rest includes pump systems (World Bank Report, 2012a). At the same time, Tajikistan is one of the main water suppliers to the downstream CAC. Water availability is a key constraint for agricultural sector in the country, and around 84% of all water used is consumed by the agricultural sector. Due to inefficiencies in the water transport infrastructure, only half of these resources reach croplands. There is an ongoing interest in managing water resources, which would include both dam building and repairing irrigation infrastructure (Jones et al., 2014). Moreover, the agricultural sector of Tajikistan often faces the consequences of climate variability as the risks of flooding, avalanches, mudslides, landslides etc.

In parallel with the existing challenges within the agricultural sector, the equipment processes are also constrained and the machinery inventories have declined dramatically since the Soviet Union period. For example, the numbers of tractors declined to 19,000 in 2006 compared with 37,000 in 1991, see in Appendix 1.5 (Lerman and Sedik, 2008). Over 50% of the equipment and machinery owned by Tajik agricultural producers is in non-working condition (Murodov, 2013). Farmers do not have financial resources for new equipments and modernization.

1.6 Summary

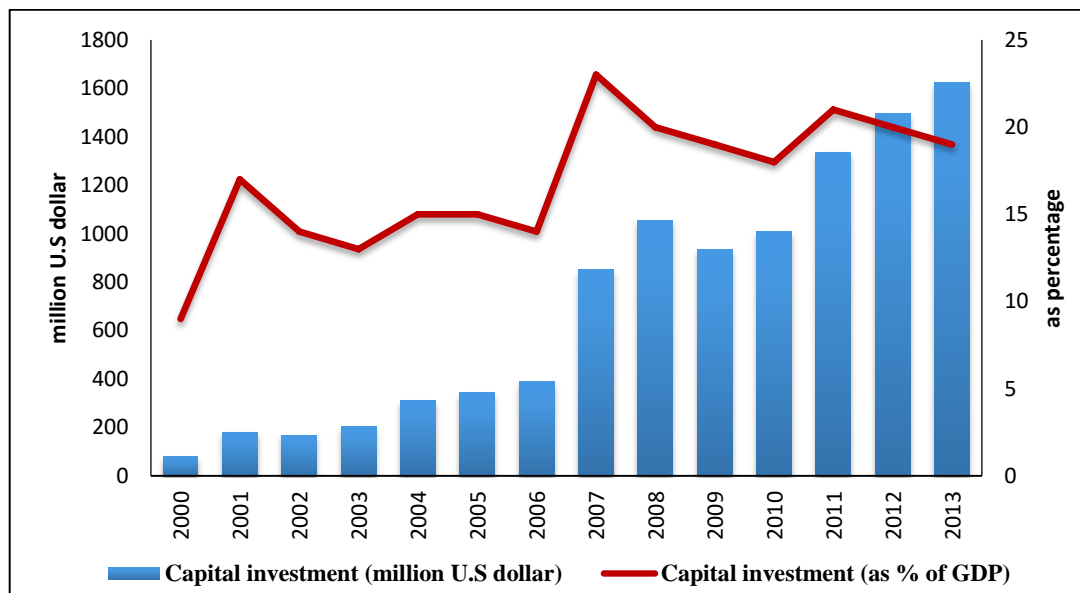
This chapter discussed the socio-economic situation in Tajikistan. After 25 years of its independence, the Tajik economy has gone through a traumatic transition process following the break-up of the Soviet Union along with an ensuing civil war and a severe socio-economic crash which increased considerably the poverty rate (Falkingham, 2000; Mughal, 2007; Amir and Berry, 2012). In spite of the implementation of several strategic programs and reforms, Tajikistan's institutional development is still unfinished.

Tajikistan has achieved significant progresses in macroeconomic stabilization, with an annual average economic growth rate of 8% between 2000-2014 (WDI, 2014) and consumer price inflation relatively under control. But GDP per capita remains below the levels of the later Soviet years at 1,114.1 US dollars in 2014 (WDI, 2014). Furthermore, the country has become dependent on remittance inflows from out-migration, which play a considerable contribution to economy growth, poverty reduction and the improvement of living standards of Tajik households. The dependence of Tajikistan's economic growth on external factors is a major source of vulnerability (World Bank, 2014).

After remittance incomes, the agricultural sector remains the main income source for the majority of Tajik households. It is obvious that both remittances income and home-food production have contributed to the achievements in poverty reduction. However, these results have a short and medium term character, bearing in mind that domestic agro-food production is still not sufficiently recovered and the labor market remains in a critical situation regarding job creation. With poor infrastructures and small production capacity, the agricultural sector cannot sustainably employ a large part of the labor force, in a country where 74% of the population lives in rural areas.

Appendix to Chapter 1

Table A1.1: Gross capital formation in Tajikistan (2000-2013)



Source: own elaboration based on WDI, 2014

Table A1.2: Agricultural equipment and machinery in Tajikistan (2008-2012)

	2008	2009	2010	2011	2012	Annual changes 2008-2012
Grain Combines (pcs.)	757	668	604	567	536	-5.8
Forage Harvester (pcs.)	319	255	259	218	192	-7.9
Lorries (pcs.)	5299	4875	4305	4177	3837	-5.5
Cotton combines (pcs.)	406	178	170	161	145	-12.8
Tractors (pcs.)	15951	14477	13697	13015	12222	-4.7

Source: Taj STAT, 2013

Table A1.3: Socio-demographic characteristics of Tajikistan's migrants by surveyed category (2008-2011)

	Households respondents (N=1.047.020)
Geographical distribution of respondents:	
-Dushanbe	12.0 %
-Khatlon	35.0 %
-Sughd	29.0 %
-RRP	19.0 %
-GBAO	4.0 %
-Total:	100 %
Age distribution of migrants:	
-18-25 years old	31.0 %
-26-35 years old	39.0 %
-36-45 years old	21.0 %
-46-55 years old	7.0 %
-56-65 years old	1.0 %
Gender distribution of migrants:	
-Male	93.0 %
-Female	7.0 %
Education (N=1503)*:	
-Compulsory	17.2 %
-Secondary or vocational	65.4 %
-Higher education	16.0 %
-No-education	1.50 %
Labor migration experience of households in 1991-2011 (N=1503)*:	
-Had migrants in 1991-2011	25.2 %
-Currently have migrants	20.4 %
-Had migrants in 1991-2011 and currently have migrants	6.70 %
-Had no migrants	47.7 %
Number of family members are migrants in abroad:	
-Household has 1 family member in migration	71 %
-Household has 2 family members in migration	22 %
-Household has 3 or more family members in migration	7 %
Migrants by occupation:	
-Labourers	51.9 %
-Construction workers	16.2 %
-Clerks, shop assistants or administrative staff	7.3 %
-Drivers or transportation services	5.9 %
-Bakers, cooks, butchers	2.8 %
-Sales agents, merchants	2.5 %
-Guard, security	1.2 %
-Others	4.8 %
Share of remittances as a %age of households income:	
-Households are depend 0-zero %	11.0 %
-Households are depend from 1-20 %	3.0 %
-Households are depend from 21-40 %	6.0 %
-Households are depend from 41-60 %	19.0 %
-Households are depend from 61-80 %	26.0 %
-Households are depend from 81-99 %	5.0 %
-Households are depend from 100 %	31.0 %
Plans to use money from the last move, in % N=618 (returned migrants in 1991-2011)*:	
-Purchases of food and basic necessities	59.7 %
-House renovation/improvement	21.5 %
-Investment in constructions	6.50 %
-Wedding expenditures	6.0 %
-Purchases of durable goods	1.50 %
-Child support	1.10 %
-Medical expenses	1.0 %
-Funeral expenditures	0.8 %
-Educational expenses	0.70 %
-Investment in household enterprise/business	0.30 %
-Other	1.0 %

Source: own elaboration based on data ILO (MRT, 2010) and *Tajikistan Household Panel Survey, IOS (THPS, 2011)

Table A1.4: World Bank funded projects in Tajikistan

Tajikistan became a member of Multilateral Investment Guarantee Agency- MIGA in 2002 and MIGA has not so far provided any political risk guarantees for investment projects in Tajikistan (World Bank Group, 2015a). The process of funds activities with cooperation of World Bank and Government of Tajikistan complements the Bank assistance program and finance a wide range of projects in key strategic sectors, including education, energy, agriculture, food security, and the social sectors, which are focused within framework of following active projects:

- Tajikistan: Environmental land management and rural livelihoods project, in the period 2013-2018 with financial budget 16.88 million U.S dollar;
- Tajikistan: Agriculture commercialization project, in the period 2014-2021 with financial budget 25.92 million U.S dollar;
- Tajikistan: Land registration and cadaster system projects, in the period 2005- 2016 with financial budget 20.63 million U.S dollar;
- Tajikistan: Second public employment for sustainable agricultural and water resources management project (PAMP II), in the period 2012- 2018 with financial budget 45.90 million U.S dollar;
- Tajikistan: Municipal infrastructure development project, in the period 2012- 2015 with financial budget 30.27 million U.S dollar;
- Tajikistan: Second Dushanbe water supply project, in the period 2012-2015, with financial budget 19.00 million U.S dollar;
- Tajikistan: Fourth global partnership for education fund grant (GPE-4), in the period 2012-2015, with financial budget 16.20 million U.S dollar;
- Tajikistan: Social safety net strengthening project, in the period 2011-2016, with financial budget 3.20 million U.S dollar;
- Tajikistan: Private sector competitiveness project, in the period 2012-2017, with financial budget 10.00 million U.S dollar;
- Tajikistan: Communal services development fund project, in the period 2015-2019, with financial budget 13.50 million U.S dollar;
- Tajikistan: Second phase of the Central Asia road links (CARS 2) program, in the period 2015-2020 with the financial budget 54 million U.S dollar;
- Tajikistan: Health services improvement project, in the period 2013 -2019 with the financial budget 23 million U.S dollar;
- Tajikistan: Scaling -up of the pilot of nutrition investments in severely food-insecure districts in Khatlon- Japan social development fund grant, in the period 2013-2018 with the financial budget 2.8 million U.S dollar;
- Tajikistan: Tax administration reform project, in the period 2012-2017 with the financial budget 18 million U.S dollar;
- Tajikistan: Central Asia programmatic poverty analysis support (CAPPAS) DFID trust fund, in the period 2010-2015 with the financial budget 18 million U.S dollar.

Table A1.5: Agricultural cultivation potential and agro-production data of Tajikistan during the period of 2007 and 2013

	2007	2008	2009	2010	2011	2012	2013
Total cultivation land ('000 ha)	891126	888911	875098	839475	850395	860147	864862
By region:							
– Dushanbe	171	171	187	164	829	939	174
– GBAO*	12281	12188	12418	12171	12476	12298	12219
– Khatlon	445978	450824	439128	419990	426907	432689	432698
– Sughd	277957	274478	272460	263861	267840	265476	270038
– RRS**	154739	151250	150905	143289	142343	148745	149733
By type of activities (as %)							
– Agricultural enterprises	24,4	21,7	19,5	18,5	17,9	17,4	17,0
– Household plots	21,6	22,9	22,2	22,6	22,8	23,4	23,3
– Dehkan Farms	54,0	55,4	58,3	58,9	59,3	59,2	59,7
By type of cultivation (as %)							
– Cereal crops	44,5	49,3	52,8	54,8	50,2	49,4	50,6
– Cotton	28,6	26,7	19,3	19,3	24,0	23,1	22,0
– Potatoes	3,3	3,2	3,4	3,8	4,3	4,8	5,3
– Vegetables	4,4	4,2	4,7	5,3	5,5	5,7	5,9
– Melon fields	1,2	1,3	2,2	2,5	2,2	2,1	2,0
– Forage crops	14,6	12,2	14,0	10,5	10,1	11,0	10,6
– Others	3,4	3,1	3,6	5,8	3,7	3,9	3,6
Production amount ('000 ton)							
– Cereal crops	931204	942894	1294522	1261059	1098182	1232591	1392644
– Cotton	419786	353146	296015	310560	416490	417978	392812
– Potatoes	662093	679774	690853	760139	863069	991044	1115696
– Vegetables	835131	908225	1046859	1142624	1242026	1342352	1490650
– Melon fields	254170	285253	424579	482393	423323	465039	495263
– Fruits	157183	262382	213915	225383	263060	313248	328467
Yields potential (tons/ha)							
– Cereal crops	2.35	2.15	2.80	2.74	2.57	2.90	3.18
– Cotton	1.65	1.49	1.76	1.91	2.04	2.10	2.06
– Potatoes	22.25	23.71	23.15	23.93	23.50	23.74	25.14
– Vegetables	21.35	24.44	25.66	25.52	26.49	27.40	29.39
– Melon fields	22.86	24.65	21.98	23.02	24.59	25.26	28.54
– Fruits	1.21	2.42	1.75	2.57	3.06	3.30	3.58

Source: Taj STAT, 2013

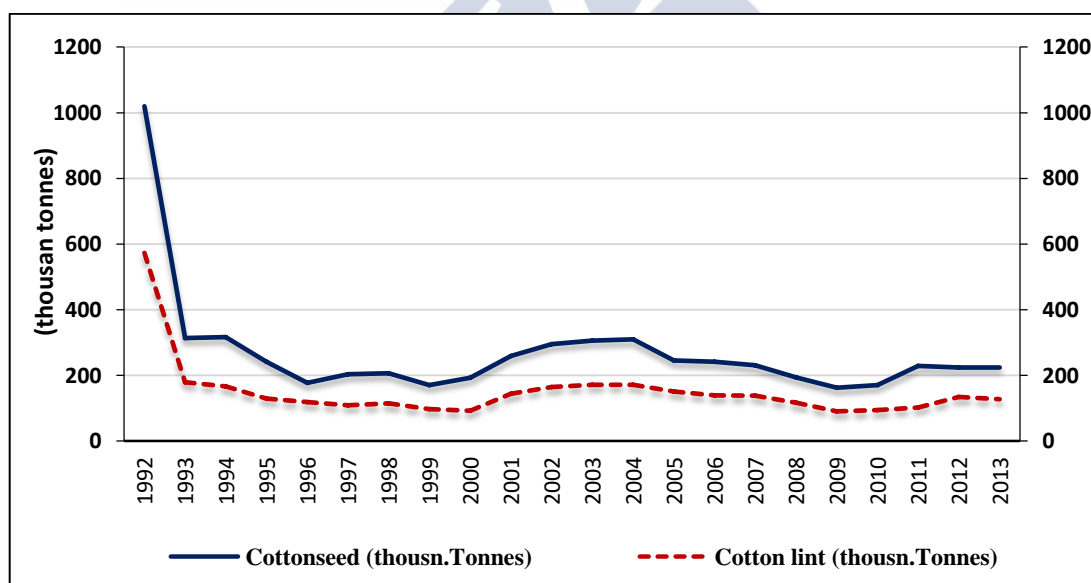
* Gorno-Badakhshan oblast

** Regions of Republican Subordination

Table A1.6: The livestock capacity in Tajikistan in the period 2007-2013 (unit head)

	Cattle		Pig	Sheep and goats	Horses	Poultry
	Total	Cow				
2007	1702.538	864.272	588	3798.427	78.528	3280.382
2008	1799.506	932.785	483	4146.763	77.068	3682.851
2009	1829.997	951.534	418	4200.184	75.796	3938.517
2010	1896.894	984.926	525	4394.192	76.420	4402.688
2011	2010.830	1033.154	694	4602.814	76.523	4655.924
2012	2043.725	1049.161	472	4732.477	76.688	4851.120
2013	2099.075	1076.315	486	4923.638	76.907	5020.482
<i>Annual average growth 2007-2013</i>	3.3%	3.5%	-2.4%	4.2%	-0.3%	7.6%

Source: Taj STAT, Agency on Statistics under President of the Republic of Tajikistan, 2013

Table A1.7. Reducing of cotton production in Tajikistan during the period 1992-2013


Source: Taj STAT, 2013





Chapter 2:

Spatial price transmission: evidences from Tajikistan



Chapter 2:

Spatial price transmission: evidences from Tajikistan

Abstract

This chapter investigates the market integration between international and domestic markets in the case of Tajikistan. More specifically, our study aims to understand the extent and speed of price transmission from international to local market. We have used cointegration techniques to analyse the price transmission mechanism, such as a vector error correction model (VEC) and threshold co-integration models. To our knowledge, there are no papers in the literature considered the price transmission from global to domestic prices in the case of Tajikistan. Policy-makers can use our results in evaluating the impacts of global agricultural price changes and trade on domestic agricultural prices. Our results can also contribute to the discussion on effects of agricultural and trade policies on food security in Tajikistan.

Introduction

The rise of world food prices and increased volatility of the agricultural commodities during recent years has attracted much attention from economists, as well as from policy makers who have to deal with potential welfare effects of higher food prices on producers, consumers and in particular on the poor and vulnerable households. High food prices raise the cost of food for consumers but increase the income of farmers (Swinnen and Squicciarini, 2012), which belong among the relatively poor segments of the society in many countries. The net effects of rising food prices depend on whether households or nations are net sellers or buyers of food items.

Domestic food prices depend on the evolution of global food prices and on price transmission from world to domestic markets. Global food prices not always are fully and/or quickly transmitted to domestic markets, either due to the existence of market imperfections or because of the government policies that attempt to isolate domestic markets from external shocks.. Governments in net exporting countries, for example, often use export bans or export taxes to prevent rises of domestic prices when global food prices soar, while similarly net food

importing countries might reduce tariffs or subsidize imports in such a situation. The pass-through of the price shocks from world to domestic markets can have significant income distribution and welfare implications for farmers and consumers. This makes the issue of price transmission very relevant from the policy-making perspective.

In this chapter, we study how global agricultural prices are transmitted to domestic prices in Tajikistan. As we described above, in Section 1.6, agriculture is one of the main food income sources for households in rural areas. On the other hand, households spend a significant share of their income on agricultural food products. For those reasons price transmission significantly affects both consumers and producers in Tajikistan.

In particular, we study the size, speed, and nature (symmetric and asymmetric) of pass-through of world agricultural commodity prices to domestic agricultural prices. Using monthly data on key agricultural products, we estimate the size of pass-through from world to domestic Tajik prices using time series methods. Policy-makers can use our results in order to evaluate the effects of trade policies on domestic agricultural commodity prices and their developments.

In the next Section, we briefly motivate our analysis describing how Tajikistan depends on imports of food products to provide for the basic necessities of its population. Then, in Section 2.2 we provide a short literature review on horizontal price transmission. Section 2.3 describes our methodology, theoretical framework and data, while Section 2.4 states our results. Section 2.5 summarizes and draws conclusions.

2.1 The external dependence of food supply in Tajikistan

After the period of civil war, the government of Tajikistan aimed at refocusing its agricultural production out from cotton monoculture towards the production of grains, livestock, and fruits and vegetables, trying to stabilize food supply in the domestic market and to increase food self-sufficiency, with mixed results that are shown in Table 2.1. At the same time, it liberalized Tajikistan's trade regime in agricultural products and removed the majority of government interventions in it. The level of Tajikistan trade openness (measured as a ratio of trade to GDP) as well as the rate of applied *Most Favored Nations (MFN)* tariffs in comparison to other CAC during the period between 2000 and 2013 are presented in Appendix 2.1 and 2.2.

Table 2.1: Self-sufficiency ratio by food commodities in Tajikistan (1992-2012)

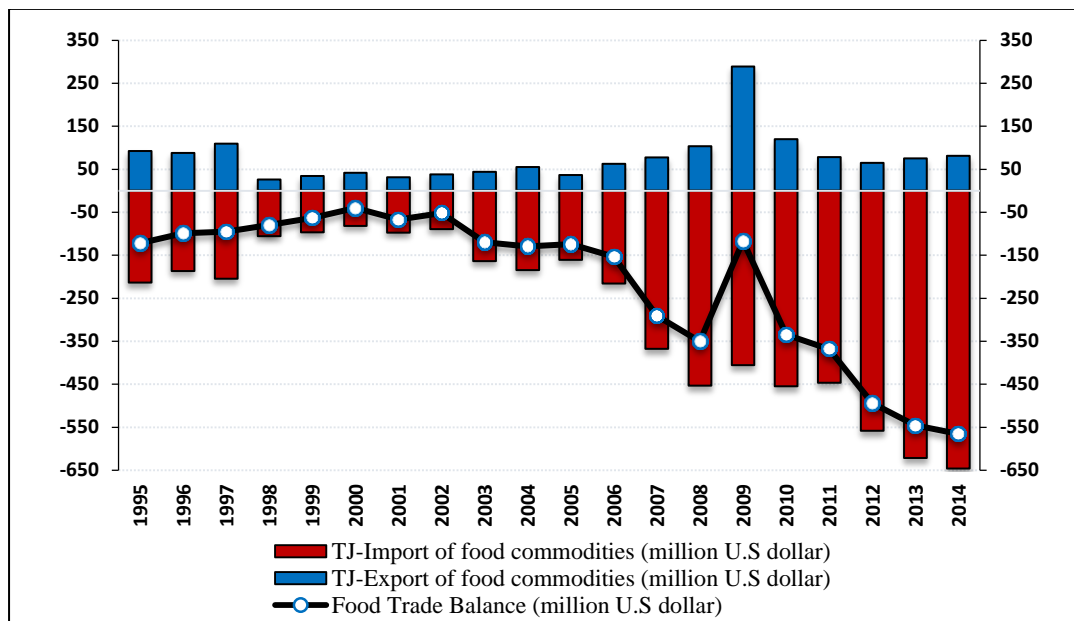
		1992	2002	2012
Wheat	Domestic production ('000 ton)	166.4	544.6	812.6
	Export ('000 ton)	-	-	-
	Import ('000 ton)	900.0	291.6	751.5
	Self-sufficiency (%)	15.6	65.1	51.9
Rice	Domestic production ('000 ton)	20.2	50.2	82.4
	Export ('000 ton)	-	-	3.7
	Import ('000 ton)	14.1	1.33	36.7
	Self-sufficiency (%)	58.9	97.5	71.4
Chicken meat	Domestic production ('000 ton)	5.2	0.1	7.5
	Export ('000 ton)	-	-	-
	Import ('000 ton)	-	0.85	19.3
	Self-sufficiency (%)	-	10.5	28.0
Fruits	Domestic production ('000 ton)	93.4	53.0	76.5*
	Export ('000 ton)	21.6	26.0	18.4*
	Import ('000 ton)	-	0.6	0.2*
	Self-sufficiency (%)	161.6	192.0	131.2*
Vegetables	Domestic production ('000 ton)	327.1	289.6	1017.5*
	Export ('000 ton)	-	8.4	2.6*
	Import ('000 ton)	-	5.2	2.2*
	Self-sufficiency (%)	144.0	101.1	100.1*

Source: own calculation based on FAOSTAT, 2015

Note: *estimated data are 2011

As mentioned in the previous chapter, Tajikistan does not have good conditions for agricultural production. This, combined with rapid demographic growth, implies that the growing domestic population cannot be supplied from domestic agricultural production alone. Therefore, Tajikistan has to rely on world markets to obtain enough food. Tajikistan imports consists from grain and flour, dairy and meat products, vegetable oil, sugar and confectionery preparations, coffee, tea and so on. Figure 2.1 provides the total food trade turnover of Tajikistan with net - trade food balance. Higher reliance on food imports makes Tajikistan more vulnerable to the volatility of global food prices.

Figure 2.1: The volume of food trade turnover of Tajikistan, (1995-2013)



Source: own elaboration based on UNCTAD, 2015

2.2 Literature review on previous studies of price transmission

Studies in agricultural economics that address the estimation of price transmission processes can approach the subject from a vertical or horizontal perspective. Price transmission across horizontally related markets presents a spatial dimension, focused on the links between prices at different locations, while in vertical price transmission the price linkages take place at the various stages of the supply chain (Vavra and Goodwin, 2005).

Overall, the issue of spatial price transmission theoretically has been widely investigated within the framework of the "*law of one price*". In the context of perfect trade linkages between several markets, the movements of commodity prices would be equal in both markets in the long-run, while allowing for deviations in the short run (Margarido et al., 2007). Barriers to price transmission from one market to another that prevent this result are usually classified by the literature into three types: the mechanisms of government trade policy, imperfect competition and transaction costs (Goodwin and Piggot 2001; Amikuzuno, 2010; Baltzer and Elleby, 2011).

Most of the studies on price transmission are focused in developed countries in Western Europe or USA. Only a few studies can be found dealing with markets in developing and

transition countries.¹⁹ Many of them use the linear co-integration approach to investigate the market integration between domestic and international rice markets without considering the effects of transaction costs, an approach that has been criticized by e.g. Enders and Siklos (2001), Meyer (2004), and Sarno et al., (2004). An alternative was advanced by Goodwin and Piggott (2001) in the form of a threshold co-integration approach. These authors found evidence for the presence of threshold effects in the US corn and soybean markets. Sanogo and Maliki (2010) have analyzed the market integration between Nepal and India using a threshold model and also confirmed the presence of threshold effects. The overall evidence is far from conclusive, with diverse results driven by methodological choices (e.g. linear co-integration vs. threshold co-integration), and particular characteristics (e.g. size, trade patterns,..... etc.) of the country under study.

2.3 Methodology, theoretical framework and data

The estimation of spatial price transmission of agricultural commodities encounters the common shortcoming in availability of data with the required frequency. There is not an unified approach in the literature. Researchers use many different methodological approaches, obtaining diverse results (Listorti, 2009). The majority of econometric studies, however, have used co-integration techniques to try to capture the long-term relation presumed to exist between horizontally or vertically linked prices (Hassouneh et.al, 2012). The general starting point in the case of assessing the relationship between international and domestic prices is given as follows:

$$p_{it} = \alpha + \beta p_{it}^* + \gamma e_t + \varepsilon_{it}^* \quad (1)$$

¹⁹ Many of them for the case of Bangladesh, either using time series methods (Nabil et al., 2006; Raihan and Razzaque, 2007) or using computable general equilibrium (CGE) models. Dorosh (2001) showed that the agricultural trade liberalization reforms in Bangladesh contributed to save the country from unprecedented price hikes during the period of domestic supply shocks in 1997. Ninno and Dorosh (2003) showed how private sector imports contributed to price stabilization following the 1998 flood. Ravallion (1986), Dawson and Dey (2002) have examined domestic spatial price integration for rice, the main staple in Bangladesh, but to date no other studies were conducted on the integration of domestic Bangladeshi and international rice prices, except Alam et al., (2012). Regarding other countries, Peter (2008) found a partial co-integration relationship between world and domestic Indonesian rice prices. Yavapolkul et al., (2006) also found evidence that the developed and developing countries' rice and wheat prices showed partial co-integration during the post-Uruguay round period.

where the domestic price of commodity i in time period t , p_{it} , is expressed as a product of the world price, p_{it}^* (Mundlak and Larson, 1992).²⁰ In case of existence of non-stationary variables, the result might be spurious regression (Granger and Newbold, 1974) in that there would appear to exist a significant relationship among variables on account of what would be, in fact, an statistical artifact without any economic meaning. As result, many of the older studies conducted in the area of market integration and price transmission were unreliable (Ardeni, 1989).

According to Mayer and von Cramon-Taubadel, (2004), Scholnick (1996), and Von Cramon-Taubadel (1998), these issues can be solved by employing *error correction models* (ECM)²¹. ECM models help to evaluate the level of integration and the price transmission between two market prices allowing for the use of non-stationary variables and they are open to intuitively appealing interpretations (Meyer and von Cramon-Taubadel, 2004). Following the study of Granger and Newbold (1974) about non-stationary variables, an important part of price transmission estimations have then tested for non-stationarity and the potential for co-integrating relationships among prices at different levels of the market, considering linear co-integration, co-integration with structural breaks in the price series, and asymmetric ECMs in order to quantify the extent, speed and nature of spatial price transmission from global markets to the domestic markets.

Following this approach, we apply time-series modeling techniques to evaluate horizontal price transmission from world markets to Tajik markets. Specifically, we employ an ECM to quantify the extent, speed, and nature of price transmission. With the intention of capturing the complexity of spatial price transmission we use a threshold Vector Error Correction Model (VECM), following Vavra and Goodwin, (2005), Hassouneh *et al.*, (2012), and Rajcaniova and Pokrivcak, (2013).

The estimation strategy can be summarized as follows: the first step is to use the augmented Dickey-Fuller (ADF) test in order to test of stationarity of prices' time series. In order to determine a unit root to each price series it is necessary then to apply the Phillips-Perron (PP) test. We determine the number of lags of the dependent variable using the Akaike Information

²⁰ Mundlak and Larson (1992) used the log-linear regression in order to estimate the variations in world prices, which is transmitted to domestic prices and as well as relationships between worlds prices and the degree of intervention.

²¹ FAO (2003) provides a review of the application of time series techniques (co-integration, ECMs) in testing market integration and price transmission for a number of cash and food crop markets in the developing countries.

Criterion (AIC). Next, if both time series are not stationary, the Johansen co-integration tests are used to evaluate the time-series properties of the data.

Then we follow the two-step approach of Engle and Granger (1987), by first estimating the co-integrating relationship among the variables by ordinary least squares (OLS), and second specifying the *error correction models* (ECM) by using lagged residuals from the co-integrating regression as error correction terms. This specification allows us to test for any asymmetries in transmission patterns, as well as for a consideration of the extent and timing of the spatial price transmission (Vavra and Goodwin, 2005).

The Johansen (1988) approach is based on a traditional vector autoregressive model (VAR):

$$\Delta p_t = \Pi p_{t-1} + \Gamma_1 \Delta p_{t-1} + \dots + \Gamma_{k-1} \Delta p_{t-k+1} + \varepsilon_t \quad (2)$$

which can be re-parametrized into a *Vector Error Correction* (VECM) form:

$$\Delta p_t = \sum_{i=1}^{k-1} \Gamma_i \Delta p_{t-i} + \Pi p_{t-k} + \varepsilon_t \quad (3)$$

where $p_t = (p_{1t}, p_{2t})$ is a vector of non-stationary price variables and Γ_i expresses the short-run dynamics of endogenous variables (thus measuring the short-run adjustment to changes in the price data) in the number of lags i . The vector of error terms denoted by ε_t is assumed to be a zero-mean, normally distributed process. Matrix Π indicates the long-run co-integrating relationships between the non-stationary variables in the model.²²

Estimation of the VECM by maximum-likelihood allows us to determine the rank of the Π matrix, that equals the number of its characteristic roots that differ from zero (Hassouneh et al., 2012). Johansen developed two tests (a trace test and a maximum eigenvalue test) in order to determine the rank of Π and to test the null hypothesis that the number of co-integrating characteristic roots is $r=0$, that can be applied both to stationary and non-stationary price time series data.

²² According to Enders, (2004), the Johansen approach can be viewed as a multivariate generalisation of the Dickey-Fuller test, allowing us to test the co-integration of the system in order to select an appropriate number of lags based on AIC statistics.

Following Johansen (1988) and Hassouneh et al., (2012) the tests can be written as follows:

$$\lambda_{trace} = -T \sum_{i=r+1}^k \ln(1 - \lambda_i) \text{ and } \lambda_{max} = -T \ln(1 - \lambda_{r+1}) \quad (4)$$

where the maximum likelihood λ_{max} by a function of the co-integration rank r determines the test of the co-integration system as a whole, testing the null rank $\Pi = r$ against the alternative rank $\Pi = r+1$. Here, λ_i denotes the values of the characteristic roots from Π , and T denotes the number of observations.

In order to assess the long-run price transmission, we estimate a typical long-run relationship between two price series by OLS, which can be written as follows:

$$v_t = \alpha + p_{1t} - \beta p_{2t} \quad (5)$$

where, p_{1t} and p_{2t} are prices at different levels of the food marketing chain and the notation v_t denotes the deviation from the equilibrium relationship, which is often called the ‘*error correction term*’ (ECT). Enders and Granger (1998) and Enders and Siklos (2001) have also used the threshold co-integration approach with the purpose to capture asymmetric movements in the residuals.

Supposing the long run relationship between two non-stationary variables x and y , such as p_{1t} and p_{2t} prices at different levels, such as global market price and domestic market price can be expressed as follows:

$$y_t = \gamma_0 + \gamma_1 x_t + \mu_t \quad (6)$$

the Engle and Granger (1987) approach, suggests a simple process of testing for co-integration by using (OLS) and a two-step estimator of the parameters of a bivariate single-equation model, which comprises the estimation of the static co-integrating regression. From this point of view, the existence of co-integration between two prices series, which present units unit roots tests according to the ADF and Phillips-Perron criteria, depends from the following autoregressive process:

$$v_t = \beta v_{t-1} + \mu_t \quad (7)$$

where, if the first variations operator $\beta \neq 0$, then the residual v_t from the regression of those series is stationary, and the price series are co-integrated. While, if we accept through an ADF test of the null hypothesis of non-co-integration that the residuals are distributed in equation (6), as non-stationary ($\beta = 0$,) then there are no relations between prices then allows us to reject the null hypothesis and to accept that the prices of p_{1t} and p_{2t} are co-integrated (Hassouneh et al., 2012).

Moreover, in the case of $\beta = 1$ the relative price is constant and the law of one price continues to hold, which indicates the spatially integration of both markets. In this manner, due to the minimization of the variation of the residuals around a mean of zero within the process of regression, the estimated residuals will be biased towards stationary. As standard ADF critical values are not applicable, the tests have to be applied to the residuals of the "co-integrating regression" and the analysis of unit roots in a single data series. Further, in order to capture the asymmetry in the price transmission process (specifically, in the price adjustment), it is necessary to apply a two-regime threshold co-integration approach:

$$v_t = \beta p_1 v_{t-1} + (1 - \beta_t) p_2 v_{t-1} + \mu_t \quad (8)$$

where parameter β_t is the Heaviside indicator ($\beta_t = 1$ in case of $v_{t-1} \geq r$, otherwise $\beta_t = 0$ if $v_{t-1} < r$). As mentioned above, the adjustment is at the rate p_1 when v_{t-1} is bigger than the threshold r , while if v_{t-1} is smaller than the threshold, then the adjustment is at the rate p_2 . The adjustment process is symmetric in the case of $p_1 = p_2$, and if the null hypothesis in the price parameters $p_1 = p_2 = 0$ is rejected, then dependent and independent variables are co-integrated (Rajcaniova and Pokrivcak, 2013), which give us the following specification for a threshold autoregressive model (TAR):

$$\begin{aligned} \Delta y_t = & \theta_y + \delta_y^+ e_{t-1}^+ + \delta_y^- e_{t-1}^- + \sum_{j=1}^j \alpha_{yj}^+ \Delta y_{t-1}^+ + \sum_{j=1}^j \alpha_{yj}^- \Delta y_{t-1}^- + \sum_{j=1}^j \beta_{yj}^+ \Delta x_{t-1}^+ \\ & + \sum_{j=1}^j \beta_{yj}^- \Delta x_{t-1}^- + \mu_{yt} \end{aligned} \quad (9)$$

where dependent and independent variables are represented by y , x respectively, t is the time period, j the number of lags, and e is the error correction. The parameters θ , δ , α , β are

coefficients, and μ is the error term. Supplementary, δ represents the speed of adjustment of the coefficients of Δy_t dependent variables, i.e. in the case of Δy_{t-1} being above or below its long-run equilibrium.

Thus, the ECT is split into positive and negative components depending on whether price transmission is symmetric or asymmetric. In this context, we use an F-test ($\alpha_{pi}^+ = \alpha_{pi}^-$ $i = 1$ and 2) to test the null hypothesis of symmetry and to discover whether the speed at which prices are transmitted differs (von Cramon-Taubadel, 1998).²³ Following the error correction representation $|(1 - \beta)x_t = -\gamma z_{t-1} + \mu_t|$ of Engle and Granger (1987) and the approach of Rajcaniova and Pokrivcak (2013), the two-error correction terms can be obtained as follows:

$$e_{t-1}^- = (1 - \beta_t)v_{t-1} \quad \text{and} \quad e_{t-1}^+ = \beta_t v_{t-1} \quad (10)$$

We use monthly price data for selected agricultural commodities traded in Tajikistan and on the world market, namely wheat, rice, beef meat, sheep meat, chicken, sugar, and soy oil. All of them have a significant share in households' consumption in Tajikistan. According to the Household Budget Survey of Tajikistan (*HBS, 2014*)²⁴, the share of wheat and bread products was 25.1%, beef meat 12.1%, rice 6.1%, sugar 3.9% percent, chicken meat 2.4%, and sheep meat 1.3% of households' food expenditure.

The time period covers January 2004 to December 2014. The prices were converted from TJS-somoni to US dollars using the current exchange rate, collecting the exchange rate data from IMF and National Bank of Tajikistan. The domestic prices of selected food items were taken from the Agency on Statistics under President of the Republic of Tajikistan (Taj STAT). They include the market average price of all type of chicken, beef and sheep meat, as well as rice, sugar and soybean oil.

²³ Von Cramon-Taubadel and Fahlbusch (1994) proposed to incorporate the standard error correction within the standard techniques of co-integration analysis in order to model asymmetric price transmission. Tsay (1989) implemented the method of testing for the threshold effects in autoregressive models based on the threshold autoregressive model. However, the first attempt at testing for vertical price transmission using the threshold vector error correction models (TVECM) was made by Goodwin and Holt, (1999).

²⁴ Agency on Statistics under President of the Republic of Tajikistan (Taj STAT) has conducting the Household Budget Survey of Tajikistan (2014) quarterly, and each year with the coverage of 3,000 households across five regions of country (HBST, 2014).

Prices of wheat were obtained from Ilyasov et al., (2014)²⁵ for the period 2003-2013, while wheat prices for the year 2014 come from Taj STAT. The price of domestic rice considered was the price of the local variety named "*рис длиннозерный*" or "*dlinnozernyy*" (Taj STAT, 2014). Table 2.2 provides domestic and global summary statistics of the selected agricultural commodities.

Table 2.2: Descriptive statistics of selected agriculture commodity prices

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>World/kg</i>					
Wheat	132	0.251	0.072	0.141	0.440
Sheep	132	5.103	0.965	3.746	6.995
Chicken	132	1.901	0.270	1.489	2.512
Rice	132	0.396	0.116	0.194	0.659
Beef	132	3.328	0.860	2.144	5.999
Sugar	132	0.354	0.131	0.128	0.653
Soy oil	132	0.862	0.260	0.460	1.423
<i>Tajikistan/kg</i>					
Wheat	132	0.378	0.119	0.171	0.608
Sheep	132	4.812	1.640	2.529	7.557
Chicken	132	2.687	0.530	1.867	3.832
Rice	132	1.436	0.564	0.437	2.140
Beef	132	4.303	1.615	2.142	7.181
Sugar	132	0.878	0.267	0.480	1.542
Soy oil	132	1.194	0.183	0.901	1.604
<i>Source: own calculation based on World Bank and Taj STAT</i>					

The trends of Tajik domestic prices for the selected food commodities along with world price trends are presented in Appendix 2.3. World prices are reported in US dollars and come from the World Bank database²⁶. The world prices of wheat and rice were converted from metric tonnes into kilograms price while soybean oil converted from metric tonnes into liters²⁷.

²⁵ Ilyasov et al., (2014) have estimated the integration of wheat markets in Central Asia.

²⁶ World price of wheat was taken as the HRW nominal price; rice as average of three auctions, such as "Nominal Vietnamese Rice Price- 5%", "Nominal Thailand Rice Price- 5%", and "Nominal Thai, A1 Special Rice Price".

²⁷ Source: <http://www.thecalculatorsite.com/conversions/common/liters-to-metric-tons.php>

2.4 Empirical results and discussion

The ADF and Phillips-Perron tests confirm that all our time series are non-stationary; we stationarized them by taking first differences. The tests indicated that all variables were stationary in first differences. The Akaike Information Criterion (AIC) determined the lags of the dependent variable in the tests.

Table 2.3: The Augmented Dickey-Fuller and Phillips-Perron tests

	<i>Augmented Dickey Fuller test results</i>				<i>Phillips Perron test results</i>			
	Level		1 st Diff		Level		1 st Diff	
	<i>ADF_c</i>	<i>ADF_t</i>	<i>ADF_c</i>	<i>ADF_t</i>	<i>PP_c</i>	<i>PP_t</i>	<i>PP_c</i>	<i>PP_t</i>
World								
Wheat	-1.856	-2.254	-7.611***	-7.599***	-1.816	-2.157	-8.776***	-8.762
Sheep	-1.519	-2.573	-5.422***	-5.396***	-1.129	-1.900	-7.296***	-7.283***
Chicken	0.114	-2.542	-5.975***	-6.076***	-0.287	-2.074	-5.000***	-5.031***
Rice	-1.969	-1.011	-4.561***	-4.895***	-2.160	-1.833	-10.976***	-11.141***
Beef	-0.173	-2.523	-6.192***	-6.242***	-0.728	-2.816	-6.952***	-6.894***
Sugar	-2.250	-1.936	-5.797***	-5.960***	-2.414	-1.925	-7.574***	-7.710***
Soy oil	-1.723	-1.872	-5.700***	-5.711***	-1.451	-1.229	-7.341***	-7.343***
Tajikistan								
Wheat	-1.942	-2.196	-5.171***	-5.193***	-1.996	-1.874	-10.968***	-11.062***
Sheep	-0.752	-1.882	-6.030***	-6.008***	-0.757	-1.493	-8.432***	-8.400***
Chicken	-1.858	-2.009	-3.632***	-4.324***	-1.479	-1.291	-10.115***	-10.138***
Rice	-2.508	-1.663	-6.239***	-6.606***	-2.267	-1.158	-8.416***	-8.724***
Beef	-1.034	-2.183	-4.034***	-4.015***	-0.686	-1.749	-9.133***	-9.103***
Sugar	-1.789	-1.367	-6.762***	-6.896***	-1.642	-1.452	-9.196***	-9.244***
Soy oil	-2.267	-2.334	-3.632***	-3.112***	-1.586	-1.344	-9.930***	-9.961***
Note: <i>ADF_c</i> is the ADF with an intercept and <i>ADF_t</i> with an intercept and a deterministic trend.					Note: <i>PP_c</i> is the PP with an intercept and <i>PP_t</i> with an intercept and a deterministic trend.			
*, **, *** denote significance at the 1%, 5%, and 10% significance levels.					*, **, *** denote significance at the 1%, 5%, and 10% significance levels.			

Having non-stationary time series, we applied the Johansen cointegration test to check whether the prices are cointegrated. Johansen cointegration test²⁸ results indicate that most of the prices are cointegrated with the world prices. There is a cointegrating relationship between world and Tajik prices of wheat, rice, sugar, and soy oil. This is consistent with our expectations. Tajikistan has open agricultural trade with the rest of the world with limited trade barriers only, and therefore Tajik domestic prices reflect the development of the world prices.

²⁸ Pantula principle was used to determine whether the time trend and the constant term should be included in the model.

Table 2.4: The Johansen co-integration test results

	<i>Rank</i>	<i>Johansen trace statistics</i>
Wheat	0	33.890
	1	4.488***
Sheep	0	11.640
	1	2.534
Chicken	0	5.862
	1	2.758
Rice	0	23.396
	1	8.021**
Beef	0	21.569
	1	8.446
Sugar	0	24.863
	1	5.417***
Soyoil	0	16.965
	1	2.066**
Source: calculated		
Note: *, **, *** denote significance at the 1%, 5%, and 10% significance levels.		

One implicit assumption of linear models, like Johansen and Juselius (1992) and Engel and Granger, (1987) is that adjustment of prices is a continuous and a linear function of the magnitude of deviations. This assumption might mislead the results because it ignores the effect of transaction costs in price adjustment (Alam and Begum, 2012). For this reason, in the next step we examine the presence of asymmetric adjustments in Tajikistan's prices.

Threshold co-integration models allow for non-linear relationship between world and local markets and vice versa. The theory does not guide us in the exact model specification and therefore in this paper we used four different threshold models: *Threshold Autoregression Model*, *Consistent Threshold Autoregression Model*, *Momentum Threshold Autoregression Model*, and *Consistent Momentum Threshold Autoregression Model*.

We report the results for models with the lowest AIC and BIC. According to the threshold co-integration tests, there is evidence of a co-integration relationship between world and local prices in the case of wheat, sheep, rice, beef, sugar and soy oil.

Table 2.5: The threshold co-integration test results

	<i>Model</i>	<i>Threshold</i>	<i>Lags</i>	ρ_1	ρ_2	$\Phi(H_0: \rho_1 = \rho_2 = 0)$	$F(H_0: \rho_1 = \rho_2)$
<i>Wheat</i>	<i>cTAR</i>	-0.155	1	-0.189***	-0.309	8.233*** [0.000]	0.582 [0.447]
<i>Sheep</i>	<i>cMTAR</i>	0.038	1	0.028	-0.048***	4.044*** [0.020]	4.404*** [0.038]
<i>Chicken</i>	<i>cMTAR</i>	0.009	1	-0.050	-0.011	1.180 [0.311]	0.908 [0.343]
<i>Rice</i>	<i>cTAR</i>	-0.134	2	-0.01	-0.196***	5.474*** [0.129]	5.425*** [0.021]
<i>Beef</i>	<i>cTAR</i>	-0.226	1	-0.098***	-0.040	5.145*** [0.007]	1.289 [0.158]
<i>Sugar</i>	<i>cTAR</i>	0.117	1	-0.333***	-0.090**	8.632*** [0.000]	6.003** [0.016]
<i>Soy oil</i>	<i>cTAR</i>	-0.049	2	-0.099***	-0.257***	6.605*** [0.002]	2.746** [0.100]

Source: calculated
 Note: *, **, *** denote significance at the 1%, 5%, and 10% significance levels, with P values reported in brackets

Even the pair of prices that have not proved to be co-integrated with the former test are co-integrated when we include the threshold adjustment. This means that the Enders and Granger model with threshold fits data better. Estimated models show that the prices are co-integrated with threshold adjustment, which can be understood as a proxy for transaction costs. Chicken prices in Tajikistan are proved to be not co-integrated by any co-integration test.

From the tests, it also follows that there is an evidence of asymmetry for world and local prices of sheep, rice, sugar, and soy oil in Tajikistan. The null hypothesis $\rho_1 = \rho_2$ is rejected at the 5% significance level for all these products except for soy oil for which it is rejected only at the 10% significance level. In all these cases, the speed of adjustment of positive price deviations (ρ_1) is higher than the speed of adjustment of negative price deviations (ρ_2). Negative and statistically significant error correction terms in the equations for Tajik wheat, rice, sugar and soy oil prices show that any short-term fluctuations between the world and domestic prices will lead to a long run relationship. The estimated coefficients indicate that the disequilibrium is corrected. However, within a year only 18% of Tajik wheat price is corrected, while for the other considered commodities the adjustment of prices to shocks occurring at the world markets is even slower. In [Appendixes 2.4 and 2.5](#), we report adjustment estimates for global prices with Tajikistan's prices on the selected food commodities. Deviations from long-term equilibrium resulting from price

increases (above the threshold) in the world wheat market would be more persistent compared to price deviations resulting from price decreases (below the threshold).

As mentioned above, the development of domestic food prices in Tajikistan followed the world price trends. However, in the case of some food items like rice, sugar and chicken meat, there is a huge gap between domestic and world price fluctuations, despite the similarity in their price movements. The reasons behind this may be multiple, like e.g. transport costs, monopoly trading, the action of local price speculators, taxes and trade barriers, etc. Unfortunately, due to the lack of data we are not able to discriminate among them.

There are several potential explanations of why meat prices in Tajikistan are not cointegrated with world prices. First, poor infrastructure makes meat trade more erratic. Second, there is bigger product differentiation in meats than in crop products. In particular, most of Tajikistan's population consists of Muslims, who consume Halal meat, which is a differentiated product from regular meat.²⁹ Third, lack of logistics services and refrigerated vans as well as underdeveloped packaging services have a stronger impact on trade with animal products than on trade with crops.

The price of rice in Tajikistan increased dramatically during the period considered, because of the low level and high production cost of local production and the lack of government subsidies to its consumption. The demand of imported types of rice is low, due to specific traditional preferences for the local type of rice by the population of Tajikistan.

On the other hand, the poor external and internal road- and rail-transport infrastructure, has resulted in an extremely inefficient and costly supply chain for importing food items to Tajikistan. As Anderson and van Wincoop, (2004) noted, in most developing countries trade costs from inadequate infrastructure and a cumbersome regulatory trade environment impose higher trade costs than tariffs and nontariff barriers.

2.5 Conclusion and final remarks

The evolution of agricultural prices has significant welfare effects in Tajikistan because the share of agriculture on GDP is relatively high and consumers spent a significant share of their incomes on food. The results of our estimation showed strong evidence of cointegration between

²⁹ Halal meat is mainly imported to Tajikistan from Iran, Russia, Turkey and some Arabic countries.

the domestic prices of Tajikistan and the world prices for several food commodities widely consumed by the Tajik population.

In our study, we have been forced to ignore transaction costs due to the lack of data, but we recognize its importance for the analysis of market integration in developing countries like Tajikistan. As our aim was the estimation of domestic and international market integration, we have chosen to use a two-regime threshold co-integration model. The statistical results of our estimation provide strong supporting evidence for the presence of co-integration and threshold effects between the domestic prices and global prices.

Empirical evidence shows that agricultural trade liberalization makes significant contributions to increase rural household incomes and to accelerate economic growth (Anderson et al., 2006). There are different positions in the literature about the results of multilateral trade reforms on international commodity prices, with some research studies suggesting values around 10% (Anderson et al., 2006) and other, more recent, studies pointing out even smaller effects. These results can be justified as the consequence of independent increases in international commodity prices, and/or because of the imposition of export taxes by developing countries (Anderson, 2009). On the other hand, Brooks and Matthews (2015) note that trade-liberalizing reforms create winners and losers via terms of trade effects, and that the losers may well include the poor and food insecure. In this context, it is important to note that the level of food security in Tajikistan is highly sensitive to price shocks (Taj STAT, 2014).

Therefore, the acceptance of trade liberalization policies by a small and underdeveloped country like Tajikistan with a low export potential is unambiguously not profitable in the short run. The commitments imposed by the multilateral trading system, the weak institutional development, the limited capacity to improve the quality of its production, the uncompetitiveness of products with limited market access, as well as the inflexible structure of production and trade in the agricultural sector are all factors that put food security at risk in a context of trade liberalization. On the other hand, the positive effects of such liberalization on market efficiency related to the removal of tariff barriers cannot be guaranteed without taking into account the persistence of non-tariffs barriers.

During food prices surges, it is necessary to react quickly to these shocks by controlling food prices (through efficient monetary policy and administrative measures) and reducing tariffs

on food imports. On the longer term, it is necessary to develop channels of food commodity distribution within the framework of supermarkets networks, in order to transform the traditional old market system into a modern market-trade system, in order to improve the efficiency of the domestic market. Thus should be accompanied by other policy measures contributing to develop the road infrastructure and capacity, logistic services, communications and information deliveries etc. The main focus of these policies should be that of reducing transaction costs if the government of Tajikistan wants to provide food security to its citizens that can be resilient to world food price shocks.



Appendix to Chapter 2

Table A2.1: Development agricultural cultivation potential in Tajikistan (1992-2013)

	1992	2005	2013
Total Land Area (1000 ha)	14310	14310	14255
Agricultural land (% of land area)	32.1	33.4	34.8
Arable Land (1000 ha)	873	773	869
Land under cereal production ('00 hectare)	273.5	417.2	418.2
Permanent crop land (% of land area)	0.9	0.8	1.0
Cereal yield (kg per hectare)	994	2164	2798
Fertilizer consumption (kg.per hec. arable land)	-	37.8	58.7
Crop production index (2004-2006=100)	76.1	97.9	151.1
Livestock production index (2004 2006=100)	113.8	102.3	163.9
Cereal production index (2004 2006=100)	30.6	102.4	134.0
Food production index (2004-2006=100)	90.8	98.2	155.7
Agricultural Output Growth Index (as per cent)	-15.2*	2.1	8.0
Share employment in agriculture (as per cent)	44.7	67.5	48.9
Rural population (as per cent)	68.3*	73.5	73.4

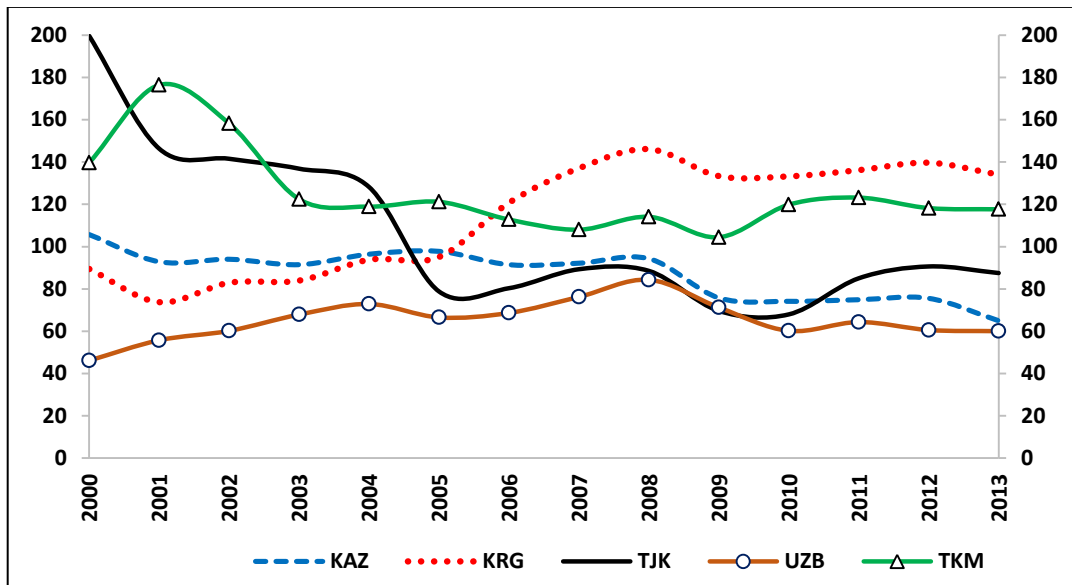
Source: WDI, 2015 and FAOSTAT, 2015

Table A2.2: Import tariffs for agricultural products in Tajikistan with comparison to other Central Asia countries, (2012-2014)

	Kazakhstan		Kyrgyzstan		Tajikistan		Uzbekistan	
	2012	2014	2012	2014	2012	2014	2012	2014
Simple average MFN applied:								
Total	9.5	8.6	4.6	4.6	7.8	7.7	15.4	14.8
Non-Agricultural prod.	8.8	8.1	4.2	4.1	7.3	7.2	14.9	14.2
Agricultural products	13.4	11.6	7.4	7.6	10.8	10.7	19.2	18.8
MFN applied duties by group of agricultural products								
Animal products	23.8	19.7	7.6	7.6	9.6	9.6	13.8	15.3
Fruit, vegetables, plants	19.2	16.7	10.8	10.8	12.5	12.5	17.3	15.8
Coffee, tea	11.0	9.7	9.7	9.7	12.0	11.9	29.0	29.0
Cereals & preparation	9.5	7.5	6.8	6.8	6.7	6.7	15.8	15.3
Dairy products	13.2	11.2	7.8	8.3	9.9	9.9	20.3	18.7
Oilseeds, fats & oils	8.5	7.5	5.7	5.9	6.7	6.7	7.2	7.9
Sugars & confectionery	14.9	13.0	4.4	6.0	6.3	6.3	26.3	24.5
Beverages & tobacco	30.9	27.6	15.1	14.7	31.2	31.1	31.6	27.3
Other agricultural prod.	5.6	5.3	2.2	2.5	6.5	6.1	10.7	10.5

Source: WTO, World Tariff Profiles 2013-2015

Table A2.3: Trade openness ratio of Tajikistan with compared to others CAC (2000-2013)



Source: calculated based on WDI, 2015

Table A2.4: Adjustment estimates for world and domestic prices

	Wheat		Sheep		Chicken		Rice	
	World	Tajikistan	World	Tajikistan	World	Tajikistan	World	Tajikistan
(Intercept)	0.003	0.000	0.001	0.012	0.001	0.004	-0.006	0.005
X.diff.world.t_1.pos	0.130	-0.004	0.389***	-0.123	0.705***	0.421	0.128	0.122
X.diff.world.t_2.pos	-	-	-	-	-	-	0.037	0.132
X.diff.world.t_1.neg	0.210	0.090	0.477***	0.317**	0.782***	-0.265	-0.137	0.689**
X.diff.world.t_2.neg	-	-	-	-	-	-	-0.012	-0.326
X.diff.domestic.t_1.pos	0.319**	0.116	0.140	0.162	0.011	-0.127	0.439***	0.078
X.diff.domestic.t_2.pos	-	-	-	-	-	-	-0.263**	0.036
X.diff.domestic.t_1.neg	0.319*	-0.128	0.131	0.577***	0.017	0.536***	-0.483**	-0.061
X.diff.domestic.t_2.neg	-	-	-	-	-	-	0.164	-0.030
X.ECT.t_1.pos	-0.132**	0.223***	-0.033*	-0.016	0.015	0.002	-0.148**	0.036
X.ECT.t_1.neg	-0.129	0.123	0.030***	-0.006	0.005	-0.001	-0.064	0.030
R-squared	0.134	0.142	0.277	0.153	0.582	0.082	0.166	0.157
Adj-R2	0.092	0.100	0.241	0.112	0.561	0.037	0.096	0.085
F-stat	3.176	3.381	7.835	3.714	28.523	1.823	2.352	2.194
Stat DW	1.978	1.922	1.931	2.011	1.427	1.962	1.933	1.986
p-value DW	0.722	0.540	0.528	0.894	0.002	0.602	0.518	0.728
AIC	-316.095	-339.000	582.856	-604.377	-854.214	-540.016	-315.970	-466.542
BIC	-293.155	-316.060	-559.916	-581.436	-831.274	-517.076	-281.652	-432.224
LB(4)	0.960	0.289	0.872	0.972	0.589	0.168	0.861	0.957
LB(8)	0.230	0.181	0.732	0.138	0.158	0.154	0.550	0.844
LB(12)	0.242	0.204	0.769	0.151	0.162	0.215	0.800	0.485

Source: calculated

Note: *, **, *** denote significance at the 1%, 5%, and 10% significance levels

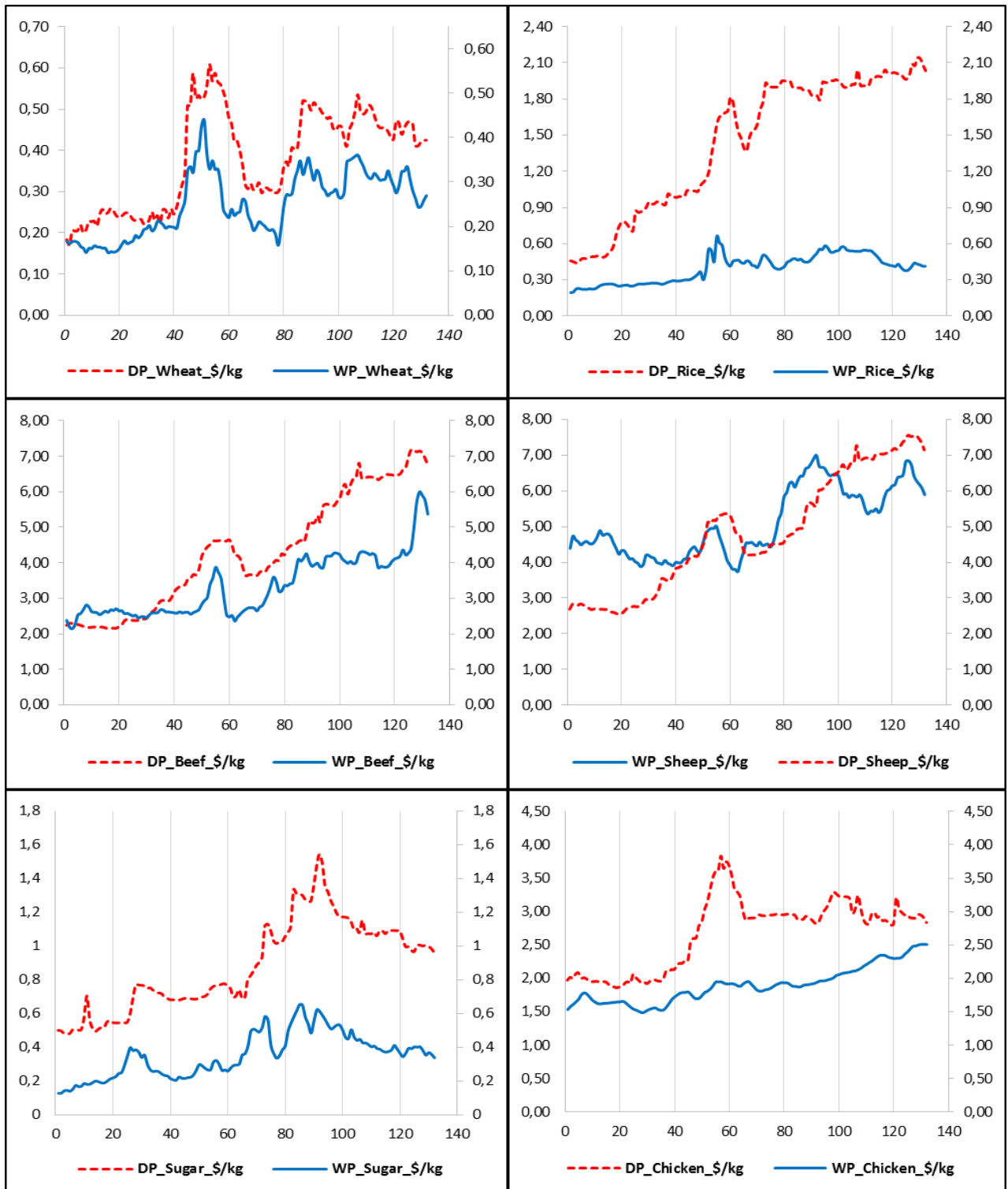
Table A2.5: Adjustment estimates for world and domestic prices

	<i>Beef</i>		<i>Sugar</i>		<i>Soy oil</i>	
	<i>World</i>	<i>Tajikistan</i>	<i>World</i>	<i>Tajikistan</i>	<i>World</i>	<i>Tajikistan</i>
(Intercept)	0.003	0.009**	-0.004	0.009	0.008	0.005
X.diff.world.t_1.pos	0.065	0.157	0.042	-0.0093	0.288	0.110
X.diff.world.t_2.pos	-	-	-	-	0.093	0.103
X.diff.world.t_1.neg	0.491***	-0.037	0.350**	0.095	0.247	0.155
X.diff.world.t_2.neg	-	-	-	-	-0.035	-0.266*
X.diff.domestic.t_1.pos	-0.104***	-0.025	0.017	0.120***	0.373**	0.109
X.diff.domestic.t_2.pos	-0.059	0.124***	-0.181**	0.086*	-0.124	-0.075
X.diff.domestic.t_1.neg	7.574	3.557	4.748	6.787	0.353**	-0.103
X.diff.domestic.t_2.neg	1.981	2.107	1.888	2.034	0.354*	0.266***
X.ECT.t_1.pos	-449.313	-569.077	-289.555	-404.410	-0.107	-0.006
X.ECT.t_1.neg	0.511	0.550	0.864	0.195	-0.108	0.059*
R-squared	0.270	0.148	0.188	0.249	0.242	0.186
Adj-R2	0.234	0.106	0.148	0.212	0.178	0.117
F-stat	7.574	3.557	4.748	6.787	3.770	2.689
Stat DW	1.981	2.107	1.888	2.034	1.964	1.956
p-value DW	0.766	0.786	0.390	0.958	0.708	0.712
AIC	-472.254	-592.018	-312.495	-427.350	-397.121	-580.053
BIC	-449.313	-569.077	-289.555	-404.410	-362.803	-545.735
LB(4)	0.511	0.550	0.864	0.195	0.384	0.779
LB(8)	0.367	0.646	0.932	0.584	0.325	0.858
LB(12)	0.318	0.420	0.514	0.474	0.384	0.769

Source: calculated

Note: *, **, *** denote significance at the 1%, 5%, and 10% significance levels

Table A2.6: The world and domestic price trends for selected food commodities (2004-2014)







Chapter 3:
Estimation of food demand systems: evidence from LSMS data
of Tajikistan



Estimation of food demand systems: evidence from LSMS data of Tajikistan

Abstract

This chapter provides a descriptive and statistical assessment of household consumption and expenditure as the measures of living standards of Tajik households based on the data taken from *Tajikistan Living Standard Measurement Survey* (LSMS) during the three years of 2003, 2007 and 2009. The chapter also estimates a food demand system for Tajikistan using the microdata from LSMS, providing precise information about household food consumption behavior taking into account the effects of the various socio-economic characteristics on which the Tajik households are heterogeneous. The demand for seven aggregate food products is estimated using the functional form of the Quadratic Almost Ideal Demand System (QUAIDS) model. The estimation employs the two-step approach of Shonkwiler and Yen, (1999), to account for zero values in consumption expenditure.

Introduction

The demand for food in Tajikistan has undergone severe upheavals due to the socio-economic and political instability along with the considerable increase in the poverty headcount since the first days of independence in 1991³⁰. This situation has raised up a wide range of development policy issues like poverty elimination, improvement in nutritional and food security, and the adequation of food subsidies. After the stabilization of the political situation with the end of the civil war in 1997, gradual improvements were observed in the food consumption patterns of Tajik households. These improvements were linked to the recovery of the agricultural production capacities in the guise of increases of home-food production by households, as well as to targeted international food aids, increases of the real income of households from both internal and external sources³¹, and structural shifts such as changes in the demographic characteristics of population.

³⁰ The poverty rate reached 86% of the population in 1998 (IMF, 2009), which was an increase from 51.2% in 1989 (Falkingham, 2000).

³¹ Internal income sources of Tajik households include wage earning incomes, home food production incomes, social benefit and assistance, private transfers etc., whereas external incomes sources come from the export of agricultural commodities by households and remittance incomes from abroad by members of households.

In spite of these positive changes in food consumption during the last years, the risks for food security are likely still high due to the instability in the patterns trends of dietary composition and nutrition levels of Tajik households. Food demand is an important dimension of household well-being. Tajik households allocate, on average, more than 65% of their consumption expenditure to food purchases (Taj STAT, 2014). Population growth at an annual average rate of 2.3% has increased food demand as well as changed its composition of food. Therefore, food demand analysis has to be predominantly concerned with a proper assessment of food consumption changes, including its response to various shocks. Although several international organizations (World Bank, IMF, FAO, WFP etc.) and some individual researchers (Falkingham, 2000; Raghbendra and Tashrifov, 2008; Forster et al., 2009; Akramov and Shreedhar, 2012; Asadov, 2013; Anríquez et al., 2013) have done substantial descriptive assessments of food consumption patterns, including the effect of various shocks on the living standards of Tajik households. However, most of these studies have focused on the investigation of poverty elimination and the construction of food security indicators. As far as we know, however, there are no previous econometric estimations about the response of food demand to any of these shocks.

A quantitative knowledge about food demand is relevant for the design and implementation of agricultural development strategies and appropriate government social security policies targeted to improve the living standards of the population. This chapter attempts to provide a first step towards a complete estimation of a food demand system for Tajikistan, using microdata taken from the *Living Standard Measurement Survey* the World Bank conducted in Tajikistan in the years 2003, 2007 and 2009.

In order to deal with the large number of products involved, we aggregated the major components of food consumption into six groups: bread & cereals; meat & fish products; dairy products; vegetables & fruits; oils & animal fats; and other food items; including all other non-food products and services in a seventh group. The demand parameters were estimated using a two-step procedure: in the first step, a censored demand system taking into account zero values in expenditures³² was estimated using simulation based on *maximum likelihood probit regression*.

³² Despite the aggregation into 7 group categories, some groups still contained a considerable number of zero-value observations for consumption expenditure, e.g. in the case of meat & fish products, dairy products and vegetables & fruits. Products in these groups can be considered as luxuries in the consumption patterns of most Tajik households.

Then, in the second step, the food demand system was estimated based on the most frequently used model for nonlinear demand systems estimation, namely the *Quadratic Almost Ideal Demand System* (QUAIDS) model, incorporating the predicted results of the probit estimation obtained from the first stage.³³ Standard errors and confidence intervals for the estimated coefficients and elasticities were computed using bootstrapping methods.

The structure of this chapter is organized as follows: the following Section reviews the literature on demand system estimation. The Section 2 discuss theoretical framework and specification of estimates demand model. Section 3 and 4 provides a descriptive summary of the data used. Section 5 reviews and discuss the household consumption patterns and income sources, while Section 6 describes estimation approach. Section 7 states our empirical results and last one presents summarizes and draws conclusions.

3.1 Literature review

A number of empirical studies have estimated food demand systems in order to obtain income and price elasticities, with results widely variable across countries. The focus of these studies lies on how households adjust their consumption in response to changes in prices and incomes, as well as in the estimation of the welfare effects of various shocks, in particular those related with food price volatility. The estimation of income-expenditure and price elasticities is required for conducting policy simulations. Considerable amounts of these studies were conducted for poor and developing countries where households spend a significant part of their income on food.

In most developing countries, food is a necessity that makes up the largest share of household expenditure (Ivanic and Martin, 2008; Mitchell, 2008; Aksoy and Isik-Dikmelik, 2008; Wood and Nelson, 2009; Ivanic et al., 2011). Several research papers have applied food demand models in order to obtain income-expenditure and price elasticities, as well as calorie and micronutrient consumption to investigate issues related to food security, nutrition and households

³³ The particular specification of the models was tested applying the Wald test with the intention to describe the validity of the demographic controls in the QUAIDS model. The restricted models were compared with linear Engel curves as well as the alternative models with quadratic Engel curves for all aggregated product groups. The outcomes from the tests supported the inclusion of the quadratic expenditure term, and thus the use of the QUAIDS model (Banks et al., 1997; Bopape, 2006).

diet (Bouis, Haddad, and Kennedy 1992; Subramanian and Deaton 1996; Abdulai and Aubert 2004; Ecker and Qaim, 2008; Pangaribowo and Tsegai, 2011 etc.).

Many of these empirical studies have employed AIDS and QUAIDS demand models (Musyoka and Bauer, 2012; Tefera et al., 2012; Sekhampu and Dubihlela, 2012; Shittu et al., 2015). Deaton, (1989) applied a non-parametric analysis and examined rice prices and income distribution in Thailand. Using Ethiopia Agricultural Marketing Household Survey (EAMHS-2008) with nonparametric NBR analysis and a QUAIDS model, Tefera et al., (2012) found that higher cereal prices have a positive impact on the aggregate welfare of rural households in Ethiopia. Abdulai and Aubert, (2004) also employed the QUAIDS model in the case of Tanzania, in an attempt to estimate price and expenditure elasticities and the impact of socio-economic variables on food demand patterns and nutrients amongst households. With significant effects of income and other socio-economic variables, the study found higher expenditure elasticities for the main household diet goods i.e. meat, fish, eggs, milk and milk products and fruits and vegetables, relatively to cereals and pulses. A similar situation was remarked in the case of Malawi (Ecker and Qaim, 2008).

Similarly, Attanasio et al., (2013) used individual household data from Mexico to estimate the welfare effect of rising food prices using a QUAIDS model. As a result, they found that poor households have been relatively more affected by changes in relative prices of food. Shittu et al., (2015) have studied the welfare impacts of high, rising, and sometimes-volatile food prices on Nigeria's farm households.³⁴ Finally, Tefera et al., (2015) estimated the habit-forming behavior of food demand for ten food commodities using both dynamic QUAIDS and generalized dynamic AIDS models in the case of Ethiopia.

3.2 Theoretical framework and methodology approach: QUAIDS model

The theoretical study of the household food demand system within microeconomic theory started at the end of the 19th century, based on the relationship between the levels of household income and quantities purchased of particular commodities or services by households (Chai and Moneta, 2010; J. Singh). Engel's Law (1857) stated that when household income increases, the

³⁴ Sola, (2013) found that demand for food in the Ondo state of Nigeria showed expenditure elasticity higher than one (corresponding to luxury goods) for rice, beans, yam flour, meat, fruit, and vegetables.

share of food purchases decreases and the consumption of other goods and services increases, i.e., the household will shift to the consumption of “*luxury goods*”. Accordingly, goods with income elasticities below zero, between zero and one, and higher than one were called inferior goods, necessities, and luxuries respectively (Lewbel and College, 2006).

Working (1943) suggested a linear budget share specification and Leser (1963) confirmed that this functional form fits better than some alternatives. The linear form of the so-called Engel curves remained to be known as the “*Working–Leser condition*” (WLC), relating the shares of the household budget to the logarithm of household expenditure:³⁵

$$\delta_i = \alpha_i + \beta_i \ln x \quad (1)$$

where the adding-up conditions imply $\sum_i \delta_i = 1$, with $\sum_i \alpha_i = 1$ and $\sum_i \beta_i = 0$.

The study of consumer demand theory has stimulated the empirical analysis of consumer behaviour and consumer preferences with always more developed econometric techniques (Stone, 1954; Deaton & Muellbauer, 1980; Blundell et al. 1994; Banks et al., 1997; Farrell & Shields, 2007). Over the last few decades, the study of the linkage between household income and expenditure based on the Engel Law has become the main objective of many microeconomic and empirical studies of the consumer demand, e.g. Deaton and Muellbauer (1980); Pasinetti (1981); Jorgenson et al., 1982; Blundell et al., (1998); Witt (2001) and Charles et al., (2009) etc. The semi-parametric estimation of Engel curves was widely investigated as well (Blow, 2003). Engel curves can be defined as Marshallian demand functions holding the prices of all goods fixed (Lewbel and College, 2006). The basic approach involves the estimation of Marshallian demand functions that specify the quantities that the household consumed as functions of prices and expenditure. While incomes vary considerably across individuals, income elasticities vary across commodities (Banks et al., 1997). The variations in the demand structure of households are based on a matrix of commodity prices and income elasticities of demand for the groups of commodities.

Several models for the estimation of demand systems can be found in the literature. The starting point was the specification of the *Linear Expenditure System (LES)* proposed by Stone

³⁵ Banks et al., (1997), based on the estimation of parametric and nonparametric methods claimed that the WLC specification does not show the individual behaviour for all commodities. A complete description of consumer behaviour requires a specification of both the Engel curve and relative price effects (Paola De Agostini, 2014).

(1954), who investigated the general linear formulation of household demand. The limitations of that model, such as proportional income and price elasticities, boosted the development of other econometric models, such as the “*Rotterdam Model*” of Theil, (1965) and the “*Translog Model*” of Christensen et al., (1975). Later, Deaton and Muellbauer, (1980) proposed a linear-logarithmic form, known as the *Almost Ideal Demand System (AIDS)*.³⁶

The AIDS model identifies the logarithm of real income-expenditure and prices as “*regressors*”, taking the household budget shares as the dependent variable, which is specified to be linear with respect to the logarithm of income. The existence of nonlinearity in the household budget shares of certain goods was observed by Banks et al., (1997), who demonstrated empirically the relevance of non-linear Engel curves. To take into account these nonlinearities, Blundell et al., (1993) proposed to estimate flexible demand systems, and stated the properties and advantages of a quadratic extension of the AIDS model, the *Quadratic Almost Ideal Demand System (QUAIDS)* model. This model is currently used in most of the empirical studies. QUAIDS can be derived from a generalization of the *Price –Independent Generalized Logarithmic (PIGLOG)* preferences that incorporate higher orders of expenditure and income in the quadratic term, which positively affects the quality of the model results (Fisher et al., 2000). Moreover, it is possible to derive both the *TLS* model of Jorgenson et al., (1982) and the AIDS model of Deaton and Muellbauer, (1980) by imposing particular restrictions on the parameters of the QUAIDS model. Banks et al., (1993, 1997) claimed that nonparametric estimates do not significantly differ from the QUAIDS model, and therefore, no more flexibility is needed. The QUAIDS model has a flexible functional form and allows for exact aggregable estimation over households. Thus, it is particularly suited to instances where aggregation or cross-price effects are important (Cranfield et al., 2003).

The empirical estimation approach we use in this chapter is based on a QUAIDS model for several food commodity groups including household demographic characteristics. Assuming the simple household model of Singh, et al., (1986), the household maximizes utility $\max u_h^\phi = u_h(c_i, c_j, \dots, c_n)$ given a vector of prices p and subject to the household budget constraint, $w_i = \sum_i^n p_i q_i$ with $q_i \geq 0$ or $p q_i \leq w_i$. However, Blundell et al., (1994) noted that there is a

³⁶ Jorgenson et al., (1982) developed the “*Transcendental Logarithmic System (TLS)*” models, not widely used in the literature.

systematic variance in household consumption behaviour based on the size and composition of the household, as well as on the age and other differentiated characteristics of each individual in the household.³⁷ Taking into account the socio-demographic characteristics z_h , the household utility maximization problem can be written as:

$$\max u_h^\phi = u_h(c_i, c_j, \dots, c_n; z_h) \quad (2)$$

Indeed, there are different ways to incorporate the household demographic characteristics into the utility function (Moro and Sckokai, 2000; Paola De Agostini, 2014). We use the scaling techniques presented by Ray (1983) that have been extended by Poi (2012) into the QUAIDS specification. Ray's approach uses the expenditure function for each household underlying the budget share $e(p, z, u) = m_0(p, z, u) \times e^R(p, u)$, which scaled by function $m_0(p, z, u) = \bar{m}(z) \times \phi(p, z, u)$ gives the expenditure function with the household characteristics z included. The first term measures the increase in household expenditure as a function of z , not being controlled by any changes in consumption patterns. E.g., despite the changes in the composition of consumed goods, a household with four members will have higher expenditures than one with a single member. The second term $\phi(p, z, u)$ controls variations in relative prices and the actual goods consumed, reflecting the variations of consumption across households. For instance, a household with two adults and two infants will consume different goods than one comprising four adults. Following Ray (1983), the function $\bar{m}_0(z)$ was estimated with parameters γ' given by $\bar{m}_0(z) = 1 + \gamma'z$.³⁸

Calling V_h the indirect utility function corresponding to u_h^ϕ , i.e. the total household expenditure m related to w_i and the vector of p that represents commodity prices including the household demographic characteristics z_h , in the QUAIDS model it can be noted as follows:

$$V_h(p, m; z_h) = \left[\left(\frac{\ln m - \ln a(p, z_h)}{b(p, z_h)} \right)^{-1} + \lambda(p, z_h) \right]^{-1} \quad (3)$$

³⁷ In particular, we consider heterogeneity in age, number of household members, employment status and other socio-demographics variables (Dybczak et al., 2010; Zheng and Henneberry, 2010).

³⁸ As in Poi (2002a), quadratic AIDS parameterizes $\phi(p, z, u)$ as $\ln \phi(p, z, u) = \frac{\prod_{j=1}^k p_j^{B_j} (\prod_{j=1}^k p_j^{\eta_j^i z} - 1)}{\frac{1}{u} - \sum_{j=1}^k \lambda_i \ln p_j}$ where η_j represents the j column of $s \times k$ parameter matrix η .

$$= \left(\frac{\ln m - \ln a(p, z_h)}{b(p, z_h) + \lambda(p, z_h)[\ln m - \ln a(p, z_h)]} \right)$$

If λ is set to zero, the household cost function would be the same in QUAIDS (Banks et al., 1997) as in the AIDS model.

The price indexes obtained from a *translog* specification with standard Cobb-Douglas aggregation in an AIDS model are defined as follows:

$$\ln a(p) = \alpha_0 + \sum_{i=1}^n \alpha_i \ln p_i + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \ln p_i \ln p_j \quad (4)$$

and

$$b(p) = \prod_i p_i^{\beta_i} \quad (5)$$

with $\lambda(p) = \sum_{i=1}^n \lambda_i \ln p_i$ where $\sum_{i=1}^n \lambda_i = 0$ and including demographic characteristics obtained in this way:

$$c(p, z_h) = \prod_i p_i^{\beta_i + \sum_{k=1}^k \beta_{ik} z_{hk}} \quad (6)$$

where $\lambda(p, z_h)$ is defined as follows:

$$\lambda(p, z_h) = \sum_{i=1}^n (\lambda_{i0} + \sum_{k=1}^k \lambda_{ik} z_{hk}) \ln p_i \quad (7)$$

Likewise, applying the Roy's identity or Shephard's Lemma³⁹ into the indirect utility function the budget share equations in the QUAIDS model can be obtained as follows:

$$\omega_i = \alpha_i + \frac{1}{2} \sum_j \gamma_{ij} \ln p_j + \beta_i \left[\ln \frac{m}{a(p)} \right] + \frac{\lambda_i}{b(p)} \left[\ln \frac{m}{a(p)} \right]^2 \quad (8)$$

And thus:

$$\omega_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + (\beta_i + \eta'_i z_h) \ln \left[\frac{m}{\bar{m} z_h a(p)} \right] + \frac{\lambda_i}{b(p) c(p, z_h)} \ln \left[\frac{m}{\bar{m} z_h a(p)} \right]^2$$

where, $\alpha_i(z_h) = \alpha_i + \sum_{k=1}^k \alpha_{ik} z_{hk}$. (9)

³⁹ The budget share equation as the log price derivative of the consumers budget function based on *Shephards Lemma* is given as follow: $w_i = \frac{p_i q_i}{C(u, p)} = \frac{\Delta \ln C(u, p)}{\Delta \ln p_i}$ or $w_i = \frac{p_i q_i}{\sum_i p_i q_i} = \frac{p_i q_i}{m}$, where m is the total household expenditure on all foods in the demand system.

Theoretical restrictions to the demand system along with the constraints of adding-up, homogeneity and symmetry derived from the fact that the expenditure shares on food should be equal to one (Paola De Agostini, 2014) imply $\sum_{i=1}^n \alpha_i = \mathbf{1}$, $\sum_{i=1}^n \omega_i = \mathbf{1}$, $\sum_{i=1}^n \beta_i = \mathbf{0}$, $\sum_{i=1}^n \lambda_i = \mathbf{0}$ and $\sum_{i=1}^n z_h = \mathbf{0}$. Moreover, the demand functions are homogeneous of degree zero in commodity prices: $\sum_{j=1}^n \gamma_{ij} = \mathbf{0} \forall j$ and the symmetry condition of the Slutsky matrix implies $\gamma_{ij} = \gamma_{ji}$.

It should be noted that there might be two potential problems that are likely to bias the econometric estimation: i) the occurrence of zero values for the household expenditure on any particular commodity, and ii) the endogeneity issue between household total expenditure and income (Mukasa and Berloff, 2013).

We can obtain the price elasticities (both uncompensated and compensated) in the QUAIDS model as:

$$\begin{aligned} \mu_i \equiv \frac{\partial \omega_i}{\partial \ln p_i} = & -\delta_{ij} \\ & + \frac{1}{w_i} \left(\gamma_{ij} - \left[\beta_i + \eta'_i z + \frac{2\lambda_i}{b(p)c(p, z_h)} \ln \left[\frac{m}{\bar{m}z_h a(p)} \right] \right] \times \left(\alpha_j + \frac{1}{2} \sum_k \gamma_{jk} \ln p_i \right) \right. \\ & \left. - \frac{\lambda_i(\beta_j + \eta'_i z_h)}{b(p)c(p, z_h)} \ln \left[\frac{m}{\bar{m}z_h a(p)} \right]^2 \right) \end{aligned} \quad (10)$$

The elasticities of demand with respect to the budget and prices for the commodities i are given as follows:

$$\varepsilon_i = \frac{\mu_i}{(\omega_i + 1)} \quad (\text{budget elasticities}) \quad (11)$$

$$\eta_i = \frac{\mu_i}{\omega_i} + 1 \quad (\text{income elasticities}) \quad (12)$$

that express the proportionate change in the quantity demanded by the household of a food product. Because of a proportionate change in the household income, prices and household characteristics remain constant. In a detailed way, it can be explained that higher income elasticity results in more sensitive consumer demand for a commodity. Thus, in the case of most commodities, the elasticity is positive, and ranging between zero and one, which signifies that the

quantity of food demanded increases when the income of household increases, but less than proportionally. Some of the food commodities will behave as luxury goods with $\varepsilon_i > 1$. In contrast, others may behave as inferior commodities with negative income elasticity, $\varepsilon_i < 0$.

The Marshallian uncompensated price elasticities can be obtained based on the parameter μ_{ij} , as follows:

$$\varepsilon_{ij}^u = \frac{\mu_{ij}}{\omega_j} - \delta_{ij} \quad (\text{Marshallian uncompensated elasticities}) \quad (13)$$

where δ_{ij} is the Kronecker delta, which is equal to 1 if $i = j$, and in the case of $i \neq j$ it is equal to 0. Uncompensated price elasticities give the proportional changes in quantity demanded in response to 1 per cent of change in the price of the same commodity (own-elasticity) or other commodities (cross-elasticity). The Hicksian price elasticities compensated for commodity $|i|$ with respect to commodity $|j|$ can be obtained as follows:

$$\varepsilon_{ij}^c = \varepsilon_{ij}^u + \varepsilon_i \omega_i \quad \text{or}$$

$$\varepsilon_{ij}^* = \varepsilon_{ij}^c = \varepsilon_{ij}^u + \omega_i \eta_i \quad (\text{Hicksian compensated elasticities}) \quad (14)$$

3.3 Data

The data used in our empirical analysis are drawn from the *Living Standard Measurement Survey* (LSMS) on Tajikistan, which covered the years, 2003, 2007 (in two rounds) and 2009. The surveys have been implemented by the *Agency of Statistic under President of the Republic of Tajikistan* (Taj STAT) based on the initiative of the World Bank and since 2007 with the collaboration of UNICEF. LSMS was conducted with the aim to estimate the poverty rate and the economic well-being of the population in Tajikistan. The survey data was designed and implemented based on a representative random sample, which was stratified by Tajikistan's four regions (Sughd, Khatlon, RRS and GBAO) and the capital city (Dushanbe), including urban and rural settlements. Total sample sizes were 4,160 households in 2003, 4,860 households in 2007 and 1,503 households in 2009. Stratification was based on the year 2000 census, following the general framework of the TLSS survey in 2003.

The survey questionnaires for 2007 and 2009 are comparable and were designed as individual and household panel surveys but 2003 datasets are not comparable with the 2007 and 2009 datasets. The TLSS survey of 2009 is a panel survey of 1,503 households, which were interviewed in the TLSS survey of 2007, so both surveys can be matched to each other. However, the questionnaires for the 2007 and 2009 surveys were designed based on that from the TLSS survey of 2003 with some modifications and the addition of new modules, e.g. Migration, Financial Services, Subjective Poverty, and Food Security etc. The TLSS survey of 2007 took place in two stages from September to November 2007. The first stage of interviews was implemented in September and October 2007, which included the Ramadan period, while the second stage of interviews was conducted during October-November 2007.⁴⁰ Out of the 4,860 households in the first round, 4,490 households were re-interviewed in the second round. Due to some adverse conditions, 54 households could not be revisited and 100 households could not be found. Furthermore, the first-round data of 216 households in the Sughd region had to be excluded. Hence, these households were revisited with a complete household questionnaire instead of just the second-round questionnaire like all the others. We used data about food expenditure in both rounds to estimate the demand system.

These survey data provide us with relevant information about the income resource and expenditure patterns of households with a wide range of demographic characteristics related to the internal-external migration process, education profile, health utilities, labor market participation, housing- dwelling, utilities and durable goods, transfer and social assistance, subjective perception of poverty and food security, households expenditure on food and non-food items, as well as data for household income sources. The income patterns include both cash and in-kind forms of wages and bonuses, remittances, scholarships, individual transfers, pensions, social assistance, income from selling harvest, farm animals and poultry (or their product) and other incomes. The expenditure patterns include payments for education, transportation, payments for medicine and hospitalization charges, food and non-food items, bank loan payments, house utilities and rent, assistance provided for other relatives or individuals, payments for the land use, purchases related to the land cultivation and harvesting, purchases of farm animal and poultry breeding along with their food.

⁴⁰ Adjustments had to be made to take into account the changes in food consumption during the Ramadan period.

The list of food and non-food products included in the 2007 and 2009 surveys is larger from the one used in the earlier survey of 2003, 32 food items were considered in the 2003 survey, extended to 66 food items in 2007 and 2009. Data on food expenditure were collected in the reference period of ‘*last seven days*’ in all surveys. The food module contained questions on both purchased and non-purchased portions of consumption. The non-purchased portion was further subdivided into four subsections: *own produced, received as a gift or humanitarian donation, received as part of wages, and taken from stock*. Additionally, in the food module of the survey of 2007 and 2009, the meals and alcoholic and non-alcoholic drinks, which were consumed outside the home, were included. Following the adjustment methodology of the TLSS survey⁴¹, we have converted all expenditure including food expenses and income variables into its monthly equivalent. To estimate a demand system for food, we aggregate all food items into seven major food groups, i.e. *bread and cereal; meat and fish; dairy products; vegetables and fruits; oils and animal fats; rest of food items; and other products and services*. Appendix 3.1 shows the aggregated food items from all surveys.

3.4 Descriptive statistics

Our data provide information on the expenditures and the purchased quantities for both food and non-food items, but market prices are not reported. We computed unit values (Deaton, 1988) as proxy variables for market prices, following several previous empirical studies (Deaton, 1997; Kedir, 2005; Gibson and Rozelle, 2006; Tafere et al., 2010) The unit value for each commodity takes the place of the corresponding price in estimating price responses of commodity demands (Tafere et al., 2010). For each commodity, its unit value is calculated as the ratio of expenditures and quantities: $uv_j^h = \frac{w_i^h}{q_i^h}$ where w_i^h is the expenditure and q_i^h is the physical amount of commodity $i=1, 2, 3, \dots, n$ which is purchased by household h . We calculated unit value indices for the aggregated commodity groups using the geometric mean with expenditure shares as weights (e.g., as in Abdulai, 2002).⁴²

⁴¹ <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/0,,contentMDK:21878045~pagePK:64168445~piPK:64168309~theSitePK:3358997,00.html>

⁴² However, due to the differences in consumed goods in each group and variations in unit values of each commodity across households, the variation in food group unit values counts as well. Deaton, (1988) claimed that the price elasticities computed from unit values might be exaggerated and biased because of the quality effect reflected by the variation in unit values.

It often happens that data on expenditure or quantity or even both will be missing across some households during the survey period. This issue also was partially observed in our data. Regarding the missing unit values, Cox and Wohlgenant (1986) proposed to use “zero-order methods”, which substitute “appropriate” sample means for the missing value. Accordingly, most empirical studies have used this approach to replace missed values by the unit value corresponding to the location, region or national level.

Cox and Wohlgenant, (1986) also supposed that the quality effect is reflected in the deviations of unit values from regional or seasonal means. They regressed the deviations on household characteristics to exclude the quality effects from unit values and obtain quality-adjusted prices. We employ this approach with the intention to adjust aggregated commodity prices in our data. We calculate average prices estimating regression residuals and then adding them up to regional price means, thus controlling the variation within location, quarters, years and household characteristics as a whole. The regional segments are formed based on the five regions of Tajikistan each of which is divided into rural and urban segments. Our estimated unit values are quite similar to the real market prices in the markets of Tajikistan. We present the statistical summary of the unit values obtained in the Table 3.1 below.

Table 3.1: Descriptive statistics of unit values for food grouped items (2003-2009)

	Mean	Std. Dev.	Min	Max
Bread & cereal products	3.001	0.853	1.40	5.47
Meat & fish products	11.33	3.298	6.00	19.0
Dairy products	2.115	0.879	1.20	5.55
Vegetables and fruits	2.368	0.724	1.43	5.33
Oils & animal fats	6.911	2.429	3.00	15.1
Rest of food items	5.222	2.085	2.76	13.2

Source: own calculation based on LSMS, Taj STAT (2003, r1-r2 2007, 2009)

Unluckily, our data does not provide the physical quantities consumed by households for all individual non-food products, which are aggregated in the group *other products and services*

in our estimation. As a result, we are not able to quantify unit values for these non-food grouped products. Consequently, we used the weights of the CPI as a proxy for the price of unit values for non-food products and services, where the monthly CPI was obtained from IMF and Taj Stat. Table 3.2 provides the summary of statistics on household demographic characteristics in Tajikistan based on the data of LSMS, 2003, 2007, and 2009.

The sex demographics of households are provided based on the Household Head reference. In the traditional Tajik society, the Head of the household is usually a male regardless of the volume of his income and its sources, his employment position/status and his other livelihoods responsibilities. On the other hand, factors like political instability (civil war) and the massive migration of men led Tajikistan to have the highest number of female-headed households relative to the other Central Asia countries-CAC (WPF, 2008).

Most of the individuals with an age of 20-65 are residents in the urban areas (Taj STAT, 2014). Moreover, a substantial number of people (especially older individuals) who are uneducated or have a basic education level are in rural households. On average, about 16.8 % of household Heads have just a basic primary education, 56 % of them are with general secondary and technical education, and 7 % are without education. Typically, urban households are headed by young males with high level of education. The level of education seems to be imbalanced between urban and rural areas.⁴³

⁴³ Moreover, noticeable dissimilarity was observed between rural and urban households in terms of household size. On average, the household size in the rural areas is made up of about 7-8 members but at a national average it consists of 5-6 persons.

Table 3.2: Description of household demographics that were used in QUAIDS estimation

	Urban		Rural	
	Mean	Std. Dev.	Mean	Std. Dev.
-Household size (Number)	5.199	2.598	6.834	2.887
-Number of Children 0-4 age	0.560	0.839	0.783	1.017
-Number of Children 5-15 age	1.233	1.252	1.667	1.398
-Number of Adults up 16 age	3.392	1.867	4.338	2.056
-Age of HH head (Number)	48.76	13.91	51.83	14.09
-Sex of HH head: <i>1 if Male, 0 otherwise</i>	0.725	0.446	0.854	0.352
-Marital status of HH: <i>1 if married, 0 otherwise</i>	0.723	0.447	0.832	0.373
-Education HH head: <i>1 if basic-secondary education, 0 otherwise</i>	0.523	0.449	0.599	0.490
-Education HH head: <i>1 if technic-high education, 0 otherwise</i>	0.285	0.451	0.138	0.345
-Employment status of HH head: <i>1 if employed, 0 otherwise</i>	0.621	0.485	0.634	0.481
-Agro-Employment: <i>1 if employed in agriculture, 0 otherwise</i>	0.035	0.184	0.264	0.442
-Poverty status of households: <i>1 if HH is poor, 0 otherwise</i>	0.272	0.445	0.306	0.461
-Migration: <i>1 if household has migrants yes, 0 otherwise</i>	0.172	0.378	0.273	0.445

Source: own calculation based on LSMS, 2003-2009

Rural households work mainly on agricultural activities, while urban households work in the public services, trade, and other sectors. Moreover, there is a high unemployment rate with a huge out-migration process in the rural areas of Tajikistan. More detailed evidences on demographics and other socio-economic characteristics of Tajik households are presented in [Appendix 3.2](#). Overall, Table 3.3 reports summary statistics for the other variables, which used in the QUAIDS estimations based on the data of LSMS, 2003, both rounds 1-2 of 2007, and 2009.

Table 3.3: Description of variables and summary statistics that used in QUAIDS estimation, (2003-2009)

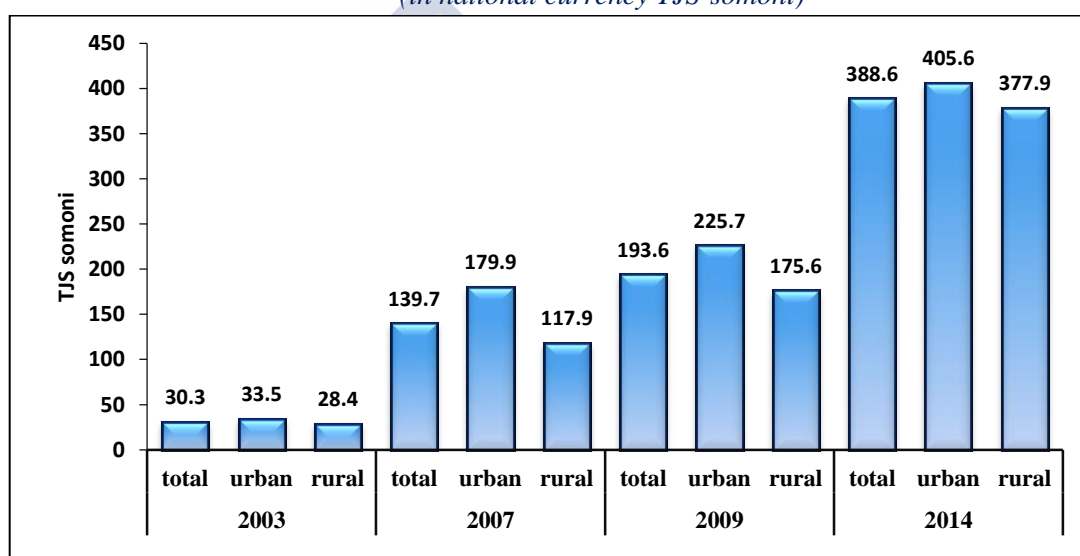
Variables	Description	Mean	Std. Dev.
Log tot_income	Total Household Income	5.734	1.236
Log tot_exp	Total Household Expenditure	6.528	0.924
Log tot_food	Household Food Expenditure	6.116	0.849
Log tot_non_food	Household Non-Food Expenditure	4.432	1.329
<i>Expenditure shares of food-grouped products</i>			
W _{bread and cereals}	Budget share of bread and cereals	0.272	0.143
W _{meat and fish}	Budget share of meat and fish	0.076	0.075
W _{dairy products}	Budget share of dairy products	0.046	0.048
W _{vegetables and fruits}	Budget share of vegetables	0.139	0.079
W _{oils and animal's fats}	Budget share of oils and animal's fats	0.077	0.054
W _{other food items}	Budget share of other food items	0.078	0.061
W _{other products & service}	Budget share of other products & service	0.311	0.161
<i>Prices of food-grouped products</i>			
Log P _{bread and cereals}	Price of bread and cereals	1.071	0.368
Log P _{meat and fish}	Price of meat and fish	2.367	0.378
Log P _{dairy products}	Price of dairy products	0.713	0.418
Log P _{vegetables and fruits}	Price of vegetables	0.842	0.347
Log P _{oils and animal's fats}	Price of oils and animal's fats	1.872	0.417
Log P _{other food items}	Price of other food items	1.605	0.437
Log P _{other products & service}	Price of other products & service	4.299	0.211
<i>Spatial dummy variables</i>			
Dum_Location	Takes value 1 if Rural, 0 otherwise	0.644	0.478
Dum_Dushanbe	Takes value 1 if Dushanbe, 0 otherwise	0.177	0.382
Dum_Sughd	Takes value 1 if Sughd, 0 otherwise	0.228	0.419
Dum_Khatlon	Takes value 1 if Khatlon, 0 otherwise	0.196	0.397
Dum_RRS	Takes value 1 if RRS, 0 otherwise	0.266	0.441
Dum_GBAO	Takes value 1 if GBAO, 0 otherwise	0.132	0.338
<i>Rounds dummy variables</i>			
Survey_1	Takes value 1 if survey was conducted in 2003, 0 otherwise	0.277	0.447
Survey_2	Takes value 1 if survey was conducted in 2007, 0 otherwise	0.323	0.469
Survey_3	Takes value 1 if survey was conducted in 2009, 0 otherwise	0.100	0.300
N			15013
<i>Source: own calculation based on data LSMS, 2003-2009</i>			
<i>Note: RRS -Regional Republic Subordination and GBAO -Gorno-Badagakashan Oblast</i>			

3.5 Household consumption patterns and income sources

Household consumption changed considerably in the last years. The average household makes their consumption purchase decisions based on their budget and the stability of their income. The substantial upsurge of household consumption is related first to the stabilization of the socio-economic life of Tajik people after the civil war along with the increase of agro-food production, and second to the increase of the households' money income from external and internal sources (see Figure 3.1).

Figure 3.1: Monthly household net-income per capita in Tajikistan (2003-2014)

(in national currency TJS-somoni)

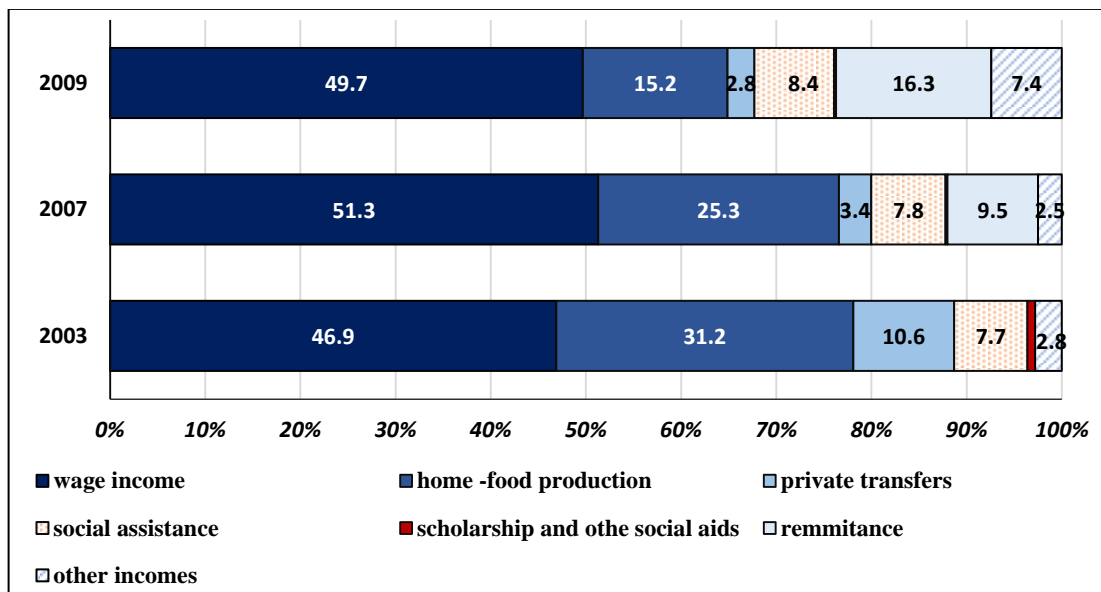


Source: own calculation based on LSMS (2003, 2007, 2009) World Bank; and HBS (2014) Taj STAT

Most of the Tajik households have temporary income that is fluctuating considerably over time. An enormous migration outflow makes the consumption expenditure of many households deeply reliant on remittance incomes. Empirical research has been conducted regarding the impact of remittances on household expenditure patterns in Tajikistan (e.g. Olimova and Bosc 2003; Brown et.al, 2008; Danzer et al., 2013a; Clément, 2011). For example, Clément, (2011) claimed that households that receive remittances tend to spend it more on consumption than the households that do not.

According to our data from LSMS (2003-2009), wage-employment, the pensions-social benefits scheme and home-food production joint with food gifts were the major sources of income. Figure 3.2 illustrates the household income patterns by economic activity sources.

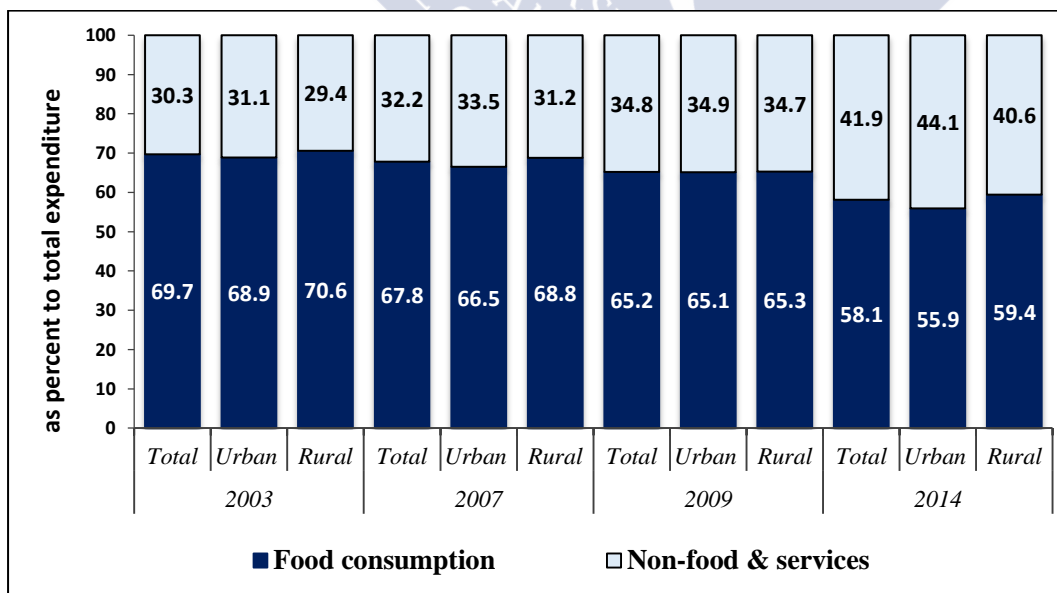
Figure 3.2: Monthly net-income households per capita by main source, (2003-2009)



Source: own calculation based on LSMS (2003, 2007-2009), World Bank and Taj STAT

Regarding consumption expenditure patterns, we observe that Tajik households allocate annually around two thirds of their total expenditure to food consumption. Figure 3.3 displays the slight rise of non-food expenditure share into households’ budget over the last years.

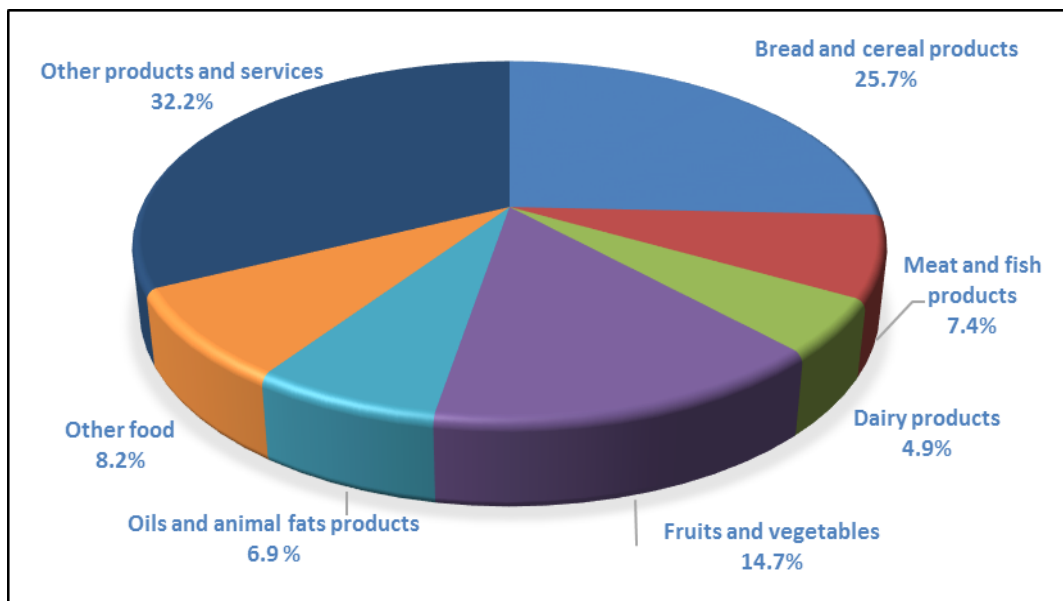
Figure 3.3: Household budget patterns across location, (2003-2014)



Source: own calculation based on LSMS (2003, 2007, 2009) World Bank; and HBS (2014) Taj STAT

Figure 3.4 illustrates the composition of household food consumption in Tajikistan. Traditional Tajik households consume a lot of bread products independently of their income level and budget allocation.

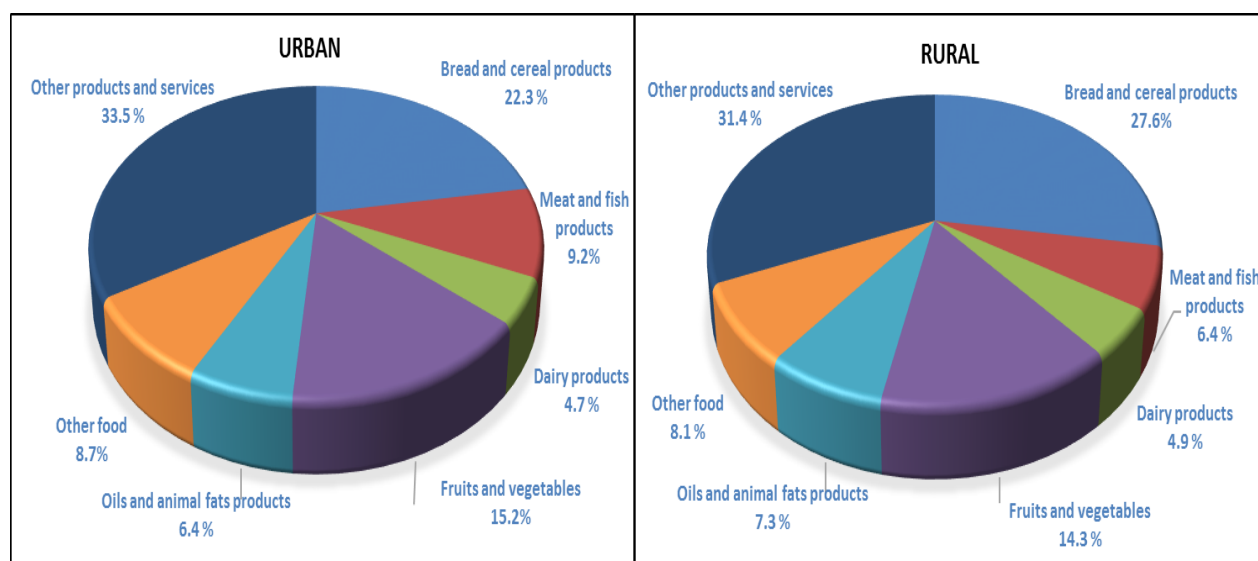
Figure 4: Composition of food diet based on food-grouped products in Tajikistan, (2003-2009)



Source: own calculation based on LSMS, World Bank (2003, 2007-2009)

The budget share of rural households on bread and cereals products tend to be greater than urban households. Commonly, the rural households allocate their expenditure budget share to the cheaper food products. In fact, low-income households with a severe food insecure status consume a poor diet consisting of bread and cereals, pasta and potatoes on a daily basis, rarely complemented with vegetables and fruits. Besides, the food consumption expenditure on dairy products is small both in the urban areas and in the rural areas. Figure 3.5 provides information about food consumption by rural and urban households.

Figure 3.5: Composition of food diet based on food-grouped products across location, (2003-2009)



Source: own calculation based on LSMS, World Bank (2003, 2007-2009)

Overall, Tajik households have increased their consumption in all food grouped products in the period 2003-2009. At the same time, computed unit values have increased year by year in all food-grouped commodities (see Table 3.4).

Table 3.4: Monthly per capita food composition and computed unit values for food -grouped products (2003-2009)

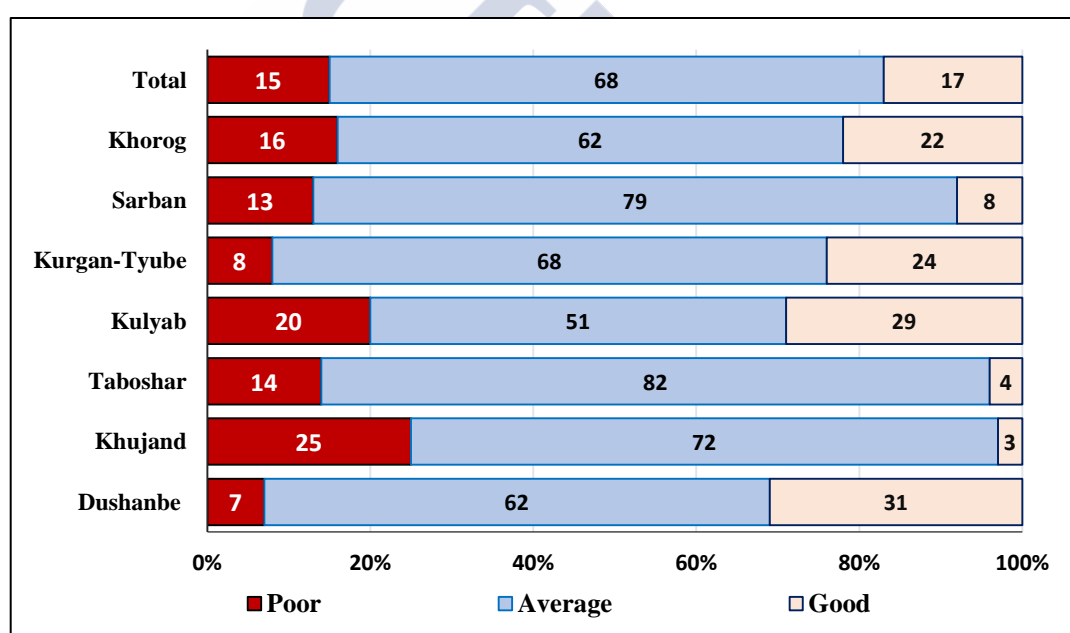
	Urban							
	Quantity Consumed/average in kg				Average computed unit values (prices)			
	2003	2007r1	2007r2	2009	2003	2007r1	2007r2	2009
Bread & cereal products	22.2	19.0	20.8	23.7	1.97	3.32	3.56	4.08
Meat & fish products	1.29	2.50	2.08	2.65	6.93	12.5	12.9	16.0
Dairy products	10.1	10.1	10.5	14.1	1.59	2.49	2.63	2.67
Vegetables and fruits	13.4	24.7	21.8	24.9	1.91	2.57	2.58	2.96
Oils & animal fats	1.41	2.60	2.41	2.46	4.14	6.84	9.23	9.41
Other food items	3.73	5.20	4.33	4.69	4.20	5.67	6.15	7.78
	Rural							
Bread & cereal products	20.5	19.2	27.4	28.1	1.84	3.19	3.51	3.61
Meat & fish products	0.61	1.18	1.34	1.46	6.71	12.3	12.8	15.8
Dairy products	8.42	7.06	7.45	8.01	1.52	2.12	2.21	2.38
Vegetables and fruits	10.1	19.5	18.9	20.4	1.83	2.47	2.48	2.78
Oils & animal fats	1.18	1.97	2.23	2.38	4.12	6.68	9.01	9.09
Other food items	2.08	3.46	3.87	3.78	4.08	4.93	5.28	6.97

Source: own calculation based on LSMS, Taj STAT (2003-2009)

There are several factors that can account for the low level of food consumption of Tajik households. The two main ones are food accessibility and food availability, which in turn may be influenced by geography, demography, disposable income, price volatility, as well as climate variability. For example, poor households in urban areas are more vulnerable to variations in the food prices, production, and availability in food stocks than the ones in rural areas.

The World Food Programme conducted a survey, based on the *Emergency Food Security Assessment* (EFSA) mission, in June 2008 that estimated the accessibility to food, coping strategies and other questions related to the well-being of urban households in Tajikistan. The results of the survey regarding household accessibility to food items in several big cities in Tajikistan are summarized in Figure 3.6.

Figure 3.6: Urban food accessibility across big cities in Tajikistan (2008)



Source: own elaboration based on WFP, (2008)

3.6 Estimation approach

To estimate the food demand system, we use the QUAIDS model, an extended form of the original AIDS model, which permits non-linear Engel curves.⁴⁴ Following the theoretical restrictions of QUAIDS, the parametric constraints of adding-up, homogeneity, and symmetry conditions across the equations are imposed and, with the intention to avoid singularity in the variance-covariance matrix, the aggregated group of non-food products and service equation is removed from direct estimation. Therefore, for the estimation of the full demand system the skipped parameters are recovered through the adding-up restrictions by re-parameterising in the equations the constant term α_i , expenditure β_i , prices γ_{ij} , expenditure squared λ_i and socio-economic variables.

Because Tajik households are poor and on the other hand, due to their socio-economic preferences, there exist a significant number of zero-value observations in our microdata, mainly in those food product groups, which are considered as luxury goods by Tajik households (see [Appendix 3.3](#)). i.e. meat & fish and dairy products. Zero consumption values may lead to inconsistent demand parameter estimates (e.g. Blundell and Robin, 1999), and as a result the estimated parameters will be biased (Barslund, 2011). Moreover, deleting the zero-consumption values only permits the estimation of conditional effects (Deaton, 1990). When the proportions of zero consumption values in the data causes censored dependent variables, it is necessary to apply an econometric technique that avoids the sample selection problem that potentially may arise. One such technique that has been widely applied is the “two-step estimation” procedure initially proposed by Heien and Wessells, (1990) and afterwards modified by Shonkwiler and Yen, (1999). This procedure consists in running a univariate probit estimation (Shonkwiler and Yen, 1999).

The probit estimation aims at determining the probability of the household consuming any positive quantity of the food commodity in the first step and the correlation among these

⁴⁴ We estimate the parameters of the QUAIDS model using a modified version of the *Nonlinear Seemingly Unrelated Regression* (NLSUR) method and the *Feasible Generalized Least Squares* (FGLS) estimator, using the STATA software package.

commodities at the second step.⁴⁵ Moreover, the process involves the estimation of several *probit models* independently:

$$\begin{aligned}
 w_{ih}^* &= f(x_{ih}, \mu_i) + u_{ih} & d_{ih}^* &= z'_{ih}\theta_i + \varepsilon_{ih} \\
 d_{ih} &= \begin{cases} 1 & \text{if } d_{ih}^* > 0 \\ 0 & \text{if } d_{ih}^* \leq 0 \end{cases} & & (15) \\
 w_{ih} &= d_{ih}w_{ih}^*
 \end{aligned}$$

where ε_{ih} and u_{ih} are random errors, w_{ih}^* and d_{ih}^* are the corresponding unobserved “latent” variables; w_{ih} and d_{ih} are the observed expenditure shares for commodities; i is the index of sub-groups commodities, h is the index of households; μ_i and θ_i are vectors of parameters associated to vectors of exogenous variables; x_{ih} are households expenditure or income and prices, and z'_{ih} are households socio-demographic and other related variables.

Then we can rewrite the system in equation (9) as follows:⁴⁶

$$w_{ih}^* = \Phi(z'_{ih}\theta_i) + f(x_{ih}, \mu_i) + \delta_i \phi(z'_{ih}\theta_i) + \xi_{ih} \quad (16)$$

where ξ_{ih} are the new errors; $\phi(z'_{ih}\theta_i)$ is the standard normal probability density function (*pdf*) and $\Phi(z'_{ih}\theta_i)$ is the standard normal cumulative distribution function (*cdf*) which are obtained from the probit model, respectively.⁴⁷

In the second step, the results of the *probit* regression should be incorporated into the QUAIDS model with household demographic variables as follows:⁴⁸

⁴⁵ We follow the maximum likelihood approach and use Poi’s STATA commands (Poi, 2002; 2008; 2012). Since these commands does not currently address the problem of censoring demand systems, we develop our own code in order to take into account the treatment of the problem of the zero expenditure share values in the dependent variable.

⁴⁶ Shonkwiler and Yen (1999) have proposed a two-step procedure that solved the inconsistency of the Heien and Wessells (1990) approach.

⁴⁷ However, it should be noted that there are some important implications in the case of the uncensored demand system, where the adding-up condition via parametric restrictions is not possible (Drichoutis, et al., 2008) and the disturbance terms are heteroscedastic in equation 2. To overcome this issue, Yen et al., (2003) proposed to treat the n^{th} -goods equation as a residual category with the aims to avoid the singularity of the variance and covariance matrix of the perturbations and to estimate the resulting $n - 1$ equation system along with the identity, $w_n = 1 - \sum_{i=1}^{n-1} w_i$. However, the shortcoming of this estimation procedure is that the resulting estimates will not be invariant to the residual selected goods w_n that might even be negative.

⁴⁸ Hence, the equation system (14) requires the estimation based on the full n -vector (Yen et al., 2002), since the right-hand side of the system does not require an adding-up restriction and the adding-up conditions given in equation (m) cannot be imposed as well.

$$\omega_i = \Phi(z'_{ih}\theta_i) \left\{ \alpha_i + \sum_j \gamma_{ij} \ln p_j + (\beta_i + \eta'_i z_h) \ln \left[\frac{m}{\bar{m} z_h a(p)} \right] + \frac{\lambda_i}{b(p)c(p, z_h)} \ln \left[\frac{m}{\bar{m} z_h a(p)} \right]^2 \right\} + \delta_i \phi(z'_{ih}\theta_i) + \xi_{ih} \quad (17)$$

Consequently, to derive conditional expenditure and food price elasticities, equation (17) is differentiated in respect to $\ln m$ and $\ln p_j$, and elasticities' equations can be rewritten as:

$$\mu_i \equiv \frac{\partial w_i^*}{\partial \ln m} = \Phi(z'_{ih}\theta_i) \left\{ 1 + \frac{1}{w_i} \left(\beta_i + \eta'_i z_h \frac{2\lambda_i}{b(p)c(p, z_h)} \left[\ln \left(\frac{m}{\bar{m} z_h a(p)} \right) \right] \right) \right\} \quad (18)$$

The *Marshallian (uncompensated)* elasticity is given by:

$$\mu_i \equiv \frac{\partial w_i^*}{\partial \ln p_i} = \Phi(z'_{ih}\theta_i) \left\{ -\delta_{ij} + \frac{1}{w_i} \left(\gamma_{ij} - \left[\beta_i + \eta'_i z_h + \frac{2\lambda_i}{b(p)c(p, z_h)} \ln \left[\frac{m}{\bar{m} z_h a(p)} \right] \right) \times \left(\alpha_j + \frac{1}{2} \sum_k \gamma_{jk} \ln p_i \right) - \frac{\lambda_i (\beta_j + \eta'_j z_h)}{b(p)c(p, z_h)} \ln \left[\frac{m}{\bar{m} z_h a(p)} \right]^2 \right) \right\} \quad (19)$$

where p_k is a price index that is calculated as the arithmetic mean of prices for all k food commodity groups in the system.

On the other hand, the *Hicksian (compensated)* price elasticities would be obtained by $\epsilon_{ij}^c = \epsilon_{ij}^u + \epsilon_i w_i$.

3.7 Empirical results

Table 3.5 shows the parameter estimates and the correlation matrix of the *univariate probit regression* with pooled data, while the results of probit estimates for each year separately are presented in **Appendixes** of 3.5, 3.8, 3.11, and 3.14, as well as for urban and rural samples, are presented in Appendixes of 3.18 and 3.21. The probit equations are estimated using the following explanatory variables: the log household income, log of price food-grouped products, household size, number of children (age 0-15 years), number of adults (age > 15 years), and

household head's age, plus dummy variables for household location (rural), poverty status, migration, and gender, literacy and employment status of the household's head. However, in the pooled estimation the number of variables was extended, including the spatial impacts by adding regional dummy variables. Most of economic and socio-demographic variables have statistical significant impact in determining the probability of obtaining zero-value observations for expenditure in grouped food consumption.

Disposable household income has positive and statistically significant impacts on the likelihood of household consumption for each food group; with the exception of bread and cereals products. Food prices also present a significant effect, independently of the net-position of households as producers or consumers of food products. Regarding the rest of the variables, most of the statistical significant coefficients are observed in the food-grouped products of meat & fish products, dairy food items, vegetables & fruits, and oils and animal fats.

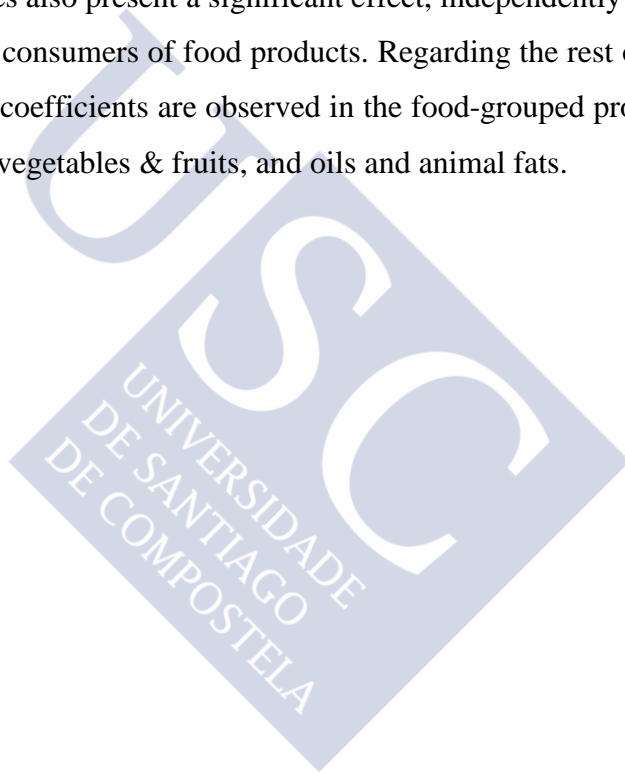


Table 3.5: Estimated Parameters of the Univariate Probit Model: Pooled Estimation LSMS (2003-2009) **Country Level**

	Bread & cereal		Meat & fish produc.		Dairy products		Vegetables & Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Log / total income	-0.014	0.099	0.151***	0.012	0.127***	0.013	0.150***	0.047	0.089***	0.019	0.163***	0.036
Log /price -bread & cereal	0.028	0.388	0.180***	0.048	0.255***	0.055	-0.001	0.171	0.023	0.069	0.040	0.129
Log /price meat & fish products	0.104	0.342	-0.072	0.051	-0.068	0.052	-0.045	0.195	0.124*	0.068	0.224*	0.125
Log /price-dairy products	0.057	0.285	-0.057*	0.033	-0.051	0.039	-0.072	0.114	-0.159***	0.048	-0.074	0.100
Log/price-vegetables & fruits	0.370	0.491	0.070*	0.038	0.282***	0.045	-0.043	0.139	-0.064	0.053	0.040	0.114
Log/price-oils & animal fats	-0.348	0.254	0.097**	0.042	0.092	0.045	0.086	0.141	0.043	0.067	0.105	0.127
Log/price-other food items	0.222	0.291	0.140***	0.029	0.151	0.032	-0.087	0.112	0.054	0.045	-0.029	0.090
Household Size (number)	0.018	0.237	-0.057**	0.027	0.031	0.029	0.046	0.096	-0.048	0.043	0.103	0.094
Children 0-15 Age (number)	0.065	0.256	0.099***	0.029	0.033	0.032	0.043	0.105	0.066	0.046	-0.012	0.101
Adults 16 > Age (number)	0.132	0.235	0.105***	0.027	-0.012	0.029	0.051	0.093	0.107**	0.042	0.005	0.091
Age of HH head (number)	-0.003	0.010	0.001	0.001	0.001	0.001	-0.002	0.004	0.000	0.002	-0.005	0.004
Gender HH head: 1 if Male	-0.761**	0.369	0.075*	0.044	0.069	0.047	-0.118	0.140	-0.075	0.068	0.301**	0.123
Location: 1 if Rural	0.143	0.207	-0.330***	0.031	0.032	0.032	-0.680***	0.136	0.008	0.047	-0.104	0.101
Marital St. HH head: 1 if Married	0.322	0.284	0.013***	0.044	0.026	0.047	0.292**	0.137	0.042	0.068	-0.376***	0.134
Education HH head: 1 if Educated	0.107	0.357	0.122**	0.050	0.093*	0.052	-0.009	0.168	0.037	0.074	0.073	0.139
Employed HH head: 1 if Employed	0.138	0.236	0.131***	0.030	0.087***	0.032	0.041	0.105	0.031	0.048	0.020	0.095
Agro-Emp HH head: 1 if Employed			-0.075**	0.033	0.146***	0.036	0.017	0.117	0.029	0.053	-0.024	0.107
Poverty: 1 if HH is Poor ¹	-0.239***	0.256	-0.949***	0.032	-0.575***	0.033	-0.587***	0.115	-0.233***	0.049	-0.308***	0.097
Migration: 1 if HH has Migrants			-0.022	0.028	0.048	0.030	0.134***	0.119	0.018	0.046	0.065	0.100
Dushanbe			0.258***	0.050	-0.334***	0.056	1.216***	0.195	0.077	0.076	0.100	0.147
Sughd			0.593***	0.039	-0.782***	0.045	1.905***	0.146	-0.047	0.061	0.146	0.119
Khatlon			-0.036	0.038	-0.739***	0.046	1.942***	0.170	-0.137**	0.061	0.230*	0.130
RRS			-0.150***	0.040	-0.727***	0.048	1.409***	0.148	-0.138	0.065	-0.019	0.127
survey2007			-0.202***	0.032	-0.036	0.034	-1.093***	0.225	-0.561***	0.054	-1.149***	0.211
survey2003			0.117**	0.064	0.594***	0.070	-1.770***	0.285	-0.319***	0.097	-0.628**	0.261
Constant	2.760***	1.003	-0.954***	0.198	-0.521**	0.212	2.265***	0.766	1.037***	0.291	1.367**	0.598
LR chi2	19.56		2859.25		1378.29		907.33		384.82		225.18	
Prob > chi2	0.2974		0.000		0.000		0.000		0.000		0.000	
Pseudo R2	0.1176		0.1521		0.0902		0.4471		0.0642		0.1517	
N	15013		15013		15013		15013		15013			

Source: own calculation based on data from LSMS, (2003-2009)

¹ Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 U.S dollar per day), LSMS, 2009 (World Bank)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

We estimate demand for food using the QUAIDS model for each round of the LSMS, as well as for the pool of all rounds. We approach the problem of zero consumption in dependent variables of the demand system using the two-step approach described above. Parameters d_i are estimated for all food- grouped items, and both probability density function (pdf) and cumulative distribution function (cdf) are properly incorporated into the QUAIDS model.

The estimated parameters of the QUAIDS model for separate years are presented in [Appendixes 3.6, 3.9, 3.12 and 3.15](#), while pooled cross-sectional estimated results at country and both urban and rural samples are presented in [Appendixes 3.17, 3.19, and 3.22](#). Total expenditure and prices are shown to be significant determinants of demand; the majority of the quadratic expenditure terms are also significant at 5% or better in all estimations. Most price coefficients come out to be statistically significant. In general, most of the parameters estimates of the QUAIDS model were obtained statistically significant at 1%, 5% and 10 % level for all aggregated food products.

The estimated expenditure parameters suggest that meat and fish, dairy products, fruits and vegetables, are luxuries for Tajik households. The socio-demographic and regional control variables are significant and have their coefficients show the expected signs. For instance, the dummy variable of poverty status of the households shows a significant effect at 1% level during all rounds. This suggests that poverty, hunger, and food insecurity should be still major policy issues for Tajikistan. The estimated parameters of the dummy variable of migration (households who have migrants) shows marginally positive effects in the demand of those products which are luxuries for Tajik households. These results are in accordance with the significance of remittances in food consumption patterns and the well-being of Tajik households. However, in the round corresponding to the year 2009, the decline in the size of the remittance flows (WDI, 2009) shows up in a reduction of the size of the coefficients of the dummy variable. The household size showed a significant and clearly positive effect for most rounds on consumption of meat & fish, dairy, vegetables & fruits, other food items, and a significant negative effect for the non-food group. This suggests that as household size increases for a given level of expenditure and prices, households try to adjust their consumption demand from non-food products towards food items. The marginal effects of some of the other socio-demographic variables, such as number of children, number of adults, or gender, are not so consistent and/or

significant. Location (rural/urban) and regional dummies, however, show significant effects throughout.⁴⁹

Table 3.6 presents the expenditure elasticities from the pooled estimation. The results show that expenditure elasticities vary across location. Expenditure elasticity of food consumption is higher for rural households for all groups of food products.

Table 3.6: Expenditure elasticities across samples (pooled estimation, LSMS, 2003-2009)

	Average (Country)		Urban		Rural	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Bread & cereal	0.852***	0.007	0.808***	0.012	0.957***	0.006
Meat & fish products	1.127***	0.016	1.038***	0.023	1.142***	0.013
Dairy products	0.891***	0.014	0.920***	0.020	0.970***	0.012
Vegetables & Fruits	0.807***	0.007	0.797***	0.011	0.903***	0.007
Oils & fats products	0.770***	0.010	0.801***	0.017	0.956***	0.007
Other food items	0.913***	0.029	0.917***	0.014	0.961***	0.007
Other prod. & services	1.273***	0.011	1.287***	0.010	1.066***	0.008

Source: own calculation based on data of LSMS, (2003-2009)

Table 3.6 shows that all expenditure elasticities have positive coefficients in all rounds across samples. The values corresponding to bread & cereals products, vegetables & fruits, and other food items groups have values of less than one, while the elasticities for meat & fish, dairy products, and other products and services are slightly above unity.

The own price elasticities in all samples and rounds for all aggregated products had the expected negative sign at 1% statistical significant level. All cross-price elasticities show a mixture of complementary and substitution relationships. Since compensated price elasticities are a measure of substitution effects net of real income, they provide a more accurate picture of cross-price substitution between food-grouped products. Table 3.7 presents both uncompensated

⁴⁹ The Wald test confirmed a proper specification of the QUAIDS model with respect to the selection of demographic variables. The results of the Wald test are presented in [Appendix 3.4](#).

and compensated price elasticities from pooled estimation.⁵⁰ Compensated elasticities suggest net substitution is the dominating pattern among the food products. Bread & cereal products are a net substitute for all food items, and show in general the highest (in absolute value) cross-price compensated elasticities. This suggests that Tajik households, when they face relatively higher prices for any other food items, react by consuming more bread & cereals products and less of other food commodities.⁵¹



⁵⁰ **Uncompensated and Compensated price** elasticities for each round of the survey are presented in the Appendixes of **3.7, 3.10, 3.13** and **3.16**, while their values according to location both urban and rural can be found in Appendixes of **3.20** and **3.23**.

⁵¹ Net complementarity relationships are rarely observed, and mostly involves the groups of oils & animal fats and other food items.

Table 3.7: Average (Country Level) Uncompensated /Compensated Prices Elasticities from Pooled Estimation, LSMS (2003-2009)

	<i>Uncompensated Price Elasticities</i>						
	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
Bread & cereal	-0.696*** (0.010)	0.003 (0.007)	-0.026*** (0.004)	-0.077*** (0.005)	-0.032*** (0.004)	-0.044*** (0.004)	0.020* (0.012)
Meat & fish products	-0.059*** (0.016)	-0.543*** (0.022)	-0.036*** (0.009)	-0.090*** (0.011)	-0.020** (0.010)	-0.050*** (0.009)	-0.288*** (0.029)
Dairy products	-0.140*** (0.019)	-0.044** (0.018)	-0.486*** (0.016)	-0.067*** (0.014)	-0.084 (0.013)	-0.019*** (0.011)	-0.074** (0.033)
Vegetables & Fruits	-0.138*** (0.009)	-0.039*** (0.009)	-0.021*** (0.006)	-0.426*** (0.009)	-0.056*** (0.006)	-0.035*** (0.005)	-0.093*** (0.015)
Oils & fat products	-0.082*** (0.014)	0.006 (0.014)	-0.052*** (0.009)	-0.092*** (0.010)	-0.562*** (0.013)	-0.084*** (0.008)	0.084*** (0.024)
Other food items	-0.160*** (0.013)	-0.052*** (0.008)	-0.013* (0.008)	-0.073*** (0.009)	-0.095*** (0.009)	-0.458*** (0.010)	-0.062*** (0.035)
Other prod.& services	-0.094*** (0.010)	-0.129*** (0.010)	-0.033*** (0.006)	-0.106** (0.007)	-0.014*** (0.006)	-0.039*** (0.005)	-0.858*** (0.023)
	<i>Compensated Price Elasticities</i>						
Bread & cereal	-0.465*** (0.010)	0.068*** (0.007)	0.013*** (0.004)	0.042*** (0.005)	0.034*** (0.004)	0.023*** (0.004)	0.286*** (0.012)
Meat & fish products	0.248*** (0.017)	-0.458*** (0.022)	0.016* (0.009)	0.067*** (0.011)	0.066*** (0.010)	0.038*** (0.009)	0.063*** (0.029)
Dairy products	0.103*** (0.019)	0.024 (0.018)	-0.445*** (0.016)	0.058*** (0.014)	-0.016* (0.013)	0.051*** (0.011)	0.204*** (0.032)
Vegetables & Fruits	0.082*** (0.009)	0.022** (0.009)	0.016*** (0.006)	-0.314*** (0.009)	0.006 (0.006)	0.028*** (0.005)	0.159*** (0.015)
Oils & fat products	0.127*** (0.014)	0.065*** (0.014)	-0.016** (0.009)	0.016*** (0.010)	-0.503*** (0.013)	-0.024*** (0.008)	0.324*** (0.024)
Other food items	0.088*** (0.015)	0.017 (0.012)	0.029*** (0.008)	0.055*** (0.011)	-0.025*** (0.009)	-0.387*** (0.010)	0.222* (0.028)
Other prod. & services	0.252*** (0.010)	-0.032*** (0.010)	0.025*** (0.006)	0.072*** (0.007)	0.084*** (0.006)	0.060*** (0.005)	-0.462*** (0.022)

Source: own calculation based on data from LSMS, 2003-2009

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

3.8 Conclusions

This chapter presented the estimation of a food demand system for Tajikistan using a QUAIDS specification that includes a set of variables representing socio-economic and demographic characteristics of households. As far as we know, there are no other estimations of this type available in the literature for the case of Tajikistan, a country that is one of the poorest and most food insecure in Central Asia.

We showed results for a pooled estimation of the QUAIDS model including all rounds (2003, two rounds in 2007, and 2009) of the LSMS survey, as well as individual estimations for each round. We also presented results for separate estimations of the system for rural and urban households in each case. Twelve socio-economic and demographic variables were included in the round estimation and, additionally other five regional variables were incorporated in demand estimation in the pooled estimation.

One important obstacle to the estimation of a food demand system in a poor country like Tajikistan is the high incidence of zero values in the consumption expenditure of particular items. In the case of the LSMS data we use, this problem is acute even when we aggregate all food items in just seven groups. A good number of households do not report any consumption at all of various groups of food products to which they have limited access or are luxuries. To avoid bias in our estimations, we employed a two-step estimation procedure similar to the one proposed by Shonkwiler and Yen, (1999). The first step estimation consisted of estimating equations using the probit model for each food-grouped products using several explanatory variables.

The main parameters of interest, i.e. the demand elasticities have been observed to vary widely across rounds, location, and food commodities. The empirical results show that Tajik households are expenditure and price responsive, whereas their food consumption pattern varies across several demographic and spatial contexts. We computed expenditure elasticities that are positive and statistically significant for all groups of food products, and own -price elasticities that are all negative and statistically significant. According to their expenditure elasticities, meat & fish products, dairy products, and vegetables and fruits can be categorized as luxuries for Tajik households, while bread & cereals, oils and animal fats as well as other food items can be categorized as necessities.

The estimations of the demand system in each round separately suggest that, as their aggregate levels of food consumption increased, Tajik households shifted their budgetary allocation from bread & cereals towards higher-value products such as meat & fish, dairy products, and fruits & vegetables, thus allowing ‘consumption diversification’ to arise out of easier access and availability of food.



Appendix to Chapter 3

Table A3.1: Aggregation of food commodities into food groups from LSMS (2003-2009)

LSMS: Household Expenditure on food items in the last 7 days of month			
	LSMS 2003	LSMS 2007-2009	
Grouped Food Items	Food items	Food items	Unit
W1 <i>Bread and Cereals products</i>	Bread	Bread	kg
	Non (bread)	Non (bread)	kg
	Flour	Flour	kg
	Grain	Wheat	kg
		Cereals	kg
	Rice	Rice	kg
	Macaroni products	Macaroni_ prod	kg
W2- <i>Meat and Fish products</i>	Other grain products (e.g. bulgar wheat)	Dried beans, pulses (beans, peas, lentils, etc.)	kg
		Other grain products (e.g. maize, oats, barley)	kg
	Beef	Beef	kg
	Chicken	Chicken	kg
	Lamb	Lamb	kg
		Pork	kg
		Sausages	kg
		Canned meat	kg
	Other meat products	Other meat products	kg
	Fish	Fish fresh	kg
W3 <i>Dairy products</i>		Fish canned	kg
	Eggs	Fish salted	kg
	Fresh milk	Eggs	kg
		Fresh milk	kg
		Cheese	kg
	Other dairy products	Powdered milk	kg
		Other dairy products	kg
W4- <i>Vegetables & Fruits</i>	Onions, garlic	Butter	kg
		Onions	kg
	Potatoes	Garlic	kg
	Tomatoes	Potatoes	kg
	Carrots	Tomatoes	kg
	Beans & peas	Carrots	kg
		Cabbage	kg
		Cauliflower	kg
	Cucumber	kg	

Continued: Aggregation of food commodities into food groups from LSMS (2003-2009)

	2003	2007-2009	Unit
W4 <i>-Vegetables & Fruits</i>		Mushrooms (fresh, salted, dried, etc.)	kg
		Preserved vegetables	kg
	Other Vegetables	Other vegetables	kg
	Apples	Apples	kg
	Citrus fruits	Oranges	kg
	Grapes	Grapes	kg
		Watermelon, melon	kg
		Pumpkin	Lt
	Other fresh fruit	Other fresh fruit	kg
	Dried fruits and nuts	Dried fruits	kg
W7 <i>Oils and animal fats</i>	Preserved fruits, vegetables	Preserved fruits	Lt
		Dried nuts	kg
	Vegetable oil, animal fat	Vegetable oil	Lt
		Ghee	kg
		Animal fat	kg
		Soft drinks (coke, etc.)	kg
		Mineral water	kg
		Fruit juice	kg
		Coffee	kg
		Tea	kg
W7- <i>Other food items</i>	Tea, coffee	Salt	kg
	Salt	Sugar	kg
	Sugar	Sweets, eastern sweets	kg
	Confectionary, caramel & biscuits, cakes	Jam	kg
		Pastries	kg

Source: LSMS, (2003-2009)

Table A3.2: Demographic indicators and structural growth rate, (1990 – 2013)

	1990	1995	2000	2005	2010	2013
Total population (thous. people)	5361.3	5701.3	6264.9	6842.6	7621.3	8161.6
Population growth rate (%)	1.8	1.4	1.5	2.1	2.4	2.5
Urban (% of total pop.)	31.3	27.4	26.7	26.5	26.4	26.6
Rural (% of total pop.)	68.7	72.6	73.3	73.5	73.6	73.4
Male (% of total pop.)	49.7	50	50.1	50.3	50.5	50.5
Female (% of total pop.)	50.3	50	49.9	49.7	49.5	49.5
by region (% of total pop.):						
Dushanbe	11.5	9.1	8.9	9.3	9.6	9.6
Sughd	30.4	30.7	31.7	30.1	29.6	29.4
Khatlon	33.5	34.7	34.4	35.2	35.3	35.4
RRS	21.2	22.2	21.6	22.3	22.7	22.9
GBAO	3.2	3.3	3.4	3.10	2.8	2.7
Life expectancy at birth						
Total	69.9	66.1	68.2	70.6	72.5	73.4
Men	67.1	62.5	66.1	68.1	70.8	71.6
Women	72.6	68.9	70.3	73.2	74.4	75.3
HDI	0.610		0.529	0.572	0.596	0.607
Labour resources and employment						
Working age (% of total pop.)	49.6	48.9	51.8	57.4	59.7	60.3
Non -working age (% of total pop.)	50.4	51.1	48.2	42.6	40.3	39.7
Labour resources (% of total pop.)	46.0	49.0	51.0	57.0	59.0	60.0
Economical active (% of total pop.)	36.2	33.1	28.6	31.5	29.9	28.9
Employed (% of total pop.)	36.0	33.0	28.0	31.0	29.0	28.0

Source : Taj STAT, 2014

Table A3.3: Percentages of zero-consumption values in the aggregated food groups

	zero consumption			
	2003	2007r1	2007r2	2009
N	4160	4860	4490	1503
Bread & cereal	0.09	0.08	0.04	0
Meat & fish products	48.48	25.48	23.54	18.96
Dairy products	25.60	20.94	16.92	16.69
Vegetables & Fruits	3.75	0.64	0.04	2.26
Oils & fats products	7.81	6.60	1.69	0
Other food items	1.46	1.36	0.04	0

Source: own calculation based on LSMS, Taj STAT (2003, r1-r2 2007, 2009)

Table A3.4: Wald test for validity of socio-demographics parameters in QUAIDS

(Pooled estimation, 2003-2009)

Demographics parameters – $H_0: \eta_i$ vs. $\rho_i = 0$			Wald Test Statistic	P-values
$\eta_{\text{Household size}}$	and	$\rho_{\text{Household size}_1} = 0$	50.08	0.0000
$\eta_{\text{Household age (Head)}}$	and	$\rho_{\text{Household age (Head)}} = 0$	2908.95	0.0000
$\eta_{\text{Children 0-4 age}}$	and	$\rho_{\text{Children 0-4 age}} = 0$	897.82	0.0000
$\eta_{\text{Children 5-15 age}}$	and	$\rho_{\text{Children 5-15 age}} = 0$	353.98	0.0000
$\eta_{\text{Adults up 16 > age}}$	and	$\rho_{\text{Adults up 16 > age}} = 0$	1157.49	0.0000
η_{Rural}	and	$\rho_{\text{Rural}} = 0$	311.08	0.0000
$\eta_{\text{Gender (Head): Male}}$	and	$\rho_{\text{Gender (Head): Male}} = 0$	76.40	0.0000
$\eta_{\text{Marital status: Married}}$	and	$\rho_{\text{Marital status: Married}} = 0$	202.87	0.0000
$\eta_{\text{Literacy (Head): Secondary}}$	and	$\rho_{\text{Literacy (Head): Secondary}} = 0$	48.89	0.0001
$\eta_{\text{Literacy (Head): High}}$	and	$\rho_{\text{Literacy (Head): High}} = 0$	151.14	0.0000
$\eta_{\text{Employed (Head)}}$	and	$\rho_{\text{Employed (Head)}} = 0$	71.23	0.0000
$\eta_{\text{Agro-employed (Head)}}$	and	$\rho_{\text{Agro-employed (Head)}} = 0$	215.96	0.0000
η_{poor}	and	$\rho_{\text{poor}} = 0$	403.59	0.0000
η_{migrants}	and	$\rho_{\text{migrants}} = 0$	30.70	0.0001
η_{Dushanbe}	and	$\rho_{\text{Dushanbe}} = 0$	371.61	0.0000
η_{Sughd}	and	$\rho_{\text{Sughd}} = 0$	548.61	0.0000
η_{Khatlon}	and	$\rho_{\text{Khatlon}} = 0$	560.86	0.0000
η_{RRS}	and	$\rho_{\text{RRS}} = 0$	483.24	0.0000
η_{GBAO}	and	$\rho_{\text{GBAO}} = 0$	456.56	0.0000

Source: own calculation based on data LSMS (2003-2009)

Table A3.5: Estimated Parameter of the Univariate Probit Model: LSMS (2003)

	Bread & cereal		Meat & fish produc.		Dairy products		Vegetables & Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Log / total income	0.236***	0.144	0.098***	0.023	0.260***	0.025	0.065*	0.047	0.125***	0.032	0.134**	0.055
Log /price -bread & cereal	-0.299	0.505	0.566***	0.086	0.482***	0.102	-0.479***	0.140	-0.221**	0.108	-0.336*	0.179
Log /price meat & fish products	-0.014	0.776	-0.175**	0.095	-0.186*	0.108	0.317*	0.172	-0.030	0.140	-0.180	0.274
Log /price-dairy products	0.179	0.747	-0.416***	0.074	0.168*	0.094	-0.605***	0.107	0.066	0.113	0.611**	0.304
Log/price-vegetables & fruits	0.820	1.021	0.150**	0.077	0.031	0.086	-0.299**	0.122	-0.082	0.105	0.062	0.253
Log/price-oils & animal fats	-0.300	0.379	-0.010	0.073	-0.014	0.082	-0.240**	0.117	0.081	0.118	0.062	0.225
Log/price-other food items	0.020	0.494	-0.220***	0.067	-0.109	0.071	0.284**	0.138	-0.025	0.092	0.091	0.199
Household Size (number)			-0.070	0.051	-0.014	0.056	-0.073	0.097	-0.019	0.075	0.100	0.149
Children 0-15 age (number)			0.080**	0.055	0.069	0.060	0.184*	0.104	0.035	0.079	-0.033	0.156
Adults up 16>Age (number)			0.126	0.049	0.029	0.053	0.128	0.092	0.081	0.071	-0.017	0.139
Age of HH head (number)			-0.003	0.002	0.000	0.002	-0.004	0.004	-0.001	0.003	0.000	0.005
Gender HH head: 1 if Male			0.148***	0.056	0.072	0.059	0.078	0.110	0.023	0.077	0.060	0.136
Location: 1 if Rural			-0.395***	0.046	-0.154***	0.049	-0.897***	0.119	0.044	0.064	-0.076	0.118
Education HH head: 1 if Educated			0.134*	0.072	0.088	0.075	-0.475**	0.189	-0.084	0.101	-0.127	0.190
Employed HH head: 1 if Employed			0.150***	0.052	0.156***	0.056	-0.204**	0.106	0.032	0.073	0.011	0.133
Poverty: 1 if HH is Poor ¹			-0.824***	0.053	-0.506***	0.059	-0.676***	0.124	-0.276***	0.076	-0.289**	0.142
Migration: 1 if HH has Migrants			0.016	0.056	0.120**	0.062	0.088	0.121	-0.089	0.081	-0.149	0.146
Constant	2.177	1.769	0.412	0.277	-0.346	0.310	3.147***	0.537	1.049***	0.399	1.575**	0.784
LR chi2	4.09		619.06		363.28		194.57		68.03		36.52	
Prob > chi2	0.7693		0.000		0.000		0.000		0.000		0.0039	
Pseudo R2	0.0643		0.1074		0.077		0.1462		0.0298		0.0574	
N	4160		4160		4160		4160		4160		4160	

Source: own calculation based on data from LSMS, 2003

¹ Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 U.S dollar per day), LSMS, 2009 (World Bank)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.6: Parameters Estimates of the QUAIDS Model: LSMS (2003)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
α_i	0.1441*** (0.0142)	0.2675*** (0.0153)	0.3116*** (0.0124)	0.1911*** (0.0113)	0.0350*** (0.0096)	0.0334*** (0.0105)	0.0173 (0.0212)
β_i	-0.0182*** (0.0058)	-0.1273*** (0.0080)	-0.0684*** (0.0052)	-0.0616*** (0.0044)	-0.0554*** (0.0032)	-0.0416*** (0.0041)	0.3724*** (0.0072)
γ_1	0.1180*** (0.0062)	-0.0686*** (0.0051)	-0.0228*** (0.0037)	-0.0400*** (0.0040)	0.0090*** (0.0027)	-0.0233*** (0.0035)	0.0277*** (0.0051)
γ_2	-0.0686*** (0.0051)	0.1228*** (0.0070)	0.0543*** (0.0041)	-0.0345*** (0.0041)	-0.0103*** (0.0028)	0.0118*** (0.0037)	-0.0755*** (0.0063)
γ_3	-0.0228*** (0.0037)	0.0543*** (0.0041)	0.0787*** (0.0033)	-0.0051* (0.0031)	-0.0128*** (0.0021)	-0.0030 (0.0027)	-0.0892*** (0.0044)
γ_4	-0.0400*** (0.0040)	-0.0345*** (0.0041)	-0.0051* (0.0031)	0.1201*** (0.0042)	-0.0016 (0.0023)	-0.0201*** (0.0027)	-0.0188*** (0.0041)
γ_5	0.0090*** (0.0027)	-0.0103*** (0.0028)	-0.0128*** (0.0021)	-0.0016*** (0.0023)	0.0395*** (0.0023)	-0.0140*** (0.0019)	-0.0098*** (0.0034)
γ_6	-0.0233*** (0.0035)	0.0118*** (0.0037)	-0.0030 (0.0027)	-0.0201*** (0.0027)	-0.0140*** (0.0019)	0.0562*** (0.0032)	-0.0076*** (0.0038)
γ_7	0.0277*** (0.0051)	-0.0755*** (0.0063)	-0.0892*** (0.0044)	-0.0188*** (0.0041)	-0.0098*** (0.0034)	-0.0076** (0.0038)	0.1732*** (0.0084)
λ_i	0.0100*** (0.0012)	0.0302*** (0.0017)	0.0160*** (0.0013)	0.0125*** (0.0010)	0.0181*** (0.0009)	0.0097*** (0.0010)	-0.0966*** (0.0024)
d_i	0.0049*** (0.0006)	-0.0727*** (0.0160)	-0.1412*** (0.0192)	-0.0174 (0.0167)	-0.3302*** (0.0239)	0.0864*** (0.0222)	
$\eta_{\text{household size}}$	-0.0064*** (0.0023)	0.0013 (0.0037)	0.0039** (0.0020)	0.0012 (0.0018)	0.0020* (0.0012)	0.0019 (0.0015)	-0.0039** (0.0049)
$\eta_{\text{household age (Head)}}$	-0.0001 (0.0001)	0.0001 (0.0001)	0.0002*** (0.0001)	0.0002*** (0.0001)	0.0000 (0.0000)	0.0001* (0.0001)	-0.0006*** (0.0001)
$\eta_{\text{gender (Head)}}$	0.0000 (0.0024)	-0.0013 (0.0036)	0.0019 (0.0020)	0.0026 (0.0018)	-0.0030** (0.0012)	-0.0033** (0.0016)	0.0030 (0.0044)
η_{rural}	-0.0004 (0.0022)	-0.0086** (0.0033)	-0.0068*** (0.0019)	0.0032* (0.0017)	0.0140*** (0.0013)	0.0067*** (0.0015)	-0.0081** (0.0040)
$\eta_{\text{employed (Head)}}$	0.0001 (0.0023)	0.0176*** (0.0036)	0.0073*** (0.0020)	-0.0024** (0.0018)	0.0014 (0.0012)	0.0007 (0.0016)	-0.0247*** (0.0047)
η_{poor}	-0.0224*** (0.0028)	-0.0999*** (0.0052)	-0.0206*** (0.0024)	-0.0097*** (0.0021)	-0.0139*** (0.0015)	-0.0030* (0.0018)	0.1695*** (0.0071)
η_{migrants}	-0.0015 (0.0027)	0.0181*** (0.0044)	0.0129*** (0.0023)	0.0107*** (0.0020)	0.0015 (0.0014)	-0.0005 (0.0018)	-0.0412*** (0.0057)
	$\rho_{\text{HH size}}$	$\rho_{\text{HH age}}$	$\rho_{\text{HH gender}}$	ρ_{rural}	ρ_{employed}	ρ_{poor}	ρ_{migrants}
ρ_i	0.1020 (0.0891)	-0.3119*** (0.0153)	-0.2766*** (0.0285)	-0.2396*** (0.0168)	-0.0499** (0.0219)	-0.1332*** (0.0198)	0.5405*** (0.0257)
RMSE	0.1168	0.0731	0.0613	0.0775	0.0428	0.0699	
R-sq	0.8402	0.4192	0.5148	0.7812	0.7504	0.7088	
N	41860	41860	41860	41860	41860	41860	41860

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.7: Estimated Demand elasticities: Uncompensated /Compensated Prices and Expenditure Elasticities, LSMS (2003)

	<i>Uncompensated Price Elasticities</i>							<i>Expenditure Elasticities</i>
	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats product	Other food items	Other goods & services	
Bread & cereal	-0.391*** (0.026)	0.030 (0.021)	-0.029** (0.014)	-0.146*** (0.016)	-0.046*** (0.011)	-0.106*** (0.014)	-0.108*** (0.034)	0.796*** (0.012)
Meat & fish products	-0.047 (0.051)	-0.384*** (0.076)	-0.040 (0.042)	-0.088** (0.038)	-0.091*** (0.026)	-0.163*** (0.037)	-0.339*** (0.088)	1.297*** (0.034)
Dairy products	-0.154*** (0.048)	-0.036 (0.062)	-0.117*** (0.051)	-0.177*** (0.044)	-0.134*** (0.028)	-0.042 (0.040)	-0.586*** (0.093)	1.016*** (0.029)
Vegetables & Fruits	-0.283*** (0.030)	-0.028 (0.030)	-0.084*** (0.024)	-0.076*** (0.035)	-0.063*** (0.017)	-0.092*** (0.020)	-0.243*** (0.052)	0.863*** (0.015)
Oils & fats products	-0.137*** (0.038)	-0.086** (0.040)	-0.118*** (0.029)	-0.099*** (0.031)	-0.290*** (0.0340)	-0.109*** (0.027)	0.078*** (0.065)	0.742*** (0.018)
Other food items	-0.279*** (0.035)	-0.139*** (0.040)	-0.020 (0.030)	-0.125*** (0.027)	-0.088*** (0.019)	-0.399*** (0.033)	0.173*** (0.060)	0.876*** (0.018)
Other prod.& services	-0.201*** (0.030)	-0.161*** (0.034)	-0.171*** (0.024)	-0.167*** (0.025)	-0.010 (0.016)	0.026 (0.021)	-0.550*** (0.065)	1.234*** (0.015)
	<i>Compensated Price Elasticities</i>							
Bread & cereal	-0.182*** (0.026)	0.077*** (0.021)	0.018 (0.014)	-0.034** (0.016)	0.011 (0.011)	-0.023 (0.014)	0.133*** (0.034)	
Meat & fish products	0.293*** (0.053)	-0.306*** (0.0760)	0.036 (0.042)	0.094** (0.038)	0.000 (0.026)	-0.026** (0.036)	0.054 (0.088)	
Dairy products	0.112** (0.049)	0.025 (0.0620)	-0.178*** (0.052)	-0.034 (0.044)	-0.063** (0.028)	0.065 (0.040)	-0.277*** (0.092)	
Vegetables & Fruits	-0.057** (0.029)	0.024 (0.0300)	-0.033 (0.024)	-0.045*** (0.034)	-0.002 (0.017)	-0.001 (0.020)	0.019** (0.051)	
Oils & fats products	0.058 (0.038)	-0.042 (0.040)	-0.074** (0.029)	0.005 (0.031)	-0.238*** (0.034)	-0.031* (0.027)	0.303*** (0.065)	
Other food items	-0.049 (0.034)	-0.086*** (0.040)	0.031 (0.030)	-0.002** (0.027)	-0.026* (0.019)	-0.307*** (0.033)	0.438*** (0.059)	
Other prod. & services	0.122*** (0.031)	-0.087** (0.034)	-0.098*** (0.024)	0.005 (0.025)	0.078*** (0.016)	0.156*** (0.021)	-0.176*** (0.064)	

Source: own calculation based on data from LSMS, 2003

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.8: Estimated Parameters of the Univariate Probit Model: LSMS round (1/2007)

	Bread & cereal		Meat & fish produc.		Dairy products		Vegetables & Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Log / total income	0.061	0.152	0.225***	0.021	0.099***	0.022	0.238***	0.077	0.084***	0.029	0.222***	0.051
Log /price -bread & cereal	0.273	0.695	0.083	0.060	0.090	0.069	-0.071	0.209	0.240**	0.108	0.205	0.183
Log /price meat & fish products	0.154	0.423	-0.024	0.067	-0.073	0.068	0.181	0.235	0.263***	0.081	0.320**	0.134
Log /price-dairy products	-0.035	0.376	-0.046	0.051	0.102*	0.060	-0.466***	0.141	-0.112*	0.069	-0.275***	0.104
Log/price-vegetables & fruits	0.240	0.584	-0.057	0.047	0.369***	0.063	-0.040	0.171	-0.112*	0.066	0.018	0.130
Log/price-oils & animal fats	-0.484	0.327	0.328***	0.057	0.176***	0.062	0.056	0.231	-0.022***	0.089	0.068	0.155
Log/price-other food items	0.394	0.430	0.106***	0.039	0.152***	0.043	-0.163	0.139	0.167	0.063	-0.067	0.102
Household Size (number)	0.098	0.071	-0.042	0.045	0.071	0.049	-0.010	0.178	0.011	0.066	0.062	0.130
Children 0-15 Age (number)			0.041	0.048	-0.022	0.052	0.226	0.201	0.001	0.071	0.050	0.140
Adults up 16> Age (number)			0.045	0.045	-0.059	0.049	0.182	0.186	0.033	0.066	0.035	0.131
Age of HH head (number)			-0.001	0.002	0.000	0.002	0.002	0.007	0.000	0.003	-0.005	0.005
Gender HH head: 1 if Male			0.076	0.053	0.120**	0.056	-0.197	0.202	-0.111	0.079	0.112	0.127
Location: 1 if Rural	0.116	0.317	-0.392***	0.045	-0.035	0.046	-0.850***	0.224	-0.176***	0.065	-0.227**	0.119
Education HH head: 1 if Educated			0.134	0.103	0.183*	0.109	0.389	0.291	0.404***	0.131	0.249	0.227
Employed HH head: 1 if Employed			0.013	0.048	0.162***	0.051	0.557***	0.188	0.095	0.070	-0.023	0.126
Poverty: 1 if HH is Poor ¹			-0.562***	0.056	-0.521***	0.058	-0.339	0.215	-0.228***	0.078	-0.294**	0.142
Migration: 1 if HH has Migrants			-0.067	0.047	0.039	0.051	0.273	0.232	0.075	0.071	0.111	0.142
Constant	1.667	1.722	-1.360***	0.284	-1.139***	0.299	0.605	0.989	-0.408	0.394	-0.302	0.677
LR chi2	5.89		403.62		268.23		105.95		84.37		91.28	
Prob > chi2	0.750		0.000		0.000		0.000		0.000		0.000	
Pseudo R2	0.091		0.068		0.054		0.282		0.036		0.131	
N	4860		4860		4860		4860		4860		4860	

Source: own calculation based on data from LSMS, round 1/2007

¹ Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 U.S dollar per day), LSMS, 2009 (World Bank)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.9: Parameters Estimates of the QUAIDS Model: LSMS (round 1 /2007)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
α_i	0.2432*** (0.0200)	0.1862*** (0.0178)	0.1299*** (0.0106)	0.2992*** (0.0130)	0.0653*** (0.0103)	0.1288*** (0.0084)	-0.0529 (0.0417)
β_i	-0.0417*** (0.0143)	-0.1071*** (0.0150)	-0.0352*** (0.0063)	-0.0654*** (0.0080)	-0.0206 (0.0053)	-0.0149*** (0.0048)	0.3442*** (0.0293)
γ_1	0.1206*** (0.0072)	0.0004 (0.0051)	-0.0040* (0.0024)	-0.0262*** (0.0035)	-0.0042* (0.0023)	-0.0128*** (0.0019)	-0.0736*** (0.0139)
γ_2	0.0004 (0.0051)	0.0830*** (0.0062)	0.0009 (0.0023)	-0.0028 (0.0031)	0.0019 (0.0024)	-0.0034* (0.0018)	-0.0800*** (0.0134)
γ_3	-0.0040* (0.0024)	0.0009 (0.0023)	0.0429*** (0.0018)	-0.0032* (0.0018)	-0.0056*** (0.0014)	0.0005 (0.0012)	-0.0314*** (0.0055)
γ_4	-0.0262*** (0.0035)	-0.0028 (0.0032)	-0.0032* (0.0018)	0.1177*** (0.0029)	-0.0124*** (0.0017)	-0.0061*** (0.0013)	-0.0667*** (0.0080)
γ_5	-0.0043* (0.0024)	0.0019 (0.0024)	-0.0056*** (0.0014)	-0.0124*** (0.0017)	0.0572*** (0.0021)	-0.0074*** (0.0012)	-0.0294*** (0.0049)
γ_6	-0.0128*** (0.0019)	-0.0034* (0.018)	0.0005 (0.0012)	-0.0061*** (0.0013)	-0.0074*** (0.0012)	0.0622*** (0.0013)	-0.0329*** (0.0038)
γ_7	-0.0736*** (0.0139)	-0.0801*** (0.0134)	-0.0315*** (0.0055)	-0.0667*** (0.0080)	-0.0294*** (0.0049)	-0.0329*** (0.0038)	0.3143*** (0.0377)
λ_i	-0.0248*** (0.0075)	-0.0724*** (0.0086)	-0.0159*** (0.0034)	-0.0147*** (0.0043)	-0.0012 (0.0026)	-0.0018 (0.0024)	0.1312*** (0.0182)
d_i	0.4986*** (0.0921)	0.0156*** (0.0055)	0.4764** (0.2039)	-0.1982 (0.1635)	13.055*** (4.0897)	-0.1408 (0.2081)	
$\eta_{\text{household size}}$	-0.0017*** (0.0003)	0.0019*** (0.0004)	0.0008*** (0.0001)	0.0004*** (0.0002)	0.0004*** (0.0001)	0.0005*** (0.0001)	-0.0024*** (0.0003)
$\eta_{\text{household age (Head)}}$	0.0000 (0.0000)	-0.0000 (0.0001)	-0.0001* (0.0000)	-0.0000 (0.0000)	-0.0000* (0.0000)	0.0000 (0.0000)	0.0001** (0.0000)
η_{rural}	-0.0156*** (0.0021)	0.0089*** (0.0018)	-0.0023*** (0.0007)	0.0040*** (0.0010)	-0.0019*** (0.0007)	0.0007 (0.0005)	0.0063*** (0.0017)
$\eta_{\text{employed (Head)}}$	0.0006 (0.0016)	0.0014 (0.0015)	0.0002 (0.0007)	-0.0002 (0.0009)	-0.0007 (0.0007)	0.0006 (0.00058)	-0.0018 (0.0015)
η_{poor}	0.0028 (0.0036)	-0.0309*** (0.0059)	-0.0067*** (0.0015)	0.0055*** (0.0016)	0.0038*** (0.0013)	0.0016 (0.0010)	0.0237*** (0.0035)
η_{migrants}	-0.0028 (0.0017)	0.0034** (0.0016)	0.0018*** (0.0007)	-0.0009 (0.0009)	-0.0010 (0.0007)	-0.0007 (0.0006)	0.0002*** (0.0015)
	$\rho_{\text{HH size}}$	$\rho_{\text{HH age}}$	ρ_{rural}	ρ_{employed}	ρ_{poor}	ρ_{migrants}	
ρ_i	0.5417 (0.4962)	0.0565*** (0.0134)	-0.0033 (0.0116)	-0.1141*** (0.0399)	0.0253 (0.0211)	0.1192*** (0.0257)	
RMSE	0.1248	0.0729	0.0419	0.0719	0.0475	0.0461	
R-sq	0.8227	0.5902	0.5421	0.8386	0.6921	0.7184	
N	4860	4860	4860	4860	4860	4860	4860

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.10: Estimated Demand elasticities: Uncompensated /Compensated Prices and Expenditure Elasticities, LSMS (round 1/2007)

	Uncompensated Price Elasticities							Expenditure Elasticities
	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats product	Other food items	Other goods & services	
Bread & cereal	-0.567*** (0.022)	-0.015 (0.015)	-0.022*** (0.008)	-0.109*** (0.012)	-0.018** (0.009)	-0.041*** (0.007)	0.034 (0.024)	0.740*** (0.036)
Meat & fish products	-0.228*** (0.076)	-0.474*** (0.071)	-0.060** (0.027)	-0.156*** (0.047)	-0.030 (0.026)	-0.064*** (0.019)	-0.354*** (0.091)	1.523*** (0.219)
Dairy products	-0.182*** (0.052)	-0.067 (0.046)	-0.235*** (0.035)	-0.115*** (0.038)	-0.123*** (0.028)	-0.001 (0.023)	-0.279*** (0.083)	1.005*** (0.107)
Vegetables & Fruits	-0.199*** (0.020)	-0.037** (0.018)	-0.028** (0.011)	-0.261*** (0.017)	-0.082*** (0.010)	-0.034*** (0.008)	-0.166*** (0.027)	0.808*** (0.035)
Oils & fats products	-0.063** (0.031)	0.032 (0.031)	-0.076*** (0.020)	-0.164*** (0.022)	-0.208*** (0.028)	-0.092*** (0.017)	-0.180*** (0.054)	0.735*** (0.024)
Other food items	-0.200*** (0.027)	-0.056** (0.026)	0.005 (0.017)	-0.093*** (0.019)	-0.111*** (0.018)	-0.068*** (0.019)	-0.381*** (0.044)	0.903*** (0.025)
Other prod.& services	-0.081 (0.049)	-0.138*** (0.044)	-0.057*** (0.019)	-0.136*** (0.032)	-0.066*** (0.017)	-0.096*** (0.013)	-0.614*** (0.045)	1.191*** (0.139)
	Compensated Price Elasticities							
Bread & cereal	-0.375*** (0.020)	0.044*** (0.014)	0.009 (0.007)	0.0067 (0.010)	0.031*** (0.008)	0.007 (0.007)	0.275*** (0.026)	
Meat & fish products	0.166*** (0.033)	-0.350*** (0.057)	0.005 (0.021)	0.081*** (0.023)	0.073*** (0.021)	0.035** (0.015)	0.142 (0.152)	
Dairy products	0.078** (0.038)	-0.067 (0.041)	-0.192*** (0.034)	0.041 (0.032)	-0.055** (0.026)	0.066*** (0.022)	0.048 (0.100)	
Vegetables & Fruits	0.010 (0.017)	0.028* (0.016)	0.006 (0.010)	-0.135*** (0.016)	-0.027*** (0.010)	0.019** (0.008)	0.097*** (0.030)	
Oils & fats products	0.127*** (0.030)	0.092*** (0.032)	-0.045** (0.019)	-0.049** (0.021)	-0.158*** (0.028)	-0.044*** (0.017)	0.060 (0.055)	
Other food items	0.033 (0.027)	0.018 (0.026)	0.044** (0.018)	0.048** (0.019)	-0.049*** (0.018)	-0.008* (0.019)	-0.086** (0.050)	
Other prod. & services	0.227*** (0.021)	-0.041 (0.034)	-0.006 (0.015)	0.049*** (0.015)	(0.013) (0.012)	-0.017* (0.009)	-0.225*** (0.071)	

Source: own calculation based on data from LSMS, 2007

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.11: Estimated Parameter of the Univariate Probit Model: LSMS (round 2/2007)

	Bread & cereal		Meat & fish produc.		Dairy products		Vegetables & Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Log / total income	-0.269	0.178	0.089***	0.023	-0.025	0.024	-0.269	0.178	-0.055	0.052	-0.269	0.178
Log /price -bread & cereal	-0.342	1.813	0.109	0.196	0.932***	0.210	-0.342	1.813	0.757*	0.418	-0.342	1.813
Log /price meat & fish products	0.100	1.457	-0.033	0.155	-0.629***	0.164	0.100	1.457	-0.071	0.319	0.100	1.457
Log /price-dairy products	-0.005	0.537	-0.120**	0.059	0.159**	0.074	-0.005	0.537	-0.457***	0.090	-0.005	0.537
Log/price-vegetables & fruits	0.016	0.959	0.459***	0.102	0.708***	0.115	0.016	0.959	0.285	0.227	0.016	0.959
Log/price-oils & animal fats	-0.155	1.336	0.177	0.151	0.417***	0.157	-0.155	1.336	0.040	0.325	-0.155	1.336
Log/price-other food items	-0.189	0.570	0.710***	0.069	0.403***	0.070	-0.189	0.570	0.020	0.139	-0.189	0.570
Household Size (number)			-0.026	0.051	0.029	0.055			-0.034	0.115		
Children 0-15 Age (number)			0.077	0.055	0.024	0.059			0.038	0.124		
Adults up 16> Age (number)			0.069	0.051	-0.024	0.055			0.196*	0.117		
Age HH head (number)			0.006**	0.002	0.004*	0.003			-0.010**	0.005		
Gender HH head: 1 if Male			0.062	0.060	0.070	0.064			-0.201	0.138		
Location: 1 if Rural			-0.407***	0.052	-0.054	0.053			0.042	0.108		
Education HH head: 1 if Educated			0.027	0.115	0.216**	0.118			-0.578	0.404		
EmployedHH head: 1 if Employed			0.186***	0.054	0.124**	0.058			0.002	0.126		
Poverty: 1 if HH is Poor ¹			-0.916***	0.063	-0.651***	0.064			-0.258*	0.140		
Migration:1 if HH has Migrants			0.006	0.053	0.014	0.056			0.079	0.124		
Constant	5.937	4.683	-2.086***	0.588	-1.336**	0.610	5.937	4.683	2.384*	1.269	5.937	4.683
LR chi2	2.57		589.05		338.97		2.57		62.63		2.57	
Prob > chi2	0.922		0.000		0.000		0.922		0.000		0.922	
Pseudo R2	0.074		0.121		0.083		0.074		0.082		0.074	
N	4490		4490		4490		4490		4490		4490	

Source: own calculation based on data from LSMS, round 2/2007

¹ Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 U.S dollar per day), LSMS, 2009 (World Bank)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.12: Parameters Estimates of the QUAIDS Model: LSMS (round 2/2007)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
α_i	-0.1553** (0.0780)	0.3544*** (0.0606)	0.0632*** (0.0206)	0.2135*** (0.0267)	0.0043 (0.0282)	0.0827*** (0.0170)	0.4371*** (0.1593)
β_i	-0.1277*** (0.0335)	-0.1637*** (0.0256)	-0.0531*** (0.0093)	-0.0529*** (0.0123)	-0.0431*** (0.0129)	-0.0314*** (0.0080)	0.4717*** (0.0527)
γ_1	-0.0109 (0.0262)	0.0509*** (0.0167)	-0.0034 (0.0058)	-0.0493*** (0.0073)	-0.0169** (0.0082)	-0.0311*** (0.0047)	0.0607 (0.0464)
γ_2	0.0509*** (0.0167)	0.0925*** (0.0190)	0.0127** (0.0054)	0.0209*** (0.0064)	0.0079* (0.0064)	0.0057*** (0.0044)	-0.1907 (0.0443)
γ_3	-0.0034 (0.0058)	0.0127** (0.0054)	0.0205*** (0.0022)	0.0015 (0.0024)	0.0005*** (0.0028)	0.0071*** (0.0015)	-0.0388*** (0.0140)
γ_4	-0.0493*** (0.0073)	0.0209*** (0.0064)	0.0015 (0.0024)	0.1055*** (0.0044)	-0.0121*** (0.0035)	0.0086*** (0.0020)	-0.0751*** (0.0163)
γ_5	-0.0169** (0.0082)	0.0079** (0.0064)	0.0005 (0.0028)	-0.0121*** (0.0035)	0.0598*** (0.0058)	-0.0066*** (0.0022)	-0.0326** (0.0162)
γ_6	-0.0311*** (0.0047)	0.0057 (0.0044)	0.0071*** (0.0015)	0.0086*** (0.0020)	-0.0066*** (0.0022)	0.0530*** (0.0017)	-0.0367*** (0.0104)
γ_7	0.0607 (0.0464)	-0.1907*** (0.0443)	-0.0388*** (0.0140)	-0.0751*** (0.0163)	-0.0326** (0.0162)	-0.0367*** (0.0104)	0.3133*** (0.1166)
λ_i	-0.0906*** (0.0255)	-0.0904*** (0.0177)	-0.0200*** (0.0060)	-0.0030 (0.0068)	-0.0064 (0.0072)	-0.0051 (0.0046)	0.2155*** (0.0458)
d_i		-0.0014 (0.1719)	1.2649 (0.8404)		0.3517 (0.2661)		
$\eta_{\text{household size}}$	-0.0017*** (0.0003)	0.0013*** (0.0002)	0.0004*** (0.0001)	0.0000 (0.0001)	0.0008*** (0.0001)	0.0003*** (0.0001)	-0.0011*** (0.0002)
$\eta_{\text{household age (Head)}}$	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	-0.0001*** (0.0000)	-0.0001** (0.0000)	0.0001 (0.0000)
η_{rural}	-0.0184*** (0.0027)	0.0052*** (0.0012)	0.0017*** (0.0004)	0.0039*** (0.0010)	-0.0008 (0.0008)	-0.0003 (0.0005)	0.0086*** (0.0019)
$\eta_{\text{employed (Head)}}$	0.0028** (0.0015)	-0.0014 (0.0010)	0.0002 (0.0004)	-0.0003 (0.0008)	-0.0003 (0.0007)	0.0002 (0.0004)	-0.0012 (0.0012)
η_{poor}	-0.0183*** (0.0030)	-0.0016 (0.0027)	0.0006 (0.0008)	0.0053*** (0.0016)	0.0000 (0.0013)	0.0028*** (0.0007)	0.0112*** (0.0027)
η_{migrants}	-0.0016*** (0.0014)	0.0001 (0.0010)	0.0009** (0.0004)	0.0003 (0.0009)	0.0006 (0.0007)	-0.0003** (0.0005)	-0.0006 (0.0012)
	$\rho_{\text{HH size}}$	$\rho_{\text{HH age}}$	ρ_{rural}	ρ_{employed}	ρ_{poor}	ρ_{migrants}	
ρ_i	0.0122 (0.0148)	-0.0157** (0.0076)	-0.0356 (0.0361)	0.3825*** (0.1326)	0.0037 (0.0058)	0.7821** (0.3145)	
RMSE	0.1411	0.0668	0.0322	0.0550	0.0564	0.0362	
R-sq	0.8317	0.6158	0.6214	0.8443	0.7451	0.7876	
N	4490	4490	4490	4490	4490	4490	4490

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.13: Estimated Demand elasticities: Uncompensated /Compensated Prices and Expenditure Elasticities, LSMS (round 2/2007)

	<i>Uncompensated Price Elasticities</i>							<i>Expenditure Elasticities</i>
	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats product	Other food items	Other goods & services	
Bread & cereal	-1.046*** (0.078)	0.104*** (0.036)	-0.032** (0.013)	-0.181*** (0.020)	-0.071*** (0.024)	-0.111*** (0.013)	0.562*** (0.074)	0.775*** (0.112)
Meat & fish products	0.440*** (0.141)	-0.295*** (0.112)	0.063* (0.035)	0.143*** (0.043)	0.032 (0.047)	0.028 (0.032)	-0.868*** (0.165)	0.290** (0.301)
Dairy products	-0.066 (0.096)	0.147** (0.073)	-0.612*** (0.031)	-0.006 (0.037)	-0.019 (0.051)	0.131*** (0.024)	-0.031 (0.139)	0.345** (0.172)
Vegetables & Fruits	-0.361*** (0.052)	0.112*** (0.035)	-0.008 (0.014)	-0.173*** (0.029)	-0.110*** (0.025)	0.062*** (0.014)	-0.127** (0.063)	0.604*** (0.050)
Oils & fats products	-0.148* (0.081)	0.024 (0.051)	-0.016 (0.025)	-0.146*** (0.033)	-0.390*** (0.057)	-0.076*** (0.021)	0.142 (0.096)	0.603*** (0.072)
Other food items	-0.439*** (0.064)	0.028 (0.049)	0.085*** (0.017)	0.110*** (0.026)	-0.112*** (0.030)	-0.214*** (0.023)	-0.087 (0.082)	0.630*** (0.066)
Other prod.& services	0.198* (0.120)	-0.451*** (0.065)	-0.060** (0.020)	-0.192*** (0.031)	-0.060* (0.035)	-0.097*** (0.021)	-1.345*** (0.161)	2.006*** (0.263)
	<i>Compensated Price Elasticities</i>							
Bread & cereal	-0.808*** (0.064)	0.167*** (0.032)	-0.002 (0.013)	-0.084*** (0.021)	0.002*** (0.024)	-0.059*** (0.013)	0.784*** (0.068)	
Meat & fish products	0.529*** (0.096)	-0.271*** (0.100)	0.075*** (0.028)	0.179*** (0.049)	0.059 (0.048)	0.047 (0.034)	-0.785*** (0.182)	
Dairy products	0.040 (0.085)	0.176*** (0.065)	-0.598*** (0.031)	0.037 (0.044)	0.013 (0.053)	0.154*** (0.027)	0.068 (0.131)	
Vegetables & Fruits	-0.175*** (0.047)	0.162*** (0.034)	0.016 (0.014)	-0.098*** (0.029)	-0.053** (0.025)	0.102*** (0.013)	0.046 (0.065)	
Oils & fats products	0.037 (0.074)	0.073 (0.050)	0.008 (0.025)	-0.070*** (0.032)	-0.333*** (0.057)	-0.036* (0.021)	0.314*** (0.099)	
Other food items	-0.246*** (0.057)	0.079* (0.048)	0.110*** (0.017)	0.189*** (0.025)	-0.053* (0.030)	-0.172*** (0.023)	0.093 (0.083)	
Other prod. & services	0.814*** (0.075)	-0.287*** (0.056)	0.019 (0.021)	0.059 (0.038)	0.129*** (0.037)	0.038* (0.023)	-0.771*** (0.127)	

Source: own calculation based on data from LSMS,2/ 2007

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.14: Estimated Parameters of the Univariate Probit Model: LSMS (2009)

	Bread & cereal		Meat & fish produc.		Dairy products		Vegetables & Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Log / total income			0.243***	0.049	0.166***	0.046			0.132	0.080		
Log /price -bread & cereal			1.127***	0.214	0.723***	0.200			-0.565	0.379		
Log /price meat & fish products			-0.105	0.236	0.253	0.211			-0.502	0.476		
Log /price-dairy products			-0.126	0.107	0.126	0.117			0.027	0.208		
Log/price-vegetables & fruits			0.001	0.188	0.544***	0.190			1.292***	0.422		
Log/price-oils & animal fats			0.243	0.171	0.345**	0.162			-0.099	0.320		
Log/price-other food items			0.430***	0.123	0.331***	0.119			-0.223	0.215		
Household Size (number)			-0.151	0.096	0.179*	0.101			-0.018	0.027		
Children 0-15 Age (number)			0.193*	0.103	-0.140	0.108						
Adults up 16> Age (number)			0.201**	0.097	-0.146	0.101						
Age of HH head (number)			0.004	0.004	-0.003	0.004						
Gender HH head: 1 if Male			-0.097	0.124	0.048	0.113			0.111	0.217		
Location: 1 if rural			-0.353***	0.102	0.072	0.094			-0.274	0.193		
Education HH head: 1 if Educated			0.228	0.214	0.184	0.201			-0.155	0.461		
Employed HH head: 1 if Employed			0.019	0.103	0.144	0.097			-0.226	0.170		
Poverty: 1 if HH is Poor ¹			-1.331***	0.111	-0.478***	0.112			-0.199	0.211		
Migration: 1 if HH has Migrants			-0.311***	0.101	0.016	0.098			0.043	0.181		
Constant			-3.114***	0.911	-4.101***	0.841			3.195*	1.721		
LR chi2			335.39		134.07				25.10			
Prob > chi2			0.000		0.000				0.033			
Pseudo R2			0.229		0.098				0.077			
N			1503		1503				1503			

Source: own calculation based on data from LSMS, 2009

¹ Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 U.S dollar per day), LSMS, 2009 (World Bank)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.15: Parameters Estimates of the QUAIDS Model: LSMS (2009)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
α_i	-0.0997* (0.0551)	0.2525*** (0.0427)	0.0815*** (0.0223)	0.2356*** (0.0316)	0.0231 (0.0222)	0.1267*** (0.0194)	0.3801*** (0.1092)
β_i	-0.0826*** (0.0242)	-0.0296** (0.0166)	-0.0117* (0.0066)	-0.0290*** (0.0091)	-0.0187*** (0.0065)	0.0083 (0.0077)	0.1635*** (0.0309)
γ_1	-0.0668*** (0.0162)	0.0166* (0.0099)	0.0008 (0.0046)	-0.0011 (0.0066)	0.0012 (0.0052)	-0.0155*** (0.0052)	0.0647*** (0.0201)
γ_2	0.0166* (0.0099)	0.0462*** (0.0108)	0.0017 (0.0036)	0.0143** (0.0059)	0.0031 (0.0047)	-0.0117*** (0.0042)	-0.0702*** (0.0161)
γ_3	0.0008 (0.0079)	0.0017 (0.0019)	0.0240*** (0.0022)	-0.0085*** (0.0029)	-0.0023 (0.0023)	0.0012** (0.0036)	-0.0170 (0.0046)
γ_4	-0.0011 (0.0066)	0.0143** (0.0059)	-0.0085*** (0.0029)	0.0622*** (0.0065)	-0.0244*** (0.0043)	0.0041 (0.0030)	-0.0464*** (0.0108)
γ_5	0.0012* (0.0052)	0.0031 (0.0047)	-0.0023 (0.0022)	-0.0244*** (0.0043)	0.0437*** (0.0039)	-0.0080*** (0.0023)	-0.0131 (0.0080)
γ_6	-0.0155*** (0.0045)	-0.0117*** (0.0042)	0.0012 (0.0019)	0.0040*** (0.0030)	-0.0080*** (0.0023)	0.0525*** (0.0028)	-0.0225*** (0.0072)
γ_7	0.0647*** (0.0200)	-0.0702*** (0.0161)	-0.0170** (0.0079)	-0.0464*** (0.0108)	-0.0131* (0.0080)	-0.0225*** (0.0072)	0.1046*** (0.0377)
λ_i	-0.0279** (0.0114)	-0.0122 (0.0067)	0.0021** (0.0023)	-0.0012 (0.0021)	0.0031*** (0.0021)	0.0103*** (0.0033)	0.0258** (0.0133)
d_i		-0.1053 (0.1903)	56.722 (65.683)		-0.0469 (0.2302)		
$\eta_{\text{household size}}$	0.0006* (0.0003)	0.0015*** (0.0004)	0.0004** (0.0001)	-0.0001 (0.0002)	0.0005*** (0.0002)	0.0000 (0.0001)	-0.0031*** (0.0007)
$\eta_{\text{household age (Head)}}$	-0.0000 (0.0000)	-0.0002*** (0.0001)	-0.0000 (0.0000)	0.0000 (0.0000)	-0.0001 (0.0001)	-0.0000 (0.0000)	0.0001** (0.0001)
η_{rural}	-0.0087*** (0.0027)	0.0033 (0.0022)	0.0007 (0.0010)	0.0024** (0.0013)	-0.0035*** (0.0012)	0.0009 (0.0010)	0.0049 (0.0035)
$\eta_{\text{employed (Head)}}$	0.0005 (0.0022)	-0.0002 (0.0021)	-0.0008 (0.0011)	-0.0013 (0.0013)	0.0003 (0.0010)	0.0001 (0.0010)	0.0014 (0.0033)
η_{poor}	-0.0430*** (0.0101)	-0.0182 (0.0112)	0.0120*** (0.0042)	0.0112** (0.0054)	0.0157*** (0.0056)	0.0231*** (0.0059)	-0.0008 (0.0141)
η_{migrants}	0.0003 (0.0020)	0.0000 (0.0019)	0.0001 (0.0009)	0.0009 (0.0012)	-0.0006 (0.0010)	-0.0015 (0.0011)	0.0008 (0.0032)
ρ_i	$\rho_{\text{HH size}}$ -0.0061 (0.0220)	ρ_{HHage} -0.0071 (0.0112)	ρ_{rural} -0.0318 (0.0378)	ρ_{employed} 0.2919** (0.1153)	ρ_{poor} 0.0034 (0.0065)	ρ_{migrants} 0.3724 (0.2605)	
RMSE	0.1166	0.0643	0.0327	0.0575	0.0407	0.0402	
R-sq	0.8115	0.6735	0.6188	0.8349	0.7697	0.7792	
N	1503	1503	1503	1503	1503	1503	1503

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.16: Estimated Demand elasticities: Uncompensated /Compensated Prices and Expenditure Elasticities, LSMS (2009)

	<i>Uncompensated Price Elasticities</i>							<i>Expenditure Elasticities</i>
	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services	
Bread & cereal	-1.251*** (0.070)	0.089** (0.042)	0.008 (0.018)	0.013 (0.030)	0.010 (0.022)	-0.048** (0.019)	0.443*** (0.092)	0.735*** (0.115)
Meat & fish products	0.169* (0.092)	-0.556*** (0.101)	0.018 (0.033)	0.141** (0.055)	0.031 (0.043)	-0.098** (0.038)	-0.542*** (0.152)	0.806*** (0.137)
Dairy products	0.047 (0.101)	0.053 (0.077)	-0.491*** (0.049)	-0.163*** (0.062)	-0.043 (0.046)	0.039 (0.041)	-0.227 (0.158)	0.743*** (0.089)
Vegetables & Fruits	0.016 (0.052)	0.127*** (0.046)	-0.063*** (0.022)	-0.501*** (0.051)	-0.186*** (0.033)	0.043* (0.023)	-0.239*** (0.080)	0.803*** (0.046)
Oils & fats products	0.053 (0.072)	0.064 (0.065)	-0.026 (0.030)	-0.314*** (0.059)	-0.395*** (0.053)	-0.093*** (0.032)	-0.013 (0.104)	0.719*** (0.068)
Other food items	-0.210*** (0.068)	-0.161*** (0.060)	0.017 (0.028)	0.056 (0.044)	-0.110*** (0.033)	-0.276*** (0.040)	-0.328*** (0.108)	1.012*** (0.136)
Other prod.& services	0.131** (0.052)	-0.223*** (0.043)	-0.054*** (0.020)	-0.155*** (0.030)	-0.044** (0.021)	-0.085*** (0.019)	-0.956*** (0.106)	1.388*** (0.081)
	<i>Compensated Price Elasticities</i>							
Bread & cereal	-1.076*** (0.062)	0.154*** (0.041)	0.037** (0.195)	0.107*** (0.027)	0.063 (0.021)	0.004 (0.018)	0.711*** (0.076)	
Meat & fish products	0.360*** (0.092)	-0.492*** (0.098)	0.050 (0.033)	0.245*** (0.054)	0.088** (0.043)	-0.039 (0.039)	-0.250* (0.145)	
Dairy products	0.223** (0.095)	0.119 (0.076)	-0.461*** (0.049)	-0.068 (0.060)	0.009 (0.045)	0.093** (0.041)	0.041 (0.164)	
Vegetables & Fruits	0.207*** (0.050)	0.197*** (0.045)	-0.031 (0.022)	-0.397*** (0.050)	-0.129*** (0.033)	0.101*** (0.023)	0.051 (0.080)	
Oils & fats products	0.224*** (0.069)	0.127** (0.064)	0.002 (0.029)	-0.221*** (0.058)	-0.344*** (0.053)	-0.041 (0.032)	0.247** (0.104)	
Other food items	0.030 (0.061)	-0.072 (0.057)	0.058** (0.026)	0.186*** (0.042)	-0.038 (0.033)	-0.202*** (0.039)	0.038 (0.095)	
Other prod. & services	0.461*** (0.049)	-0.101** (0.043)	0.001 (0.021)	0.022 (0.028)	0.054** (0.021)	0.014 (0.019)	-0.452*** (0.097)	

Source: own calculation based on data from LSMS, 2009

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.17: Parameter Estimates of the QUAIDS Model: Pooled Estimation LSMS, 2003-2009 (Country Level)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
α_i	0.4609*** (0.0087)	0.3221*** (0.0096)	0.2310*** (0.0055)	0.3307*** (0.0063)	0.1286*** (0.0065)	0.0542*** (0.0052)	-0.5274*** (0.0156)
β_i	-0.0727*** (0.0044)	-0.1740*** (0.0052)	-0.0879*** (0.0029)	-0.0531*** (0.0025)	-0.1092*** (0.0029)	-0.0525*** (0.0023)	-0.5493*** (0.0071)
γ_1	0.1001*** (0.0036)	-0.0123*** (0.0027)	-0.0077*** (0.0016)	-0.0276*** (0.0018)	-0.0071*** (0.0017)	-0.0212*** (0.0014)	-0.0242*** (0.0035)
γ_2	-0.0123*** (0.0027)	0.0445*** (0.0039)	-0.0082*** (0.0016)	-0.0236*** (0.0017)	-0.0335*** (0.0019)	-0.0315*** (0.0014)	0.0645*** (0.0067)
γ_3	-0.0077*** (0.0016)	-0.0082*** (0.0016)	0.0322*** (0.0013)	-0.0172*** (0.0011)	-0.0074*** (0.0011)	-0.0105*** (0.0009)	0.0187*** (0.0031)
γ_4	-0.0276*** (0.0018)	-0.0236*** (0.0017)	-0.0172*** (0.0011)	0.1033*** (0.0017)	-0.0147*** (0.0012)	-0.0116*** (0.0010)	-0.0086*** (0.0026)
γ_5	-0.0071*** (0.0017)	-0.0335*** (0.0019)	-0.0074*** (0.0011)	-0.0147*** (0.0012)	0.0231*** (0.0018)	-0.0251*** (0.0010)	0.0646*** (0.0039)
γ_6	-0.0212*** (0.0014)	-0.0315*** (0.0014)	-0.0105*** (0.0009)	-0.0116*** (0.0010)	-0.0251*** (0.0010)	0.0550*** (0.0010)	0.0448*** (0.0024)
γ_7	-0.0242*** (0.0035)	0.0645*** (0.0067)	0.0187*** (0.0031)	-0.0086*** (0.0026)	0.0646*** (0.0039)	0.0448*** (0.0024)	-0.1597*** (0.0132)
λ_i	0.0203*** (0.0016)	0.0434*** (0.0021)	0.0191*** (0.0011)	0.0126*** (0.0009)	0.0278*** (0.0011)	0.0112*** (0.0008)	-0.1344*** (0.0043)
d_i	0.0898*** (0.0230)	0.0116 (0.0216)	-0.1942*** (0.0205)	0.1626*** (0.0118)	0.1479*** (0.0112)	0.1368*** (0.0163)	
$\eta_{\text{Household size}}$	0.0034** (0.0039)	0.0041 (0.0047)	-0.0007*** (0.0021)	0.0020 (0.0020)	0.0022 (0.0019)	-0.0005 (0.0017)	-0.0104*** (0.0029)
$\eta_{\text{Children 0-4 age}}$	-0.0037** (0.0039)	-0.0029 (0.0047)	0.0006 (0.0021)	-0.0012 (0.0021)	-0.0015 (0.0019)	0.0009 (0.0017)	0.0079*** (0.0029)
$\eta_{\text{Children 5-15 age}}$	-0.0001 (0.0039)	-0.0041 (0.0047)	0.0004 (0.0021)	-0.0022*** (0.0020)	-0.0011 (0.0019)	0.0007 (0.0017)	0.0063** (0.0029)
$\eta_{\text{Adults up 16> age}}$	-0.0017 (0.0038)	-0.0048** (0.0046)	0.0011 (0.0021)	-0.0024 (0.0020)	-0.0023 (0.0019)	0.0001 (0.0017)	0.0100*** (0.0028)
$\eta_{\text{Household age (Head)}}$	0.0000 (0.0000)	0.0001*** (0.0000)	0.0000 (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	0.0001*** (0.0000)	-0.0004*** (0.0000)
η_{Rural}	0.0095*** (0.0012)	0.0016* (0.0009)	-0.0027*** (0.0006)	-0.0024*** (0.0006)	-0.0024*** (0.0005)	-0.0037*** (0.0005)	0.0001 (0.0013)
$\eta_{\text{Gender (Head): Male}}$	0.0018 (0.0017)	0.0077*** (0.0013)	0.0011 (0.0008)	0.0018** (0.0009)	0.0058*** (0.0008)	-0.0002 (0.0007)	-0.0180*** (0.0017)
$\eta_{\text{Marital status:Married}}$	0.0001 (0.0017)	-0.0071*** (0.0013)	-0.0032*** (0.0007)	-0.0028*** (0.0009)	-0.0034*** (0.0007)	-0.0006 (0.0007)	0.0171*** (0.0016)
$\eta_{\text{Literacy (Head):Seconda}}$	-0.0053*** (0.0013)	0.0039*** (0.0010)	0.0021*** (0.0006)	0.0013** (0.0007)	0.0026*** (0.0006)	0.0018*** (0.0005)	-0.0064*** (0.0013)
$\eta_{\text{Literacy (Head):High}}$	-0.0124*** (0.0015)	0.0075*** (0.0012)	0.0030*** (0.0007)	0.0000 (0.0008)	0.0015** (0.0007)	0.0025*** (0.0006)	-0.0022 (0.0015)
$\eta_{\text{Employed (Head)}}$	-0.0041*** (0.0011)	0.0015* (0.0009)	0.0009* (0.0005)	0.0025*** (0.0006)	0.0024*** (0.0005)	0.0019*** (0.0005)	-0.0050*** (0.0012)
$\eta_{\text{Agro-employed (Head)}}$	0.0096*** (0.0013)	0.0007 (0.0010)	-0.0029*** (0.0006)	0.0002 (0.0007)	-0.0016*** (0.0006)	0.0002 (0.0005)	-0.0062*** (0.0015)
η_{poor}	0.0301*** (0.0018)	0.0096*** (0.0015)	0.0012 (0.0008)	-0.0011 (0.0009)	-0.0083*** (0.0008)	-0.0081*** (0.0007)	-0.0234*** (0.0021)

Continued : Pooled Estimation 2003-2009, (Country level)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
$\eta_{migrants}$	0.0028*** (0.0010)	0.0007 (0.0008)	-0.0009** (0.0005)	0.0006 (0.0005)	0.0005 (0.0005)	0.0013*** (0.0004)	-0.0050*** (0.0012)
$\eta_{Dushanbe}$	0.0118*** (0.0022)	0.0017 (0.0017)	0.0067*** (0.0010)	0.0018 (0.0012)	0.0066*** (0.0010)	0.0078*** (0.0009)	-0.0365*** (0.0027)
η_{Sughd}	0.0112*** (0.0020)	-0.0153*** (0.0016)	0.0175*** (0.0010)	-0.0023** (0.0011)	0.0152*** (0.0009)	0.0060*** (0.0009)	-0.0322*** (0.0026)
$\eta_{Khatlon}$	0.0363*** (0.0022)	-0.0085*** (0.0016)	0.0113*** (0.0010)	-0.0023** (0.0011)	-0.0010 (0.0010)	0.0042*** (0.0009)	-0.0400*** (0.0027)
η_{RRS}	0.0175*** (0.0021)	-0.0006 (0.0016)	0.0113*** (0.0010)	0.0004 (0.0011)	0.0031*** (0.0010)	0.0038*** (0.0009)	-0.0354*** (0.0027)
η_{GBAO}	0.0189*** (0.0023)	0.0124*** (0.0017)	-0.0005 (0.0010)	-0.0117*** (0.0013)	0.0065*** (0.0010)	0.0092*** (0.0010)	-0.0347*** (0.0030)
$\eta_{Survey\ 2003}$	-0.0317*** (0.0017)	0.0118*** (0.0013)	0.0063*** (0.0007)	-0.0156*** (0.0010)	-0.0092*** (0.0008)	-0.0006 (0.0007)	0.0390*** (0.0020)
$\eta_{Survey\ 2007}$	-0.0214*** (0.0012)	0.0014 (0.0009)	0.0009*** (0.0005)	0.0076*** (0.0006)	-0.0071*** (0.0006)	-0.0043*** (0.0005)	0.0230*** (0.0015)
$\eta_{Survey\ 2009}$	-0.0186*** (0.0015)	0.0027** (0.0011)	0.0026*** (0.0006)	0.0026*** (0.0008)	-0.0046*** (0.0007)	-0.0011* (0.0006)	0.0164*** (0.0018)
	$\rho_{HH\ size}$	$\rho_{child\ 0-4}$	$\rho_{child\ 5-15}$	$\rho_{adults\ up16}$	$\rho_{HH\ age}$	ρ_{rural}	$\rho_{HH\ gender}$
ρ_i	0.0164 (0.0953)	-0.3002*** (0.0052)	-0.1853*** (0.0050)	-0.1606*** (0.0101)	-0.4748*** (0.0119)	-0.3325*** (0.0176)	0.0906*** (0.0196)
	$\rho_{Marital\ St}$	$\rho_{Literacy1}$	$\rho_{Literacy2}$	$\rho_{employed}$	$\rho_{agro-emp.}$	ρ_{poor}	$\rho_{migrants}$
ρ_i	-0.0030*** (0.0002)	-0.0715*** (0.0201)	-0.0991*** (0.0197)	-0.0719*** (0.0192)	0.2105*** (0.0108)	-0.1870*** (0.0113)	0.2001*** (0.0116)
	$\rho_{Dushanbe}$	ρ_{Sughd}	$\rho_{Khatlon}$	ρ_{RRS}	ρ_{GBAO}	$\rho_{Surv-2003}$	$\rho_{Surv-2007}$
ρ_i	-0.1190*** (0.0088)	-0.0797*** (0.0111)	-0.1549*** (0.0087)	0.0529*** (0.0123)	0.1105*** (0.0133)	-0.0641*** (0.0096)	-0.2424*** (0.0172)
	$\rho_{Surv-2009}$						
ρ_i	-0.3796*** (0.0158)						
RMSE	0.1266	0.0697	0.0448	0.0652	0.0485	0.0505	
R-sq	0.8308	0.5772	0.5519	0.8351	0.7337	0.7359	
N	15013	15013	15013	15013	15013	15013	15013

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.18: Estimated Parameters of the Univariate Probit Model for **Urban Sample**: Pooled Estimation LSMS (2003-2009)

	Bread & cereal		Meat & fish produc.		Dairy products		Vegetables & Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Log / total income	-0.050	0.135	0.142***	0.021	0.099***	0.021	0.099***	0.082	0.084***	0.031	0.045	0.057
Log /price -bread & cereal	0.005	0.515	0.259***	0.079	0.240***	0.085	-0.173	0.230	0.056	0.104	-0.010	0.174
Log /price meat & fish products	-0.316	0.520	-0.072	0.084	-0.036	0.079	0.004	0.297	0.054	0.111	0.094	0.195
Log /price-dairy products	0.142	0.389	0.012	0.048	0.190***	0.057	-0.104	0.190	-0.040	0.070	0.077	0.150
Log/price-vegetables & fruits	-0.050	0.509	0.023	0.071	0.379***	0.082	-0.054	0.256	-0.173**	0.090	-0.149	0.163
Log/price-oils & animal fats	-0.165	0.460	0.183**	0.074	0.061	0.074	-0.072	0.284	-0.019	0.112	0.195	0.199
Log/price-other food items	0.376	0.416	0.135***	0.047	0.164***	0.049	-0.112	0.190	0.044	0.070	0.032	0.141
Household Size (number)	-0.186	0.301	-0.064	0.055	0.014	0.055	1.154***	0.414	0.050	0.083	0.317*	0.188
Children 0-15 Age (number)	0.232	0.328	0.114**	0.058	0.054	0.059	-0.994**	0.429	-0.009	0.089	-0.192	0.199
Adults 16 > Age (number)	0.308	0.312	0.093**	0.054	0.004	0.054	-1.019**	0.398	0.019	0.081	-0.168	0.180
Age of HH head (number)	-0.006	0.013	0.001	0.002	-0.003	0.002	-0.017**	0.009	-0.005	0.003	-0.010*	0.006
Gender HH head: 1 if Male	-0.544	0.470	0.187***	0.068	0.023	0.070	-0.593**	0.248	0.046	0.100	0.388**	0.173
Marital St. HH head: 1 if Married	0.237	0.423	0.012	0.071	-0.004	0.073	0.630**	0.264	-0.021	0.104	-0.337*	0.188
Education HH head: 1 if Educated	0.448	0.419	0.312***	0.091	0.225**	0.091	-0.097	0.378	0.107	0.127	-0.075	0.263
Employed HH head: 1 if Employed			0.181***	0.049	0.140***	0.050			-0.016	0.074	-0.018	0.145
Agro-Emp HH head: 1 if Employed			0.004	0.117	0.175	0.117			-0.265*	0.146	-0.287	0.277
Poverty: 1 if HH is Poor ¹	-0.365	0.354	-0.992***	0.054	-0.640***	0.056	-0.767***	0.234	-0.514***	0.080	-0.512***	0.158
Migration: 1 if HH has Migrants			0.094*	0.057	0.147**	0.059	0.180	0.282	0.057	0.089	-0.051	0.169
Sughd			0.303***	0.058	-0.318***	0.054			-0.149	0.077	-0.082	0.140
Khatlon			-0.307***	0.062	-0.438***	0.062			-0.136	0.093	0.411	0.274
RRS			-0.516***	0.070	-0.389***	0.072			0.192	0.131	0.099	0.242
survey2007			-0.135**	0.057	-0.110**	0.056	-0.401	0.310	-0.436***	0.090	-0.811***	0.250
survey2003			0.281***	0.108	0.656***	0.109	-0.577	0.400	-0.240	0.152	-0.412	0.337
Constant	3.699***	1.412	-1.231***	0.332	-0.838**	0.327	3.680***	1.171	1.453***	0.455	2.188**	0.884
LR chi2	8.50		1052.38		555.10		64.43		190.96		86.54	
Prob > chi2	0.9021		0.0000		0.0000		0.0000		0.0000		0.0000	
Pseudo R2	0.1066		0.1771		0.1047		0.2173		0.0881		0.1553	
N	5344		5344		5344		5344		5344		5344	

Source: own calculation based on data from LSMS, (2003-2009)

¹ Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 U.S dollar per day), LSMS, 2009 (World Bank)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.19: Parameter Estimates of the QUAIDS Model: Pooled Estimation LSMS, 2003-2009, (Urban Sample)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
α_i	0.0810*** (0.0241)	0.1067*** (0.0213)	0.0541*** (0.0124)	0.2006*** (0.0159)	-0.0099 (0.0131)	0.0724*** (0.0126)	0.4950*** (0.0473)
β_i	-0.0217*** (0.0051)	-0.0307*** (0.0047)	-0.0112*** (0.0023)	-0.0203*** (0.0029)	-0.0045** (0.0024)	-0.0115*** (0.0026)	0.0999*** (0.0071)
γ_1	0.0952*** (0.0056)	-0.0091** (0.0038)	-0.0049** (0.0021)	-0.0213*** (0.0028)	-0.0096*** (0.0023)	-0.0199*** (0.0023)	-0.0303*** (0.0070)
γ_2	-0.0091** (0.0038)	0.0789*** (0.0049)	-0.0023 (0.0019)	-0.0106*** (0.0027)	0.0011 (0.0023)	-0.0024 (0.0021)	-0.0555*** (0.0069)
γ_3	-0.0049** (0.0021)	-0.0023 (0.0019)	0.0271*** (0.0016)	-0.0071*** (0.0016)	-0.0051*** (0.0013)	0.0019 (0.0012)	-0.0095** (0.0041)
γ_4	-0.0213*** (0.0028)	-0.0106*** (0.0027)	-0.0071*** (0.0016)	0.1141*** (0.0030)	-0.0101*** (0.0020)	-0.0051*** (0.0016)	-0.0598*** (0.0050)
γ_5	-0.0096*** (0.0023)	0.0011 (0.0023)	-0.0051*** (0.0013)	-0.0101*** (0.0020)	0.0446*** (0.0024)	-0.0082*** (0.0014)	-0.0127*** (0.0042)
γ_6	-0.0199*** (0.0023)	-0.0024 (0.0021)	0.0019 (0.0012)	-0.0051*** (0.0016)	-0.0082*** (0.0014)	0.0587*** (0.0018)	-0.0250*** (0.0038)
γ_7	-0.0303*** (0.0070)	-0.0555*** (0.0069)	-0.0095** (0.0041)	-0.0598*** (0.0050)	-0.0127*** (0.0042)	-0.0250*** (0.0038)	0.1927*** (0.0154)
λ_i	0.0029*** (0.0005)	-0.0040*** (0.0005)	-0.0006** (0.0003)	0.0017*** (0.0003)	0.0015*** (0.0003)	-0.0004*** (0.0003)	-0.0011*** (0.0008)
d_i	1.7727 (0.7306)	1.9062 (0.5412)	-3.4440 (14.5845)	8.1490 (2.8457)	2.0792*** (0.4256)	7.6494** (2.2473)	
$\eta_{\text{Household size}}$	0.0000 (0.0008)	-0.0002 (0.0005)	-0.0001 (0.0003)	-0.0003 (0.0005)	-0.0001 (0.0003)	0.0000 (0.0003)	0.0007 (0.0012)
$\eta_{\text{Household age (Head)}}$	0.0000 (0.0000)	-0.0001** (0.0000)	0.0000 (0.0000)	0.0001** (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
$\eta_{\text{Children 0-4 age}}$	-0.0002*** (0.0009)	0.0002 (0.0006)	-0.0002 (0.0003)	0.0005 (0.0005)	0.0000 (0.0004)	-0.0001*** (0.0003)	-0.0003 (0.0014)
$\eta_{\text{Children 5-15 age}}$	-0.0006 (0.0008)	0.0007 (0.0005)	0.0005 (0.0003)	0.0008 (0.0005)	0.0002 (0.0003)	0.0002 (0.0003)	-0.0018 (0.0013)
$\eta_{\text{Adults up 16> age}}$	-0.0011 (0.0008)	0.0012** (0.0005)	0.0005** (0.0003)	0.0007 (0.0005)	0.0000 (0.0003)	0.0004 (0.0003)	-0.0016 (0.0012)
$\eta_{\text{Gender (Head): Male}}$	-0.0026*** (0.0009)	-0.0012 (0.0006)	0.0005 (0.0003)	-0.0009** (0.0005)	-0.0007 (0.0003)	-0.0006 (0.0004)	0.0054*** (0.0013)
$\eta_{\text{Marital status:Married}}$	0.0025*** (0.0009)	0.0004 (0.0006)	0.0001 (0.0003)	0.0012*** (0.0005)	0.0005 (0.0004)	0.0005 (0.0004)	-0.0052*** (0.0013)
$\eta_{\text{Literacy (Head):Seconda}}$	0.0003 (0.0007)	-0.0002 (0.0005)	-0.0002 (0.0003)	0.0000 (0.0004)	-0.0005 (0.0003)	0.0004** (0.0003)	0.0003 (0.0010)
$\eta_{\text{Literacy (Head):High}}$	0.0034*** (0.0008)	-0.0023*** (0.0006)	-0.0006*** (0.0003)	-0.0001** (0.0005)	0.0001 (0.0004)	0.0002 (0.0003)	-0.0008 (0.0013)
$\eta_{\text{Employed (Head)}}$	0.0010** (0.0006)	-0.0008 (0.0005)	0.0002 (0.0003)	-0.0001 (0.0004)	0.0003 (0.0003)	0.0004 (0.0002)	-0.0011*** (0.0009)
$\eta_{\text{Agro-employed (Head)}}$	-0.0036*** (0.0016)	0.0006 (0.0010)	-0.0004 (0.0005)	-0.0007* (0.0010)	0.0005 (0.0007)	0.0010 (0.0006)	0.0027*** (0.0025)
η_{poor}	-0.0035*** (0.0007)	0.0028** (0.0011)	-0.0009** (0.0005)	0.0000 (0.0004)	0.0002 (0.0005)	-0.0007** (0.0003)	0.0020*** (0.0015)
η_{migrants}	0.0019** (0.0009)	-0.0008 (0.0005)	0.0003** (0.0003)	0.0005 (0.0005)	0.0002 (0.0004)	0.0001 (0.0003)	-0.0021 (0.0014)

Continued : Pooled Estimation 2003-2009, (Urban sample)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
η_{Sughd}	0.0013** (0.0007)	0.0008 (0.0005)	0.0008** (0.0003)	0.0015*** (0.0004)	-0.0010*** (0.0003)	0.0003 (0.0003)	-0.0037*** (0.0012)
$\eta_{Khatlon}$	-0.0028*** (0.0008)	0.0015** (0.0007)	0.0012*** (0.0004)	0.0028*** (0.0005)	0.0014*** (0.0004)	-0.0024*** (0.0003)	-0.0016 (0.0013)
η_{RRS}	-0.0024** (0.0009)	0.0055*** (0.0010)	0.0002 (0.0005)	-0.0014** (0.0006)	-0.0005 (0.0004)	-0.0011*** (0.0004)	-0.0003 (0.0016)
$\eta_{Survey\ 2003}$	0.0129*** (0.0012)	-0.0062*** (0.0008)	-0.0010** (0.0004)	0.0078*** (0.0007)	0.0063*** (0.0005)	-0.0011** (0.0004)	-0.0187*** (0.0017)
$\eta_{Survey\ 2007}$	0.0071*** (0.0008)	-0.0020*** (0.0005)	-0.0001 (0.0003)	-0.0013** (0.0005)	0.0037*** (0.0004)	0.0004 (0.0003)	-0.0077*** (0.0014)
$\eta_{Survey\ 2009}$	0.0062*** (0.0012)	-0.0016** (0.0007)	-0.0001 (0.0004)	0.0001 (0.0008)	0.0025*** (0.0005)	-0.0001 (0.0004)	-0.0070*** (0.0020)
	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}
	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}
	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}
RMSE	0.1130	0.0728	0.0429	0.0633	0.0471	0.0563	
R-sq	0.8173	0.6465	0.5679	0.8501	0.7166	0.7103	
N	5344	5344	5344	5344	5344	5344	5344

Note: Standard Errors are presented in parentheses and;
*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.20: Urban- Uncompensated /Compensated Prices and Expenditure Elasticities from Pooled Estimation, LSMS (2003-2009)

	<i>Uncompensated Price Elasticities</i>							Expenditure Elasticities
	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services	
Bread & cereal	-0.588*** (0.024)	-0.022 (0.016)	-0.016* (0.009)	-0.096*** (0.012)	-0.044*** (0.010)	-0.080*** (0.010)	0.038 (0.029)	0.808*** (0.012)
Meat & fish products	-0.088*** (0.031)	-0.387*** (0.039)	-0.028* (0.016)	-0.098*** (0.021)	0.008 (0.019)	-0.029* (0.017)	-0.407*** (0.055)	1.038*** (0.023)
Dairy products	-0.093** (0.037)	-0.047 (0.033)	-0.531*** (0.028)	-0.131*** (0.028)	-0.090*** (0.022)	0.031 (0.021)	-0.075 (0.071)	0.920*** (0.020)
Vegetables & Fruits	-0.149*** (0.019)	-0.056*** (0.018)	-0.044*** (0.011)	-0.222*** (0.020)	-0.072*** (0.014)	-0.028** (0.011)	-0.227*** (0.032)	0.797*** (0.011)
Oils & fats products	-0.127*** (0.031)	0.038 (0.031)	-0.060*** (0.017)	-0.134*** (0.026)	-0.409*** (0.032)	-0.101*** (0.018)	-0.019 (0.054)	0.801*** (0.017)
Other food items	-0.246 (0.028)	-0.030 (0.025)	0.022 (0.015)	-0.066*** (0.020)	-0.101*** (0.017)	-0.289*** (0.021)	-0.208*** (0.044)	0.917*** (0.014)
Other prod.& services	-0.081*** (0.020)	-0.179*** (0.019)	-0.033*** (0.012)	-0.170*** (0.014)	-0.034*** (0.012)	-0.081*** (0.011)	-0.710*** (0.043)	1.287*** (0.010)
	<i>Compensated Price Elasticities</i>							
Bread & cereal	-0.402*** (0.024)	0.052*** (0.016)	0.021** (0.009)	0.022* (0.012)	0.013 (0.010)	-0.014 (0.010)	0.307*** (0.029)	
Meat & fish products	0.150*** (0.031)	-0.290*** (0.039)	0.020 (0.015)	0.053** (0.021)	0.082*** (0.019)	0.056*** (0.017)	-0.061 (0.054)	
Dairy products	0.118 (0.037)	0.038 (0.033)	-0.488*** (0.028)	0.003 (0.028)	-0.024 (0.022)	0.106*** (0.021)	0.231*** (0.071)	
Vegetables & Fruits	0.034*** (0.019)	0.017 (0.018)	-0.007 (0.011)	-0.106*** (0.020)	-0.015 (0.013)	0.037*** (0.011)	0.038 (0.032)	
Oils & fats products	0.057** (0.031)	0.112*** (0.031)	-0.023 (0.017)	-0.018 (0.026)	-0.352*** (0.031)	-0.035** (0.018)	0.248*** (0.054)	
Other food items	-0.035*** (0.027)	0.055** (0.025)	0.065*** (0.0150)	0.067*** (0.019)	-0.035** (0.016)	-0.214*** (0.021)	0.098** (0.044)	
Other prod. & services	0.215*** (0.020)	-0.060*** (0.019)	0.027** (0.012)	0.017 (0.014)	0.058*** (0.012)	0.025** (0.011)	-0.282*** (0.043)	

Source: own calculation based on data from LSMS, (2003-2009)

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.21: Estimated Parameters of the Univariate Probit Model for **Rural Sample: Pooled Estimation LSMS (2003-2009)**

	Bread & cereal		Meat & fish produc.		Dairy products		Vegetables & Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Log / total income	0.032	0.150	0.153***	0.016	0.147***	0.017	0.126***	0.043	0.091***	0.025	0.270***	0.049
Log /price -bread & cereal	0.034	0.532	0.176***	0.061	0.231***	0.073	-0.312***	0.114	0.017	0.094	0.122	0.210
Log /price meat & fish products	0.479	0.403	-0.093	0.065	-0.074	0.070	0.337**	0.142	0.175**	0.088	0.303*	0.168
Log /price-dairy products	-0.103	0.423	-0.179***	0.046	-0.256***	0.054	-0.670***	0.092	-0.292***	0.066	-0.239*	0.137
Log/price-vegetables & fruits	0.989	0.853	0.099**	0.045	0.213***	0.054	-0.221	0.099	-0.010	0.068	0.250	0.185
Log/price-oils & animal fats	-0.402	0.295	0.066	0.051	0.096*	0.058	-0.148	0.109	0.074	0.085	0.034	0.166
Log/price-other food items	0.047	0.400	0.141***	0.037	0.136***	0.042	0.121	0.112	0.063	0.061	-0.069	0.120
Household Size (number)	0.376	0.502	-0.060**	0.031	0.033	0.035	-0.111	0.085	-0.090**	0.050	0.022	0.111
Children 0-15 Age (number)	-0.238	0.525	0.095***	0.034	0.031	0.038	0.227**	0.093	0.098**	0.054	0.051	0.119
Adults 16 > Age (number)	-0.157	0.471	0.113***	0.031	-0.013	0.035	0.164**	0.082	0.148***	0.050	0.063	0.108
Age of HH head (number)	-0.003	0.015	0.002	0.002	0.003*	0.002	-0.001	0.004	0.003	0.002	-0.002	0.005
Gender HH head: 1 if Male	0.040	0.394	0.000	0.058	0.110*	0.064	0.003	0.151	-0.173*	0.094	0.293	0.191
Marital St. HH head: 1 if Married			0.024	0.058	0.047	0.064	0.079	0.147	0.095	0.090	-0.489**	0.208
Education HH head: 1 if Educated			0.074	0.061	0.034	0.063	-0.340**	0.162	0.014	0.093	0.182	0.172
Employed HH head: 1 if Employed			0.092**	0.039	0.052	0.042			0.047	0.063	0.038	0.131
Agro-Emp HH head: 1 if Employed			-0.057	0.036	0.170***	0.039			0.064	0.059	0.002	0.124
Poverty: 1 if HH is Poor ¹	-0.017	0.393	-0.916***	0.040	-0.514***	0.043	-0.536***	0.108	-0.101	0.064	-0.214***	0.132
Migration: 1 if HH has Migrants			-0.059*	0.033	0.013	0.036	0.200*	0.111	-0.002	0.055	0.098	0.129
Sughd			0.688***	0.048	-1.065***	0.062			0.001	0.076	0.310**	0.147
Khatlon			0.060	0.045	-0.949***	0.062			-0.144**	0.074	0.190	0.147
RRS			-0.034	0.047	-0.941***	0.064			-0.187***	0.077	-0.025	0.145
survey2007			-0.190***	0.037	-0.070*	0.041	-4.642	157.6	-0.619***	0.067	-4.157	106.0
survey2003			0.055	0.080	0.448***	0.092	-5.408	157.6	-0.354***	0.128	-3.528	106.0
Constant	1.131	1.372	-1.104***	0.249	-0.206	0.282	6.768	157.6	0.834**	0.384	3.457	106.0
LR chi2	14.97		1670.59		924.79		444.98		261.13		175.34	
Prob > chi2			0.0000		0.0000		0.0000		0.0000		0.0000	
Pseudo R2	0.1748		0.1321		0.0928		0.2651		0.0683		0.1893	
N	9669		9669		9669		9669		9669		9669	

Source: own calculation based on data from LSMS, (2003-2009)

¹ Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 U.S dollar per day), LSMS, 2009 (World Bank)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A3.22: Parameter Estimates of the QUAIDS Model: Pooled Estimation LSMS, 2003-2009, (Rural Sample)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
α_i	0.4009*** (0.0191)	0.1239*** (0.0165)	0.1164*** (0.0108)	0.2868*** (0.0114)	0.0926*** (0.0104)	0.1169*** (0.0086)	-0.1375*** (0.0348)
β_i	0.0181*** (0.0030)	-0.0071*** (0.0020)	-0.0037*** (0.0009)	0.0051*** (0.0014)	-0.0034*** (0.0009)	-0.0035*** (0.0008)	-0.0055 (0.0036)
γ_1	0.1179*** (0.0059)	-0.0044 (0.0036)	-0.0143*** (0.0022)	-0.0354*** (0.0025)	-0.0070*** (0.0022)	-0.0177*** (0.0019)	-0.0391*** (0.0065)
γ_2	-0.0044 (0.0036)	0.0607*** (0.0045)	-0.0055*** (0.0021)	-0.0091*** (0.0022)	-0.0024 (0.0022)	-0.002 (0.0017)	-0.0364*** (0.0060)
γ_3	-0.0143*** (0.0022)	-0.0055** (0.0021)	0.0438*** (0.0020)	-0.0056*** (0.0014)	-0.0042*** (0.0015)	-0.0002 (0.0011)	-0.0140*** (0.0037)
γ_4	-0.0354*** (0.0025)	-0.0091*** (0.0022)	-0.0056*** (0.0014)	0.1134*** (0.0022)	-0.0151*** (0.0014)	-0.0077*** (0.0012)	-0.0405*** (0.0039)
γ_5	-0.0070*** (0.0022)	-0.0024 (0.0022)	-0.0042*** (0.0015)	-0.0151*** (0.0014)	0.0580*** (0.0020)	-0.0095*** (0.0011)	-0.0197*** (0.0037)
γ_6	-0.0177*** (0.0019)	-0.0028 (0.0017)	-0.0002 (0.0011)	-0.0077*** (0.0012)	-0.0095*** (0.0011)	0.0599*** (0.0013)	-0.0221*** (0.0030)
γ_7	-0.0391*** (0.0065)	-0.0364*** (0.0060)	-0.0140*** (0.0037)	-0.0405*** (0.0039)	-0.0197*** (0.0037)	-0.0221*** (0.0030)	0.1718*** (0.0128)
λ_i	0.0044*** (0.0003)	-0.0026*** (0.0002)	0.0000 (0.0001)	0.0023*** (0.0001)	0.0005*** (0.0001)	0.0006*** (0.0001)	-0.0052*** (0.0004)
d_i	1.5956*** (2.8207)	-0.9881*** (0.0107)	0.6361*** (0.1426)	5.1615*** (2.3426)	5.7374*** (1.6442)	8.7696*** (1.7025)	
$\eta_{\text{Household size}}$	-0.0019*** (0.0006)	0.0006 (0.0005)	0.0003 (0.0003)	0.0001 (0.0003)	-0.0003 (0.0002)	0.0001 (0.0002)	0.0012 (0.0008)
$\eta_{\text{Household age (Head)}}$	0.0000 (0.0000)	-0.0001** (0.0000)	-0.0001** (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)	0.0001** (0.0000)
$\eta_{\text{Children 0-4 age}}$	0.0013** (0.0007)	-0.0009** (0.0005)	-0.0003 (0.0003)	-0.0003 (0.0004)	0.0005* (0.0003)	-0.0001 (0.0002)	-0.0001 (0.0009)
$\eta_{\text{Children 5-15 age}}$	0.0006** (0.0007)	0.0002 (0.0005)	-0.0001 (0.0003)	0.0004 (0.0003)	0.0007*** (0.0003)	0.0002 (0.0002)	-0.0020** (0.0009)
$\eta_{\text{Adults up 16> age}}$	0.0009** (0.0006)	0.0001 (0.0005)	0.0001 (0.0002)	0.0002 (0.0003)	0.0006** (0.0002)	0.0003 (0.0002)	-0.0021** (0.0008)
$\eta_{\text{Gender (Head): Male}}$	0.0006 (0.0011)	0.0000 (0.0009)	0.0004 (0.0005)	0.0001 (0.0006)	0.0002 (0.0004)	-0.0003 (0.0004)	-0.0011 (0.0015)
$\eta_{\text{Marital status:Married}}$	-0.0011 (0.0011)	-0.0003 (0.0009)	-0.0004 (0.0005)	0.0002 (0.0006)	0.0003 (0.0004)	0.0010*** (0.0004)	0.0003 (0.0015)
$\eta_{\text{Literacy (Head):Seconda}}$	0.0036*** (0.0007)	-0.0002 (0.0006)	0.0007** (0.0003)	0.0007** (0.0004)	0.0001 (0.0003)	0.0001 (0.0002)	-0.0049*** (0.0010)
$\eta_{\text{Literacy (Head):High}}$	0.0073*** (0.0010)	-0.0015** (0.0008)	0.0005 (0.0004)	0.0019*** (0.0005)	0.0002 (0.0004)	0.0005 (0.0003)	-0.0088*** (0.0013)
$\eta_{\text{Employed (Head)}}$	0.0004 (0.0008)	-0.0019*** (0.0006)	-0.0001 (0.0003)	-0.0001 (0.0004)	-0.0001 (0.0003)	0.0005** (0.0003)	0.0013 (0.0010)
$\eta_{\text{Agro-employed (Head)}}$	-0.0023*** (0.0007)	0.0013** (0.0005)	-0.0003 (0.0003)	-0.0007** (0.0003)	-0.0004 (0.0003)	-0.0008*** (0.0002)	0.0032*** (0.0009)
η_{poor}	-0.0078*** (0.0010)	0.0035*** (0.0010)	-0.0009** (0.0004)	-0.0003 (0.0005)	-0.0022*** (0.0003)	-0.0002 (0.0003)	0.0079*** (0.0016)
η_{migrants}	-0.0016** (0.0006)	0.0004*** (0.0005)	0.0002 (0.0003)	0.0007** (0.0003)	0.0000 (0.0002)	-0.0006 (0.0002)	0.0009 (0.0008)

Continued : Pooled Estimation 2003-2009, (Rural Sample)

	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services
η_{Sughd}	0.0098*** (0.0010)	-0.0007 (0.0011)	0.0045*** (0.0005)	-0.0031*** (0.0008)	-0.0012*** (0.0004)	0.0022*** (0.0003)	-0.0115*** (0.0017)
$\eta_{Khatlon}$	0.0048*** (0.0009)	0.0077*** (0.0009)	0.0026*** (0.0005)	-0.0102*** (0.0008)	-0.0005 (0.0004)	-0.0011*** (0.0003)	-0.0031** (0.0015)
η_{RRS}	0.0045*** (0.0011)	0.0049*** (0.0009)	0.0029*** (0.0005)	-0.0043*** (0.0008)	0.0019*** (0.0004)	0.0022*** (0.0004)	-0.0120*** (0.0016)
$\eta_{Survey\ 2003}$	0.0205*** (0.0017)	-0.0130*** (0.0012)	-0.0035*** (0.0007)	0.0151*** (0.0008)	0.0068*** (0.0006)	0.0014** (0.0005)	-0.0273*** (0.0022)
$\eta_{Survey\ 2007}$	0.0059*** (0.0011)	-0.0039*** (0.0009)	-0.0010** (0.0005)	0.0005 (0.0007)	0.0045*** (0.0006)	0.0028*** (0.0004)	-0.0089*** (0.0016)
$\eta_{Survey\ 2009}$	0.0078*** (0.0014)	-0.0034*** (0.0011)	-0.0006 (0.0006)	0.0026*** (0.0009)	0.0038*** (0.0005)	0.0019*** (0.0005)	-0.0121*** (0.0018)
	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}
	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}
	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}	ρ_{i}
RMSE	0.1303	0.0676	0.0463	0.0669	0.0502	0.0479	
R-sq	0.8436	0.5218	0.5357	0.8233	0.7330	0.7437	
N	9669	9669	9669	9669	9669	9669	9669

Note: Standard Errors are presented in parentheses and;
 *, **, *** defined significance at 10, 5 and 1 percent, respectively

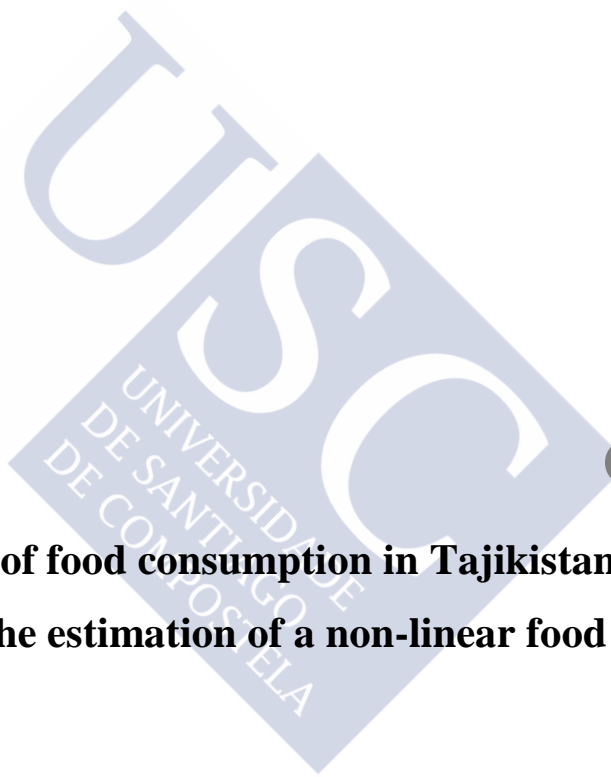
Table A3.23: **Rural-** Uncompensated /Compensated Prices and Expenditure Elasticities from Pooled Estimation, **LSMS (2003-2009)**

	<i>Uncompensated Price Elasticities</i>							Expenditure Elasticities
	Bread & cereal	Meat & fish products	Dairy products	Vegetables & Fruits	Oils & fats products	Other food items	Other prod. & services	
Bread & cereal	-0.595*** (0.020)	-0.010*** (0.012)	-0.046*** (0.007)	-0.117*** (0.009)	-0.021*** (0.008)	-0.057*** (0.006)	-0.111*** (0.022)	0.957*** (0.006)
Meat & fish products	-0.057* (0.034)	-0.431*** (0.043)	-0.058*** (0.020)	-0.094*** (0.021)	-0.030 (0.021)	-0.032*** (0.017)	-0.390*** (0.058)	1.142*** (0.013)
Dairy products	-0.240*** (0.038)	-0.093** (0.037)	-0.245*** (0.035)	-0.094*** (0.025)	-0.070*** (0.026)	-0.001 (0.020)	-0.232*** (0.064)	0.970*** (0.012)
Vegetables & Fruits	-0.236*** (0.018)	-0.055*** (0.016)	-0.036*** (0.010)	-0.175*** (0.016)	-0.102*** (0.010)	-0.049*** (0.009)	-0.252*** (0.0280)	0.903*** (0.007)
Oils & fats products	-0.075*** (0.026)	-0.025 (0.026)	-0.048*** (0.018)	-0.176*** (0.017)	-0.307*** (0.024)	-0.111*** (0.014)	-0.217*** (0.044)	0.956*** (0.007)
Other food items	-0.224*** (0.025)	-0.033 (0.023)	0.000 (0.015)	-0.097*** (0.016)	-0.122*** (0.015)	-0.212*** (0.017)	-0.273*** (0.040)	0.961*** (0.007)
Other prod.& services	-0.141*** (0.022)	-0.129*** (0.020)	-0.050*** (0.012)	-0.141*** (0.013)	-0.070*** (0.012)	-0.078*** (0.010)	-0.457*** (0.043)	1.066*** (0.008)
	<i>Compensated Price Elasticities</i>							
Bread & cereal	-0.313*** (0.020)	0.054*** (0.012)	-0.002*** (0.007)	0.014*** (0.009)	0.056*** (0.007)	0.015** (0.006)	0.176*** (0.022)	
Meat & fish products	0.281*** (0.034)	-0.355*** (0.043)	-0.005*** (0.020)	0.062*** (0.021)	0.062*** (0.021)	0.054*** (0.017)	-0.047 (0.057)	
Dairy products	0.046 (0.038)	-0.029 (0.037)	-0.201*** (0.035)	0.038 (0.025)	0.007 (0.026)	0.072*** (0.020)	0.059*** (0.064)	
Vegetables & Fruits	0.031* (0.018)	0.005 (0.016)	0.006 (0.010)	-0.152*** (0.016)	-0.030*** (0.010)	0.019** (0.009)	0.019 (0.028)	
Oils & fats products	0.208*** (0.026)	0.039 (0.026)	-0.004 (0.018)	-0.045*** (0.017)	-0.231*** (0.024)	-0.038*** (0.014)	0.070 (0.044)	
Other food items	0.060*** (0.025)	0.032 (0.023)	0.044*** (0.015)	0.034** (0.016)	-0.045*** (0.015)	-0.139*** (0.017)	0.015 (0.040)	
Other prod. & services	0.174*** (0.022)	-0.058*** (0.020)	-0.001 (0.012)	0.005 (0.013)	0.015 (0.012)	0.003 (0.010)	-0.238*** (0.043)	

Source: own calculation based on data from LSMS,(2003-2009)

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 percent, respectively



Chapter 4:

Seasonality of food consumption in Tajikistan: evidence from the estimation of a non-linear food demand system



Chapter 4:

Seasonality of food consumption in Tajikistan: evidence from the estimation of a non-linear food demand system

Abstract

This chapter analyses the seasonal food consumption pattern of Tajik households using a complete demand system based on data from the *Household Budget Survey of Tajikistan* covering five quarters in the years 2013-2014. Given the evidence about potential non-linearity of the Engel curves for Tajikistan, we use an extended form of the *Quadratic Almost Ideal Demand System* (QUAIDS) model, which includes socio-demographic information, spatial and seasonal factor effects. The main contribution of this chapter is the use of household longitudinal data and a QUAIDS model to take into account both yearly and seasonal food consumption behaviour on the part of the Tajik households. To the best of our knowledge, it is the first research paper dealing with the issue of a demand system for food taking into account seasonality for the case of Tajikistan.

Introduction

Many households in developing countries depend on their own production for their food supply. Their food consumption patterns usually show significant seasonal variations. The implications of the seasonality in food prices for households' consumption patterns involve important consequences for policies aimed to eliminate food insecurity. Thus, it is necessary to investigate how households change their expenditure on food consumption in response to seasonal changes in prices and income and/or to seasonality in agricultural production and the accumulation of food stocks.

According to Waldrop and Mogelonsky (1992) "*The seasons influence not only what consumers buy, but how they feel and think during different times of the year*". Therefore, another interesting issue is the understanding of seasonal-habit food consumption by households. Dynan, (2000) described habits as the derivation of utility by consumers not just from current expenditure, but from a "*stock*" formed by lagged expenditure as well. Most households in developing countries present a seasonal-habit on food consumption due to the lack of economic

opportunities and to the seasonal variations in food prices due to the effect of several factors like e.g. weather conditions, holiday events, or the agricultural production schedule. In general, food prices tend to rise during the off-season and fall during the harvest season (Arnade et al., 2005). Similarly, Epperson et al., (1981) observed that prices for fresh fruits and vegetables varied seasonally. This seasonal volatility in food prices and incomes also plays a significant role in the fluctuations of food consumption by altering the composition of market baskets. For example, during the winter period (*lean season*) households typically reduce their consumption of fruits, vegetables and dairy products and increase their consumption of cereal products; then reversing this behavior during summer. The seasonality in food availability, food prices, and incomes may result in transitory food insecurity. Seasonal consumption of, e.g., fruits and vegetables leads to qualitative and quantitative dietary changes that affect the completion of food dietary norms over time (Larson, 1997; Dostie et al., 2002; Camara, 2013). Corbett, (1988) has noted that shifts from preferred food items to other of lower status are typical in areas with food deficits.

Seasonal price movements in agricultural food commodities are more acute in rural areas than in urban ones (Dostie et al., 2002). As seasonal-habit formation might vary across locations (e.g. between urban and rural or between regions), therefore spatial-seasonal interactions might be an important issue for policy makers. In the case of Tajikistan, a country where the poverty rate is high, poor households in both urban and rural areas quickly respond to decreases in income, variations in food stocks, and increases in the volatility of food prices by further cutting the quantity and quality of their food consumption. In this context, managing food security policy requires not only considering how policies influence food availability and household income, but also considering how households can have sustainable access to food and cope with unfavourable shocks during the whole year.

This chapter aims to shed light on the question of seasonality in food consumption patterns in Tajikistan. We start by providing a broad overview of the seasonal behaviour in food consumption based on descriptive and statistical analysis, mapping out the intra-quarterly variation in expenditure patterns of Tajik households. Then we estimate the demand parameters in order to obtain demand elasticities. Demand elasticities that vary seasonally provide important information for agricultural food producers and marketers, as well as for policy makers. However, demographic factors can have significant impacts on food consumption arising from

variances in preferences and price levels (Abdulai, 2002). Therefore, our study also considers the marginal effects of socio-demographic characteristics of household along with seasonality effects.

We carry out the empirical estimation using an instrumental variables regression (*Limited-Information Maximum Likelihood -LIML*) to correct the problem of endogeneity in total expenditure, where the log of total food expenditure is instrumented as a function of the log of total real income, and a vector of prices and socio-demographic variables. Then, we employ the *Quadratic Almost Ideal Demand System* (QUAIDS) proposed by Banks et al., (1997) in the context of a two-stage budgeting procedure,⁵² extended to take into account seasonal consumption in the second stage of estimation (e.g. as Abdulai, 2002; Cranfield, 2012; Gil and Molina 2009).

We aggregate all commodity items into eight commodity groups, being the eight the non-food expenditure share. The QUAIDS model is used to estimate price and expenditure elasticities, taking into account not only the impact of household demographic characteristics but also the controlled seasonal variations in food consumption patterns across the four seasons of the year: *winter, spring, summer, autumn*, and the spatial variations across five regions.⁵³ The estimations use data drawn from the *Household Budget Survey of Tajikistan*.

As far as we know, there are no previous estimations of household demand systems for food in any Central Asian transition country. The particular case of Tajikistan is interesting and relevant because according to the FAO food security estimated indicators (FAOSTAT, 2014), the country remains one of the most food-insecure countries among all former Soviet Union republics.

This chapter proceeds as follows. The following section reviews the existing literature on seasonal variation of food consumption. Section 4.2 describes the microdata used to estimate the demand system. Section 4.3 provides a descriptive analysis of seasonal food consumption

⁵² The two-stage budgeting procedure assumes that the household utility maximisation decision can be decomposed into two separate stages. In the first stage, the consumer determines the allocation of total expenditure between various products groups, e.g., food and non-food products; while in the second stage, the expenditure is allocated among different food items within the groups (Abdulai, 2002).

⁵³ We also performed the Wald test on the estimated parameters of the QUAIDS model in order to, on one hand, test for significance of the homogeneity and symmetry restrictions on expenditures and of the quadratic term for all aggregated commodity groups, and on the other hand to confirm the validity of the demographic controls included in the estimation of the demand system.

behaviour across household income-class and regions based on food-grouped products. Section 4.4 discusses the empirical evidence regarding the seasonal food security circumstances in Tajikistan. Section 4.5 illustrates the estimation approach. Section 4.6 discusses the empirical results along with possible policy implications, whereas the last Section provides concluding remarks.

4.1 Literature review

The negative consequences of the seasonal variation in household consumption and income patterns due to the seasonal volatility in food prices and food production in developing countries were widely discussed in several empirical studies (Sahn, 1989; Dostie et al., 2002; Camara, 2013). Some of them show a strong negative association between price seasonality and intra-annual fluctuations in both food and non-food consumption (Kaminski et al., 2014).

Regarding the sources of seasonality, Heien, (2001) noted that seasonality is often linked with supply-related events, such as production availability, weather conditions, holiday events etc. Larson (1997) stated that seasonal cycles in food demands might rely on the natural behaviour of some of these factors. Moreover, Macdiarmid, (2014) linked seasonal food consumption at specific times of the year to the cultural events which occasionally have drastic effects.

Several studies have estimated demand systems taking seasonal variations into account (Greenstreet et al., 1997; Chiang, Lee, and Brown, 2001; Fraser and Moosa, 2002; Arnade et al., 2005; Harri et al., 2010; Silva and Dharmasena, 2013; Macdiarmid, 2014; Singh et al., 2014). Singh et al., (2014) applied a dynamic version of the *Almost Ideal Demand System* (AIDS) model using scanner data to the demand for fish products in the United States. The results of this study, which provided evidence on demand and prices elasticities, found that the highest demand elasticities for finfish was during the Lent periods (February and April). The authors claimed that seasons do not affect the responsiveness of demand to changes in own-prices.

Likewise, Arnade et al., (2005) employed an AIDS model to test various characteristics of the seasonal component of seven types of fruits demanded in the United States. The authors argued that in order to be able to identify the attributes of a season, distinct features of the seasonal cycle must be estimated to reveal any seasonal change. To test the location of the

seasonal cycle within the year, the study used the most common approach to account for seasonality, i.e. the use of deterministic quarterly or monthly dummy variables.

Fraser and Moosa, (2002) estimated demand systems for meat demand in the United Kingdom, using a sample of quarterly and seasonally unadjusted per capita time series data covering the period from January 1960 to April 1994. They applied a test for deterministic trend and seasonality against the stochastic trend and seasonality alternatives. As a result, they confirmed that in the case where seasonality is stochastic and is assumed to be deterministic, the resulting model may be mis-specified and the estimated coefficients would be inconsistent. Similarly, Cranfield, (2012) applied a QUAIDS model to estimate the demand for meat products in Canada using quarterly data from 1998 to 2010. Seasonality was accounted for by using quarterly dummy variables and allowing for different intercepts in the equations.

In contrast, Harri et al., (2010) argued that most of the previous empirical studies do not fully account for the existence of autocorrelation, which depends on the level of seasonal differencing. They showed how to obtain consistent and asymptotically efficient estimates for a demand system⁵⁴ using seasonally differenced data. Some other papers (Zheng and Kaiser, 2008; Dharmasena and Capps, 2012) used autoregressive terms in the demand system corresponding to lagged error terms. Heien and Durham (1991) suggested that the use of a lagged dependent variable as a proxy of habit formation could overstate the true effect, since the lag structure may depend itself on the season.

Silva and Dharmasena, (2013) criticized previous demand system studies for ignoring the unit root problem of price. In their own study, using non-alcoholic beverage expenditure data from the United Kingdom they applied the QUAIDS model based on the evidence of seasonal unit roots in price and expenditure variables. They stated that the absence of unit roots in one frequency does not imply the absence of unit roots in some other frequencies. At the same time, they found that the seasonal-habit QUAIDS model outperforms the static, myopic-habit and rational-habit specifications.

Johnston et al., (2011) claimed that an interest in eating more seasonal and local food items, often viewed as ethical eating, tends to be a more common aspiration within higher socio-economic classes. Consequently, seasonal volatility in prices could also lead households to switch

⁵⁴ They employed differential demand models e.g., the First-Difference Almost Ideal Demand System (FDAIDS) model.

their consumption preferences, i.e., due to the high prices, most of the households; particularly the poorest households will shift from consumption of higher-value food items to lower value ones, despite their net marketing positions.

Giving a bright example, Dostie et al., (2002) found that due to seasonal variation in food availability and prices, caloric intake declined by 5 % among poor households in Madagascar. Poor households are able to consume above the nutritional threshold only after the harvest season. A similar study has been done by Camara, (2013) using household-level panel data to estimate a complete demand system. The study investigated the impact of seasonal changes in real household incomes (proxied by real expenditures) and relative prices on households' consumption patterns in Bamako, Mali's capital city. The study found significant declines in nominal household expenditure by 35 % between the lean and post-harvest season, and by 15 % between the post-harvest and planting season.⁵⁵

4.2 Theoretical framework: specification of the seasonal QUAIDS model

The econometric framework for the estimation of demand in this chapter, like in the previous one, is the standard functional form of the QUAIDS model (Banks et al., 1997).⁵⁶ Following the approach of Holt and Goodwin, 2009; Cranfield, 2012; and Singh et al., 2014, we account for seasonality effects through intercepts.

We attempt to capture the effects of seasonality on price and expenditure elasticities by modifying the equation (9) of the previous Chapter 3, to include the interactions of demographic and seasonal dummy variables:

$$\omega_i = \alpha_i + \sum_{k=1}^k \theta_{ik} S_k + \sum_j \gamma_{ij} \ln p_j + (\beta_i + \eta'_i z_h) \ln \left[\frac{m}{\bar{m} z_h a(p)} \right] + \frac{\lambda_i}{b(p)c(p, z_h)} \left(\ln \left[\frac{m}{\bar{m} z_h a(p)} \right] \right)^2 \quad (1)$$

⁵⁵ Moreover, during the lean season, about 48 % of Bamako households are unable to meet the minimum daily calorie requirement.

⁵⁶ The effects of socio-economic variables in demand system are incorporated following Ray's approach (1983), as was described in the previous chapter.

where S_k denotes seasonal (quarterly) dummy variables to be estimated along with θ_i parameters. The additional adding-up constraint $\sum_{k=1}^k \theta_{ik} = \mathbf{0}$ is required. The budget shares are driven by seasonality when coefficients of seasonal parameters are statistically significant and are assumed to be constant (Cranfield, 2012).

As in the previous chapter, the problem of zero consumption was observed in the microdata set used, and once again we use the two-step approach of Shonkwiler and Yen, (1999)⁵⁷ to deal with it (see the previous chapter for details). In the first step we estimate a univariate probit with μ_{ih} new errors introduced in the Equation (1):

$$\omega_i = \Phi(z'_{ih}\theta_i) \left\{ \alpha_i + \sum_{k=1}^k \theta_{ik} S_k + \sum_j \gamma_{ij} \ln p_j + (\beta_i + \eta'_i z_h) \ln \left[\frac{m}{\bar{m} z_h a(p)} \right] + \frac{\lambda_i}{b(p)c(p, z_h)} \left(\ln \left[\frac{m}{\bar{m} z_h a(p)} \right] \right)^2 \right\} + \delta_i \phi(z'_{ih}\theta_i) + \mu_{ih} \quad (2)$$

where δ_i are estimated parameters of the two-step approach in the demand model which explain the covariance between the error term in the budget share equation (Aepli, 2014).

We complete the analysis of the demand for food by calculating the expenditure elasticities and uncompensated/compensated price elasticities as follows:

$$\mu_{ik} = \frac{\partial \omega_i}{\partial \ln m} = \left\{ 1 + \frac{1}{w_i} \left[\beta_i + \eta'_i z + \left(\frac{2\lambda_i}{b(p)c(p, z_h)} \right) \left[\ln \left(\frac{m}{\bar{m} z_h a(p)} \right) \right] \right] \right\} \Phi(z'_{ih}\theta_i) \quad (3)$$

and

⁵⁷ The proportion of the zero consumption observation are presented in Table 4.3.

$$\begin{aligned} \epsilon_{ijk} = \frac{\partial \omega_i}{\partial \ln p_i} = & \left\{ -\delta_{ij} \right. \\ & + \frac{1}{w_i} \left[\gamma_{ij} - \left[\beta_i + \eta'_i z + \theta_{ik} S_k + \left(\frac{2\lambda_i}{b(p)c(p, z_h)} \right) \left[\ln \left(\frac{m}{\bar{m} z_h a(p)} \right) \right] \right] \right. \\ & \left. \left. \times \left(\alpha_j + \sum_l \gamma_{jl} \ln p_l \right) - \left(\frac{(\beta_i + \eta'_i z) \lambda_i}{b(p)c(p, z_h)} \right) \left[\ln \left(\frac{m}{\bar{m} z_h a(p)} \right) \right]^2 \right] \right\} \Phi(z'_{ih} \theta_i) \end{aligned} \quad (4)$$

where δ_{ij} is the the *Kronecker delta*, which is equal to one for own-price elasticities ($i = j$) and zero for cross-price elasticities ($i \neq j$), while the subscript $k=0$.

4.3 Data description

In our study, we use data from the *Household Budget Survey in Tajikistan* (HBS), which is a continuous survey on household expenditures, money incomes, labour and agricultural activity, including data on socio-demographic characteristics of households. The survey is annually conducted by the *Agency of Statistic under the President of the Republic of Tajikistan* (Taj STAT). The starting point of surveys on household expenditures in Tajikistan was in 1952, during the Soviet Union, which maintained a 1,250-household sample size until 1992 (Taj STAT). In the period 1992-2009, the number of surveyed households was reduced to 600 due to the difficult political, economic, and financial situation of the country. However, since 2009 it has increased again to 3,000 households.

Taj STAT conducts HBS quarterly across the five regions of Tajikistan, with a coverage of 38.3% of households in urban areas and 66.7% of households in rural areas. By regularly changing the surveyed households (sampled at random), information is obtained continuously throughout the year. The spatial sample distribution of surveyed households is presented in Table 4.1 below.

Table 4.1: The sample distribution of surveyed households of Tajikistan

Regions	Population (thous. of people) 2014*	Urban		Rural		Total	
		number	in %	number	in %	number	in %
Dushanbe	776	400	34.8	-	-	400	13.3
Sughd	2.401	330	28.7	530	28.6	860	28.7
Khatlon	2.898	240	20.9	660	35.7	900	30.0
RRS	1.874	120	10.4	480	25.9	600	20.0
GBAO	212	60	5.2	180	9.70	240	8.0
Total country	8.161	1.150	38.3	1.850	66.7	3.000	100

Source: own calculation based on HBS (2013-2014)
*from Taj STAT (2014)

The HBS is focused on three types of household questionnaires: a diary for household income and expenditures, supported by a monthly journal; a quarterly questionnaire on household supply, consumption of agricultural products, fodder and fuel; and an annual household questionnaire. In addition, the following information is collected within HBS: household composition and demographic characteristics; economic activity in both agricultural and non-agricultural sectors; housing and infrastructure; household supply and consumption of agricultural products, fodder and fuel, livestock, and land plot use. However, some important indicators by characteristics including gender, age, and other demographics are not reported, which should be required in future surveys.

Households' expenditure includes data for food and non-food items. Data on food expenditures are collected for 73 food items, providing a very detailed image of consumption patterns. Particularly, the survey collects food expenditure from food at home including purchased food, gift-received food, and self-supplied food, as well as from the food away from home.

For the purpose of this study, we aggregate the food items into *eight* major food groups, as follows: *bread and cereal; meat and fish; dairy products; vegetables; fruits; oil and animal fats; rest of food items; and other products and services*. Into the "rest of food items" category we grouped food commodities such as soft drinks, fruit juice, sugar and confectionery, condiments

etc.⁵⁸ The non-food group includes all non-food goods and services. We include a non-food group in estimation with the aim to examine the effects of expenditure on non-food items from a general point of view.

Using detailed microdata for the estimation of the demand system allows us to analyse the consumption patterns at the individual households' level. Moreover, it gives us a clear representation of the responses of different household groups, classified according to their socio-demographic characteristics, such as income level, households' size, employment status, education, and spatial location etc., to any consumption shocks. We only found data available for Q3 and Q4 of 2013, as well as for Q1, Q2 and Q4 of 2014, which at least give us an overview of the whole period of four seasons, i.e. winter, spring, summer and autumn. Some descriptive statistics are provided in Table 4.4.

Our data provide information on the expenditures and the purchased quantities for both food and non-food items, but market prices are not reported. Thus, we compute unit values as proxys (see the discussion about unit values in the previous chapter). Afterward, we calculate price indices for the aggregated commodity groups using the geometric mean with expenditure shares as weights (e.g., as in Abdulai, 2002). Moreover, we employ Cox and Wohlgemant (1986) approach, and regress the mean-deviated unit values on household characteristics to exclude the quality effects from unit values and obtain quality-adjusted prices. Finally, we calculate average prices estimating regression residuals then adding them up to regional price means, whereby controlling the variation within location, quarters, years and household characteristics as a whole. The regions considered are the five administrative regions of Tajikistan, each of which is divided into rural and urban segments. We present the statistical summary of obtained unit values in the Table 4.2 below.

⁵⁸ There are still a very limited number of empirical or theoretical studies regarding commodity grouping for the analysis of household budget data (Blundell et al., 1993), therefore, it is usually an ad hoc decision on the part of researchers (Abdulai, 2002). The main purpose behind our choice of food-grouping categories is to avoid the problem of zero-value observations, as well as to reduce the number of parameters to be estimated, which make the estimation of the demand system simpler and smoother. The aggregated picture of food commodities is given in [Appendix 4.1](#).

Table 4.2: Descriptive statistics of unit values for food-grouped items (2013-2014)

	Mean	Std. Dev.	Min	Max
Bread & cereal products	4.92	0.83	3.87	7.00
Meat & fish products	26.99	5.90	13.76	36.00
Dairy products	43.23	24.83	5.00	81.00
Vegetables	3.45	0.80	2.28	5.29
Fruits	6.17	2.49	2.38	13.00
Oils & animal fats	9.94	2.36	6.23	15.35
Rest of food items	9.44	4.45	3.91	20.00

Source: own calculation based on HBS, Taj STAT (Q3-Q4, 2013; Q1,Q2-Q4,2014)

Our data does not provide the physical quantities consumed by households for all individual non-food products. As a result, we are not able to quantify unit values for these non-food grouped products. Consequently, we used the weights of the CPI as a proxy for the price of non-food product and services, where the monthly CPI was obtained from IMF and Taj STAT.

Moreover, due to the social-economic preferences and seasonal access of households to food, the probability of existing considerable zero observations in data is inevitable. Some food-grouped products performed a significant zero consumption. Table 4.3 presents the proportions of observed zero observation in the consumption of food-grouped items.

Table 4.3: The proportion of zero consumption in food groups items (2013-2014)

	Q3-2013	Q4-2013	Q1-2014	Q2-2014	Q4-2014
Bread and cereals	0.23	0.30	0.40	0.20	0.83
Meat and fish products	4.50	4.00	4.03	5.00	4.16
Dairy products	25.9	26.5	24.2	25.3	17.6
Vegetables	3.93	6.46	4.53	1.26	6.00
Fruits	13.2	35.8	23.8	54.0	26.0
Oils and animal fats	3.13	2.86	3.26	2.30	2.23
Other foods items	0.20	0.16	0.46	0.43	0.50

Source: own calculated based on HBS, Taj STAT, (Q3-Q4, 2013; Q1-Q2-Q4,2014)

Table 4.4: Summary statistics, definition and description of variables estimated in QUAIDS

Variables	Description	Mean	Std. Dev.
Log tot_income	Total household income	7.471	0.647
Log tot_exp	Total household expenditure	7.141	0.588
Log tot_food	Household food expenditure	6.526	0.498
Log tot_non_food	Household non-food expenditure	5.418	1.173
<i>Expenditure shares of food-grouped products</i>			
W _{bread and cereals}	Budget share of bread and cereals	0.193	0.104
W _{meat and fish}	Budget share of meat and fish	0.092	0.055
W _{dairy products}	Budget share of dairy products	0.025	0.025
W _{vegetables}	Budget share of vegetables	0.074	0.052
W _{fruits}	Budget share of fruits	0.024	0.029
W _{oils and animal's fats}	Budget share of oils and animal's fats	0.057	0.032
W _{other food items}	Budget share of other food items	0.071	0.042
W _{other products & service}	Budget share of other products & service	0.463	0.174
<i>Prices of food-grouped products</i>			
Log P _{bread and cereals}	Price of bread and cereals	1.586	0.185
Log P _{meat and fish}	Price of meat and fish	3.263	0.269
Log P _{dairy products}	Price of dairy products	0.911	0.447
Log P _{vegetables}	Price of vegetables	1.212	0.262
Log P _{fruits}	Price of fruits	1.717	0.499
Log P _{oils and animal's fats}	Price of oils and animal's fats	2.285	0.267
Log P _{other food items}	Price of other food items	2.141	0.515
Log P _{other products & service}	Price of other products & service	4.904	0.028
<i>Household demographics variables</i>			
h_size	Household size (in number)	7.416	3.669
h_nempl	Number of employers in HH	1.424	0.925
h_nreter	Number of retirees in HH	0.462	0.742
h_nschoolar	Number of scholarship- holders in HH	0.012	0.155
h_nchild_sm16	Number of children from 0-16 years old in HH	1.990	1.548
h_noth_mem	Number of adults from 16-65 years old in HH	3.978	2.328
<i>Spatial dummy variables</i>			
dum_rural	Takes value 1 if rural, 0 otherwise	0.616	0.486
dum_Dushanbe	Takes value 1 if Dushanbe, 0 otherwise	0.080	0.271
dum_Sughd	Takes value 1 if Sughd, 0 otherwise	0.286	0.452
dum_Khatlon	Takes value 1 if Khatlon, 0 otherwise	0.300	0.458
dum_RRS	Takes value 1 if RRS, 0 otherwise	0.200	0.400
dum_GBAO	Takes value 1 if GBAO, 0 otherwise	0.080	0.271
<i>Seasonal dummy variables</i>			
dum_Winter	Takes value 1 if winter, 0 otherwise	0.200	0.400
dum_Spring	Takes value 1 if spring, 0 otherwise	0.200	0.400
dum_Summer	Takes value 1 if summer, 0 otherwise	0.200	0.400
dum_Autumn	Takes value 1 if autumn, 0 otherwise	0.200	0.400

Source: own calculation based on data HBS, Taj STAT, (2013-2014)

4.4 Descriptive statistics on households' seasonal consumption and income patterns

If we look at the profile of food consumption in Tajikistan, it is characterized by a poor diet with severe risk of chronic food insecurity, especially in rural areas. Ensuring food security has been an ongoing concern of the Tajik government during the last two decades (Taj STAT, 2014). One of the most disturbing problems is that most of the poor households reduce their food consumption and nutritional intake dramatically over the periods, where food insecurity is higher (FSMS, 2014). In this Section, we give detailed information about the image of seasonality food security in Tajikistan based on empirical studies and present descriptive statistics for the seasonal consumption behaviour of Tajik households based on quarterly data from the HBS for 2013-2014.

We calculate the budget share on a particular food grouped category as the ratio of total household expenditure. As we mentioned it in the previous section, we aggregate food commodities in 8 categories comprising products that are close substitutes. The quarterly variations in the share of each of these food categories reflect seasonality variation in food expenditure. We compute averaged levels of food expenditure per capita disaggregating households by six income-classes (sextiles). When the values of food expenditure are deflated using the price index correspondents to each stratum (*Paasche Spatial Price Index*)⁵⁹ we will refer to them as “*real food consumption*”.

In addition to seasonal variability in expenditure, seasonal income fluctuations can be observed as well. For rural households, increases in household income emanating from their plots usually start just after the first harvest, i.e. at the end of springtime. A second, more general determinant of income variability is linked to the seasonal migration of Tajik households abroad (mainly to Russia) which usually start from the beginning of March-April until the end of November. Many Tajik households have a seasonal money income coming from migration that is regarded as the second main income source for the majority of the Tajik households⁶⁰.

Food expenditure per capita patterns display seasonal variations across location and income groups as a whole. The rich households in the rural areas are considered to be “*the richest*”

⁵⁹ Spatial price index was taken from Taj STAT, source available at: http://www.stat.tj/en/img/69ba753fe72c1df9b0019eb3c75e42c1_1436004916.pdf

⁶⁰ According to some estimations, about 31% of Tajik households have remittances from migration as their only source of monetary income (*ILO, 2010*).

of the rich” in Tajikistan, and they correspondingly spend a small portion of their income on food. In general, however, urban households have a higher income. We observe that all household groups in Tajikistan reduce their spending on food during the winter period independently of their income levels. Therefore, the differences in food consumption patterns across season periods are remarkable when households reduce their food consumption along with a decline in their income during the lean season from January until May. Table 4.5 presents seasonal values of food expenditure to income ratios for each income and location group.

Table 4.5: Seasonal share of real food expenditure to income ratio across location and income-class (2013-2014)

Location	Sextiles	2013				2014					
		Q3-Summer		Q4-Autumn		Q1-Winter		Q2-Spring		Q4-Autumn	
		1	2	1	2	1	2	1	2	1	2
Urban	Poorest	226.7	57.1	204.4	55.3	221.6	50.8	221.1	55.4	258.6	57.1
	2	251.9	52.3	255.2	49.6	246.9	45.7	227.2	48.8	294.3	53.0
	3	316.7	47.6	323.2	48.8	328.3	42.4	307.5	46.9	317.0	49.0
	4	370.1	46.8	367.4	45.4	385.8	38.5	376.5	43.5	380.2	43.8
	5	466.2	40.0	476.3	39.9	476.8	35.8	497.3	37.8	492.2	40.3
	Richest	961.3	28.6	868.8	30.2	745.5	28.2	790.8	28.7	769.3	31.5
Rural	Poorest	146.0	64.5	146.9	64.7	143.7	57.4	144.1	61.2	155.9	60.5
	2	198.4	54.5	204.6	55.1	191.3	51.5	188.4	55.4	193.9	56.9
	3	244.6	47.8	243.6	49.2	238.5	46.2	236.9	49.2	239.7	52.0
	4	283.8	41.1	280.2	43.6	286.2	39.5	304.6	43.5	299.6	47.4
	5	400.1	34.5	384.7	35.9	385.3	31.8	380.4	36.6	416.8	38.8
	Richest	993.9	20.4	1002.8	21.2	995.3	18.3	959.5	19.4	924.7	25.9
Total:	Average	399.2	44.5	397.1	44.9	361.6	41.8	370.8	44.8	433.4	44.4

Source: own calculation based on HBS, Taj STAT, (Q3-Q4, 2013; Q1-Q2-Q4, 2014)

1- Average net-income per capita indicated in national currency somoni (TJS)

2- Real food consumption to income ratio (as %) and deflated to the strata price index (Paasche Spatial Price Index)

The composition of food expenditure exhibits seasonal variations as well. Households substitute among food products according to the seasons. In wintertime, households consume more bread and cereal products, meat products, oil and animal fats, sweets and confectionery products and less vegetables and fruits products. It is common that rural households build their stocks for the wintertime in harvest period since food stocks are crucial at this time of the year. The price mechanism then relates the food consumption behaviour of urban households to the

food stocks of rural households. Table 4.6 reports seasonal values of the budget shares of food grouped items.

Table 4.6: Seasonal household consumption per-capita and the budget share of food grouped products in total expenditure (2013-2014)

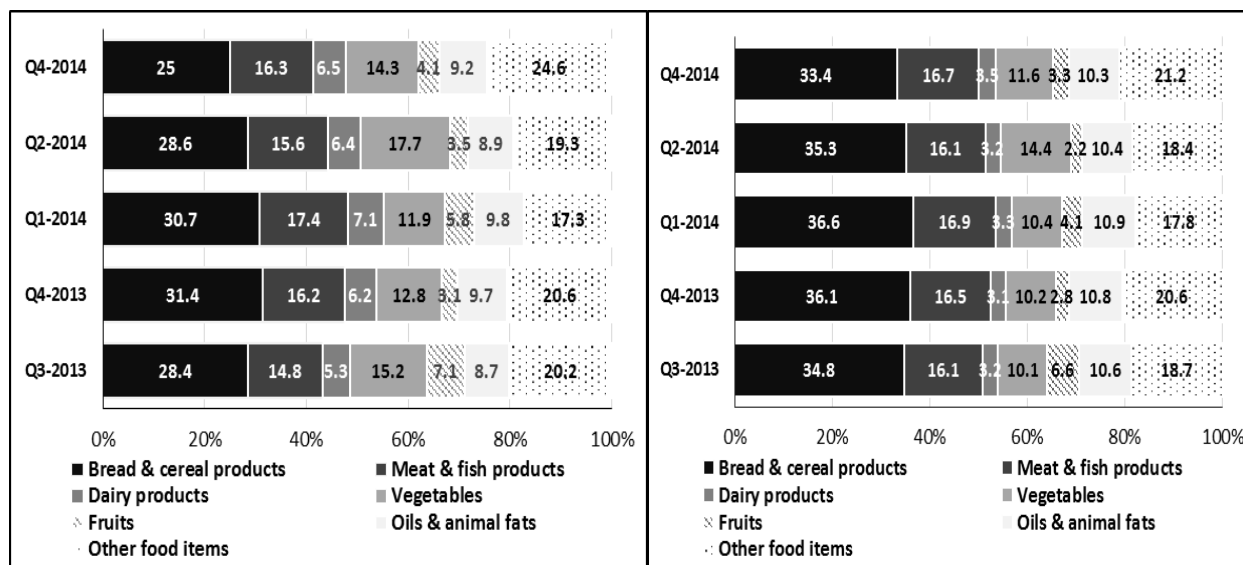
Location	Food -grouped products	2013		2014		
		Q3-Summer	Q4-Autumn	Q1-Winter	Q2-Spring	Q4-Autumn
Urban	Total consumption per-capita*	319.3	320.9	274.6	300.5	344.6
	Food- consumption per-capita*	159.0	159.5	141.5	155.7	176.5
	Bread & cereal products (w1)	16.6	17.5	17.1	16.3	14.3
	Meat & fish products (w2)	8.3	8.9	9.6	8.7	8.9
	Dairy products (w3)	3.1	3.4	3.9	3.6	3.6
	Vegetables (w4)	8.9	7.2	6.7	10.1	8.0
	Fruits (w5)	4.2	1.7	3.2	2.2	2.4
	Oils & animal fats (w6)	4.9	5.4	5.4	5.0	5.1
	Rest of food items (w7)	6.3	5.9	5.7	5.5	6.0
	Other products & services(8)	47.7	50.0	48.4	48.6	51.7
Rural	Total consumption per-capita*	254.8	255.4	204.6	221.5	286.2
	Food- consumption per-capita*	114.9	121.1	102.9	112.3	140.3
	Bread & cereal products (w1)	20.4	21.3	22.5	21.8	19.8
	Meat & fish products (w2)	8.9	9.2	9.8	9.5	9.6
	Dairy products (w3)	1.8	1.8	2.0	1.9	2.0
	Vegetables (w4)	6.0	6.1	6.3	9.0	7.0
	Fruits (w5)	3.7	1.6	2.3	1.5	2.1
	Oils & animal fats (w6)	5.9	6.1	6.5	6.1	5.8
	Rest food items (w7)	7.8	8.0	8.2	7.8	7.6
	Other products & services(8)	45.5	45.9	42.4	42.4	48.1

Source: own calculation based on HBS, Taj STAT (Q3-Q4, 2013; Q1-Q2-Q4,2014)

*Average total and food consumption per capita are deflated to the strata price index (Paasche Spatial Price Index) and indicated in national currency, somoni (TJS)

Figure 4.1 illustrates the budget share of food grouped items to the total food expenditure ratio over the season's time.

Figure 4.1: Share of food grouped products into total food expenditure across location (2013-2014)



Source: own calculation based on HBS, Taj STAT, (Q3-Q4, 2013; Q1-Q2-Q4, 2014)

Note: left-side figure indicates urban data and right-side figure indicates rural data.

Food prices often follow a seasonal behaviour since agricultural production is seasonal and storage is costly in Tajikistan. It should be noted that there is a high correlation between expensive storage cost and seasonal food prices in Tajikistan from harvest period to off-season time. The World Food Program (2008) on the basis of a survey they conducted (EFSA), has found seasonal variations on the availability of potatoes, fruits and vegetables in Tajikistan, which were irregularly available or in fewer amounts than sufficient to meet the demand in the lean season, while their availability was not a concern in summertime.⁶¹

Usually, the price of domestic food items, mainly fruits and vegetables is hugely reduced during harvest time and skyrockets during off-seasons. The groups of food products more sensible to seasonal effects are the ones comprising vegetables and fruits. These are also the only kind of food products for which Tajikistan’s production is self-sufficient, producing 132% and 103% of the national consumption levels⁶².

Table 4.7 below shows the degree of seasonality on the quantity consumed and the computed unite values (prices) for food-grouped products.

⁶¹ Food stocks are a crucial determinant of household food access and dietary food diversity during the lean season period. A clearer picture of the seasonal market price movements for some domestic and imported food items is given in [Appendix 4.2](#).

⁶² Source: data was calculated for 2012 by author based on FAOSTAT, 2014.

Table 4.7: Composition of the food diet in Tajikistan and computed unit values for food -grouped products across location by seasons, (2013-2014)

<i>Food -grouped products</i>	Urban									
	Quantity Consumed per capita (average in kg)					Average computed unit values (prices)				
	2013		2014			2013		2014		
	<i>Q3</i>	<i>Q4</i>	<i>Q1</i>	<i>Q2</i>	<i>Q4</i>	<i>Q3</i>	<i>Q4</i>	<i>Q1</i>	<i>Q2</i>	<i>Q4</i>
Bread & cereal products	60.5	64.1	61.3	59.4	53.4	5.1	5.1	5.1	5.2	5.6
Meat & fish products	5.3	5.8	5.9	5.4	6.1	26.4	26.4	26.0	27.3	29.5
Dairy products	6.5	6.3	7.4	7.5	7.6	28.6	32.4	27.9	27.6	29.5
Vegetables	76.9	65.4	47.1	62.1	62.6	3.2	3.2	3.6	4.5	3.8
Fruits	36.1	11.7	14.3	16.7	21.5	5.0	6.7	7.0	6.8	7.2
Oils & animal fats	8.0	8.4	7.7	8.1	9.1	10.3	10.9	11.2	10.6	10.9
Other food items	18.1	16.5	15.4	16.3	16.2	9.6	10.2	9.7	9.3	11.1
	Rural									
Bread & cereal products	75.4	80.7	76.3	74.9	76.3	4.6	4.7	4.7	4.7	5.1
Meat & fish products	5.0	5.4	4.9	4.9	5.9	26.7	26.6	26.4	27.2	28.7
Dairy products	2.6	2.3	2.0	1.9	2.5	49.2	52.1	51.7	52.5	54.5
Vegetables	51.2	51.8	36.1	43.6	50.4	2.9	2.9	3.2	4.2	3.5
Fruits	33.3	12.5	9.7	17.9	17.0	4.2	6.3	6.4	6.2	6.7
Oils & animal fats	10.8	10.5	8.8	9.3	11.1	9.2	9.4	9.6	9.3	9.7
Other food items	23.2	23.0	21.1	21.3	22.3	8.8	9.5	8.9	8.6	10.1

Source: own calculation based on HBS, Taj STAT (Q3-Q4, 2013; Q1-Q2-Q4,2014)

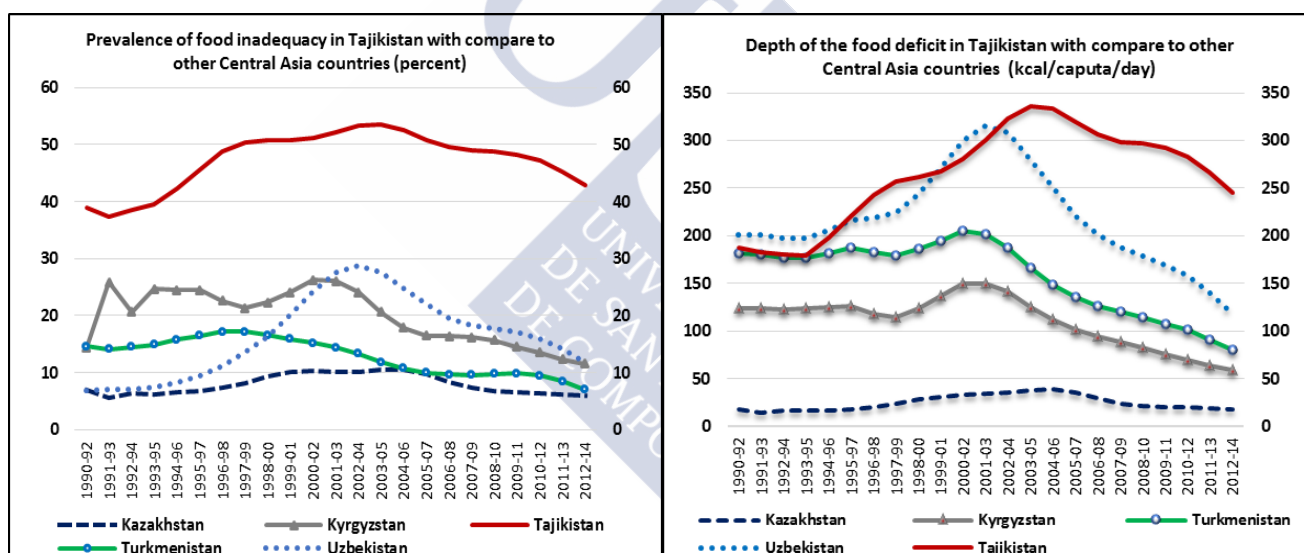
Some significant contrasts are observed between poor and rich households with respect to food diet in general. Both the behavior and the consumption structure of poor households differ from rich households even across locations. We present some information about the average composition of the food diet across income-class and location in [Appendix 4.3](#).

Research on food security usually proceeds by describing the standard norm of food consumption and the situation of a country in terms of its ability to adequately ensure that the population has sufficient, safe and nutritious food at the national or regional level. Food security is a multi-dimensional phenomenon that has been studied from several perspectives and its concept has been defined in different but similar ways (FAO, 2003; Hospes et al, 2010). In The State of Food Insecurity 2001, FAO (2003) provided the most comprehensive and conventional definition for food security that is relevant to developing countries. It is described as " *a situation that exists when all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*". However, food security in the Law of the Republic of Tajikistan is defined as " *food security as a situation in the economy when the state ensures the physical accessibility of*

sufficient food through domestic production to guarantee the active and healthy life and demographic growth” (Asadov, 2013).

The technical and policy issues on the achievement of food security policy depend on these three important components: food availability and stability of supply, economic, and social accessibility to food and food intake and utilization (FAO, 2003). According to these three dimensions, Tajikistan is a highly food insecure country with the highest prevalence of undernourishment among the CAC. While agricultural food production steadily increased following two decades of agrarian reform, yields have not been improved and food availability per capita increased slowly⁶³. In Figure 4.2, we compare the food security indexes of Tajikistan and other CAC.

Figure 4.2: Food security indicators of Tajikistan and other Central Asia countries, (1990-2014)



Source: own elaboration based on FAOSTAT, 2014

The World Food Program (WFP) has conducted seasonal surveys about critical food insecurity and malnutrition in Tajikistan. The surveys are elaborated every quarter within the

⁶³ Accordingly, Tajikistan with the cooperation of European Union in 2005 adopted the implementation of “European Commission Matrix on Policy Reform of Memorandum of Understanding on Food Security Program in the Republic of Tajikistan.” Further, the Minister of Health of Tajikistan issued order № 598 from 24/10/2011, and set up an Intersectoral Working Group for the development of the “Nutrition and Food Safety Strategy for Republic of Tajikistan with an action plan for the period of 2013-2020.”

frame of *Food Security Monitoring System (FSMS)* across households of rural areas and poor zones.⁶⁴

The important key variable for measuring and evaluating the food security and country food situation is food consumption, in terms of kcal/per capita/day. These standards of nutrition estimation have been developed by FAO and WHO for assessment of the nutrition rate and low level of food consumption. According to these standards, the average food consumption consists of 2,700 kcal/per capita/day and those who are consuming less than 2,150 kcal/per capita/day are on the verge of hunger and malnutrition. Those people who are consuming 1,500 kcal/per capita/day or less are classified as starving (WHO, FAO, and IAEA, 1996; FAO Nutrition Report, 2001). Deviations from this standard depend on the climate, the nature of work, sex, age, dietary habits etc. Following this standard approach, Tajikistan's average food availability was 13% below of the recommended minimum nutrition rate in 2000. Table 4.8 indicates that the nutritional values and food consumed per capita in Tajikistan did not change significantly in the following decade.

Table 4.8: Nutritional values and origin of food consumed (per capita) in Tajikistan (2000- 2012)

	2000	2006	2009	2012
Total Calories (kcal/per capita/day)	1918	2219	2246	2164
Protein/grams:	45.1	50.4	51.4	50.58
-of animal origin/grams	6.5	7.1	7.7	8.8
<i>Deviation from recommended norm/100 grams</i>	54.9%	49.6%	48.6%	49.4%
Fat/grams:	39.8	51.0	54.8	55.0
-of animal origin/grams	7.4	9.2	9.6	11.18
<i>Deviation from recommended norm/100 grams</i>	60.2%	49%	45.2%	45%
Carbohydrate/grams	335.7	381.4	382.5	362.72
<i>Deviation from recommended norm/400 grams</i>	16.1%	4.7%	4.4%	9.3%

Source: Asadov, (2013)

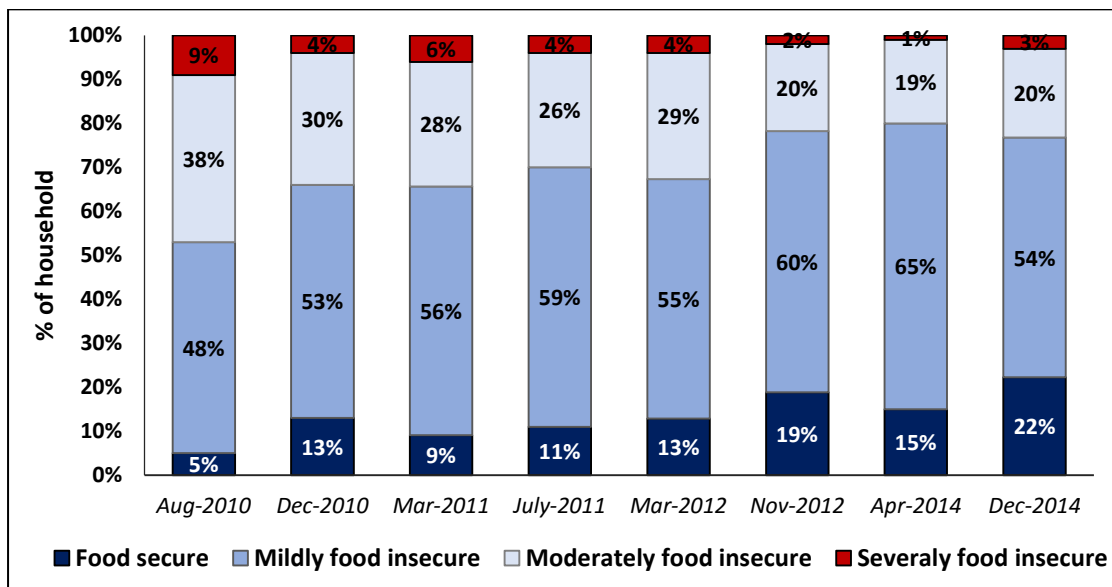
In general, the rural households are more food insecure, which will likely make them live poorer than the households in urban areas.⁶⁵ The most significant signs of vulnerability are observed, according to the FSMS surveys, in mountains rural places with high poverty rates, in

⁶⁴ A number of food security indicators of Tajikistan are presented in [Appendix 4.4](#)

⁶⁵ The food security condition in urban and rural areas of Tajikistan is showed in [Appendix 4.5](#).

particular at the beginning of the winter and spring season. Overall food security trends throughout the lean season in Tajikistan are presented in Figure 4.3.

Figure 4.3: Overall food security trends throughout the lean season in Tajikistan, (08/2011-12/2014)



Source: own elaboration based on FSMS (2014-2015)

4.5 Estimation approach

We divide our estimation process in two steps: i) we estimate each quarterly data separately in STATA; ii) we extend the model following Banks et al., (1997), based on a pooled cross-sectional estimation with the aim of capturing the effects and the importance of the seasonality variations in food consumption.⁶⁶ In both stages, we create a dummy variable for each region intended to capture any regional variances. These regional dummy variables were included along with all the demographic variables.

In order to incorporate seasonality factors in our seasonal -QUAIDS model we use binary seasonal dummy variables to account for seasonal effects on the consumption behaviour of households through the impact on the budget share of aggregated products. This approach of

⁶⁶ We estimate a QUAIDS model applying a modified version of *Nonlinear Seemingly Unrelated Regression* (NLSUR) and *Feasible Generalized Least Squares* (FGLS), using the STATA software package. For the quarterly separated estimations, we use the code developed by Poi (2008, 2012) which is not contains the problem of zero consumption in estimation. The two-step approach of censoring zero consumption was only adjusted for pooled-cross sectional estimation in all samples.

employing seasonality dummies into demand equations was commonly applied in several empirical studies with different economic techniques (e.g. Fraser and Moosa, 2002; Holt and Goodwin, 2009; Cranfield, 2012; Silva and Dharmasena, 2013; Singh et al., 2014).⁶⁷

Our data consists of an unbalanced panel comprising five quarters over two years. Therefore, the time trend intercept was not taken into account in the estimation; nor did we run any seasonality tests. The non-linear system was estimated using an iterative procedure (Browning and Meghir, 1991), because of the quadratic total expenditure term and the two expressions in log prices. To estimate the parameters of equation (1), the 'Stone price index' has been used along with imposed homogeneity and symmetry restrictions using *Nonlinear Seemingly Unrelated Regression* (NSUR). Afterward, the system was re-estimated via the new price index that was obtained by using the estimated parameters and equation (2). Consequently, the steps were repeated until the estimated values of the parameters converged (Abdulai, 2002). The number of demographic characteristic of households included in the estimation was limited to those available in the HBS.

4.6 Empirical results

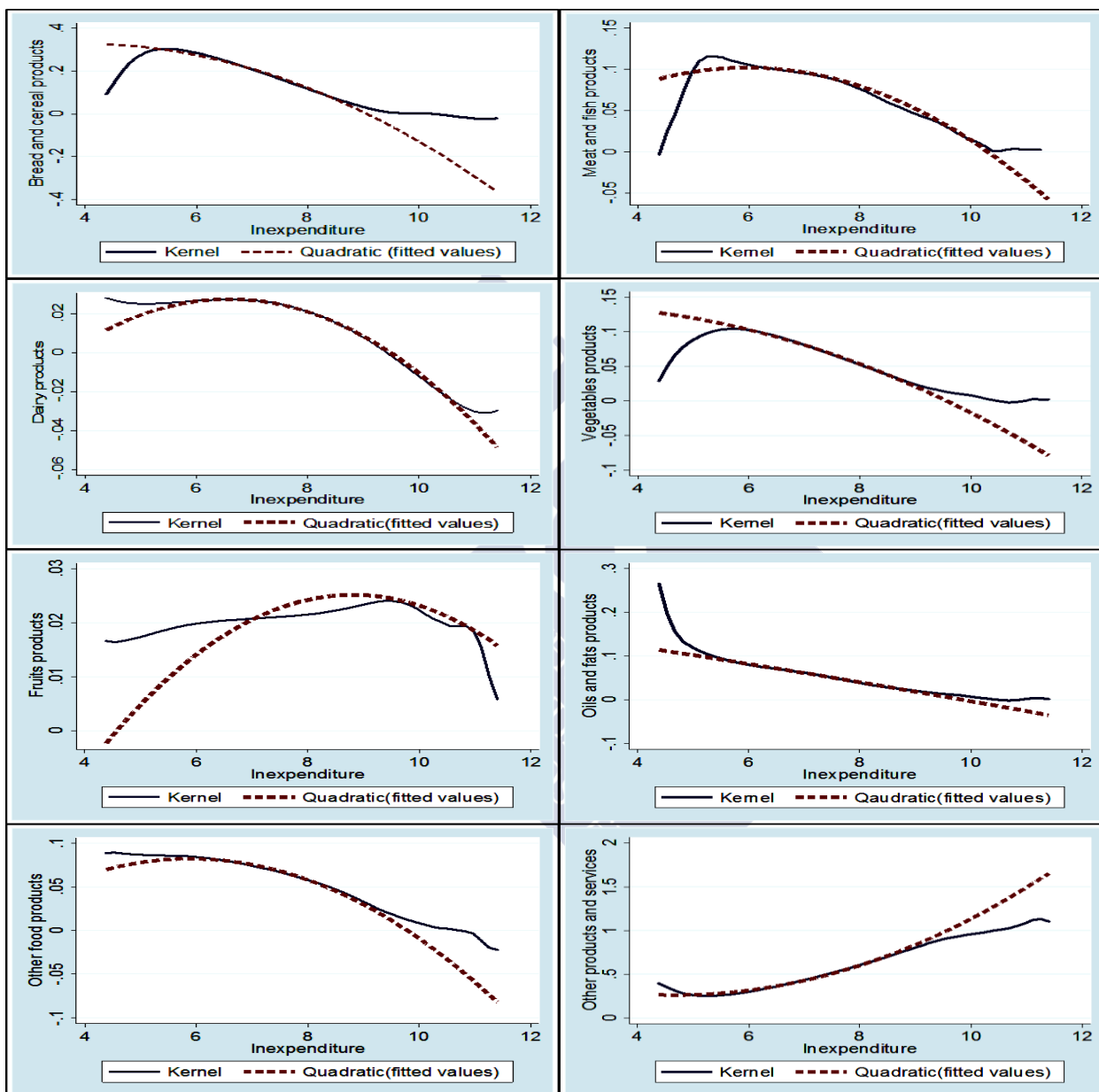
The description of the relationship between the budget shares of aggregated products and the logarithm of total expenditure can be based on the estimates of the Engel curves, and measured by Kernel and polynomial regressions. Figure 4.4 displays the Engel curves, where the budget share of each of the eight aggregated-products is plotted against the logarithm of total expenditure.

The patterns of the Engel curves give a clear picture of the fact that an increase in the income of households is related to a monotonic decline in the share of expenditure on bread and cereals products, where there is a positive relationship between the increase in income and the expenditure share of meat and fish products, dairy products and vegetables. The similar positive

⁶⁷ However, Wildt (1977) claimed that it is better to employ consecutive dummy variables only as intercept shifters because important interactions may be omitted and thus the specification of slope and intercept shifters might lead to multicollinearity issues. Osborn, (1988) in turn argued that employing dummy variables can only capture incompletely seasonal patterns. As a result, he stated that a desirable demand specification would include separate elements to control habit formation and seasonality.

trend is evident as well in the category of oils and animal products. Overall, food seems to be a luxury for low-income Tajik households and a necessity for high-income households.

Figure 4.4: Engel curves for groups of food product (2013-2014)



Source: own elaboration based on HBS, Taj STAT (2013-2014)

The differences in the outcomes from the separate estimations partially confirm the seasonal habit behaviour on the consumption pattern of Tajik households, since the estimated parameters and demand elasticities vary across season's time. For instance, expenditure

parameters β_i are obtained with lower coefficients in summer time and high coefficients results in wintertime. The same picture can be observed with the rest of the estimated parameters as well.

The non-economic effects of the estimation of our demand system are also controlled through the demographic variables. The results of the estimations show several positive and negative significant effects. Thus, the rural dummy variable shows positive effects on bread and cereals products, particularly in summer time. The estimated parameters of household size suggest that the larger Tajik households are, the higher their consumption of non-food products. Similarly, the households with children below 16 years of age appear as consuming more bread & cereals products, meat and fish products, and fruits, especially during the lean season. These results suggest that the households with working persons and children below 16 years of age often try to have a better food diet with more energy and protein-rich products. Generally, most of the positive effects of the demographic characteristics of households on the expenditure of all food items are discovered during lean season from December until May.

The estimated coefficients are used to compute price and expenditure elasticities. The expenditure elasticities were computed segmenting households by income class in order to ascertain the extent to which demand responses to changes in income are different for different income groups. The quarterly and spatially disaggregated expenditure elasticities along income class from quarterly separated estimations are reported in Tables 4.9 to 4.10.

As Table 4.9 and 4.10 show, there is a notable contrast between the richest and poorest households across location. Poor households present systematically higher expenditure elasticities than richer ones, meaning that for them a wider range of food products belongs to the category of luxuries. A more specific example is the high seasonality of the expenditure parameter that is observed in the case of fruit products, which shows a unitary high elastic with coefficient of 1.590 for rural areas, and 1.217 for urban ones during the lean season, but lower value in summertime.⁶⁸

⁶⁸ Full results of the separate quarterly estimations are reported in the [Appendix to this chapter \(Tables A4.9 to A4.18\)](#).

Table 4.9: Urban-quarterly expenditure elasticities across income groups (2013-2014)

	Quarterly					Income class		
	Q3-2013	Q4-2013	Q1-2014	Q2-2014	Q4-2014	Low-income	Middle-income	High-income
Bread and cereals	0.442 (0.019)	0.500 (0.019)	0.583 (0.021)	0.581 (0.021)	0.458 (0.020)	0.560 (0.009)	0.493 (0.011)	0.350 (0.013)
Meat and fish	0.811 (0.025)	0.713 (0.022)	0.856 (0.024)	0.925 (0.028)	0.843 (0.025)	0.834 (0.016)	0.829 (0.012)	0.785 (0.010)
Dairy products	0.649 (0.031)	0.736 (0.025)	0.757 (0.029)	0.778 (0.030)	0.768 (0.026)	0.725 (0.015)	0.695 (0.014)	0.609 (0.014)
Vegetables	0.482 (0.022)	0.594 (0.024)	0.655 (0.024)	0.592 (0.021)	0.670 (0.024)	0.605 (0.012)	0.598 (0.011)	0.513 (0.012)
Fruits	0.838 (0.034)	0.993 (0.046)	0.977 (0.033)	1.217 (0.064)	1.017 (0.042)	1.076 (0.033)	1.021 (0.023)	0.959 (0.017)
Oils and animals fats	0.666 (0.024)	0.590 (0.023)	0.643 (0.025)	0.645 (0.025)	0.597 (0.022)	0.569 (0.013)	0.560 (0.014)	0.571 (0.152)
Other foods items	0.640 (0.025)	0.494 (0.023)	0.599 (0.027)	0.813 (0.029)	0.584 (0.022)	0.592 (0.015)	0.645 (0.012)	0.599 (0.011)
Other products and service	1.442 (0.013)	1.045 (0.012)	1.331 (0.013)	1.303 (0.014)	1.329 (0.010)	1.497 (0.008)	1.389 (0.006)	1.298 (0.004)

Source: own calculation based on HBS, Taj STAT (Q3-Q4, 2013; Q1-Q2-Q4,2014)

Table 4.10: Rural-quarterly expenditure elasticities across income groups (2013-2014)

	Quarterly					Income class		
	Q3-2013	Q4-2013	Q1-2014	Q2-2014	Q4-2014	Low-income	Middle-income	High-income
Bread and cereals	0.482 (0.014)	0.538 (0.015)	0.628 (0.014)	0.593 (0.013)	0.567 (0.015)	0.607 (0.007)	0.527 (0.009)	0.439 (0.010)
Meat and fish	0.732 (0.021)	0.704 (0.022)	0.827 (0.021)	0.815 (0.021)	0.846 (0.023)	0.813 (0.016)	0.805 (0.012)	0.702 (0.009)
Dairy products	0.842 (0.048)	0.619 (0.051)	0.851 (0.049)	0.864 (0.048)	0.733 (0.047)	0.783 (0.028)	0.771 (0.028)	0.689 (0.026)
Vegetables	0.601 (0.029)	0.509 (0.029)	0.635 (0.023)	0.591 (0.020)	0.647 (0.029)	0.603 (0.015)	0.594 (0.014)	0.515 (0.014)
Fruits	0.872 (0.037)	1.068 (0.054)	1.042 (0.041)	1.590 (0.084)	1.068 (0.049)	1.248 (0.048)	1.159 (0.030)	1.080 (0.021)
Oils and animals fats	0.603 (0.019)	0.581 (0.021)	0.642 (0.018)	0.605 (0.017)	0.615 (0.020)	0.559 (0.012)	0.513 (0.013)	0.516 (0.014)
Other foods items	0.604 (0.018)	0.552 (0.016)	0.577 (0.016)	0.698 (0.017)	0.632 (0.017)	0.636 (0.010)	0.624 (0.009)	0.540 (0.008)
Other products and service	1.473 (0.012)	1.485 (0.012)	1.429 (0.012)	1.435 (0.013)	1.386 (0.011)	1.597 (0.009)	1.487 (0.007)	1.367 (0.005)

Source: own calculation based on HBS, Taj STAT, (Q3-Q4, 2013; Q1-Q2-Q4,2014)

In addition, Table 4.10 shows that poor households in rural areas have higher expenditure elasticities on bread & cereals and other food items unlike the rich households and the poor households in urban areas, though these food-grouped products are considered the main food diet in the consumption patterns of most Tajik households.

We also ran a pooled estimation covering household microdata from 5 quarters of the two years 2013 and 2014 across five regions of Tajikistan. As a result, in total, 15,000 observations were used in the pooled analysis. The results support the existence of seasonality in the consumption of vegetables and fruits, as well as showing an increase in the consumption of bread and cereal products during the lean season and a decrease in the consumption of meat & fish and dairy products in wintertime.⁶⁹ Table 4.11 illustrates the expenditure elasticities from pooled estimation at country as well as urban and rural level.

Table 4.11: Expenditure elasticities of seasonal QUAIDS model from pooled estimation (2013-2014)

	Average (Country)		Urban		Rural	
	<i>Coef.</i>	<i>Std.Err.</i>	<i>Coef.</i>	<i>Std.Err.</i>	<i>Coef.</i>	<i>Std.Err.</i>
Bread and cereals	0.860***	0.429	0.552***	0.016	0.561***	0.011
Meat and fish	0.791***	0.022	0.681***	0.241	0.521***	0.028
Dairy products	1.333***	0.409	0.583***	0.145	0.687***	0.027
Vegetables	0.786***	0.812	0.585***	0.095	0.537***	0.016
Fruits	0.938***	0.103	0.711***	0.360	0.848***	0.028
Oils and animals fats	0.909***	0.388	0.638***	0.026	0.609***	0.014
Other foods items	1.070***	0.369	0.552***	0.190	0.538***	0.018
Other products and service	1.491***	0.215	1.425***	0.120	1.559***	0.016

Source: own calculated based on HBS, Taj STAT, (Q3-Q4, 2013; Q1-Q2-Q4,2014)
 *, **, *** defined significance at 10, 5 and 1 %, respectively

Moreover, the comparison of coefficients between urban and rural areas shows that the expenditure elasticity for all products is slightly higher in rural areas than in urban ones. For rural households, the expenditure elasticities of the fruit products are elastic during all seasons except summertime, whereas for the urban households it is elastic only in the lean season. In general terms, these differences in expenditure elasticities by type of location seem to correspond to the

⁶⁹ Full results of the pooled estimation are reported in the [Appendix](#) to this chapter (Tables A4.21, 4.23 and 4.23).

main source (local production or imports) of the food products that are consumed by the households.⁷⁰

Table 4.12: Uncompensated and compensated own-price elasticities over seasons (2013-2014)

(Quarterly separate estimation (QUAIDS model) - censoring not adjusted)

	Q3-2013 Summer	Q4-2013 Autumn	Q1-2014 Winter	Q2-2014 Spring	Q4-2014 Autumn
Uncompensated					
Bread and cereals	-1.830	-1.970	-1.992	-1.837	-2.074
Meat and fish products	-0.567	-0.483	-0.515	-0.497	-0.438
Dairy products	-0.450	-0.381	-0.454	-0.368	-0.520
Vegetables	-0.652	-0.621	-0.561	-0.353	-0.683
Fruits	-0.764	-0.089	-0.058	-0.964	-0.087
Oils and animal fats	-0.782	-0.783	-0.963	-0.804	-0.963
Other foods items	-0.358	-0.302	-0.352	-0.433	-0.347
Other products and service (non-food)	-1.316	-1.305	-1.193	-1.166	-1.262
Compensated					
Bread and cereals	-1.741	-1.866	-1.866	-1.721	-1.980
Meat and fish products	-0.501	-0.419	-0.433	-0.418	-0.359
Dairy products	-0.433	-0.365	-0.432	-0.347	-0.511
Vegetables	-0.613	-0.585	-0.519	-0.297	-0.635
Fruits	-0.730	-0.072	-0.085	-0.941	-0.065
Oils and animal fats	-0.748	-0.749	-0.923	-0.769	-0.929
Other foods items	<i>-0.314</i>	-0.263	-0.310	-0.382	-0.304
Other products and service (non-food)	<i>-0.639</i>	-0.615	-0.571	-0.546	-0.601

Source: own calculated based on HBS, Taj STAT, (Q3-Q4, 2013; Q1-Q2-Q4,2014)

⁷⁰ The estimated price elasticities are reported in the Appendix to this chapter (Tables A4.24 to A4.31).

Table 4.13: **Urban-** Uncompensated and compensated own-price elasticities over seasons (2013-2014)*(Pooled estimation (seasonal QUAIDS model) - censoring adjusted)*

	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
Uncompensated								
S1	-1.433***	-0.450***	-0.348***	-0.812***	-0.449***	-0.922***	-0.317***	-1.251***
S2	-1.433***	-0.446***	-0.347***	-0.823***	-0.453***	-0.921***	-0.321***	-1.264***
S3	-1.437***	-0.449***	-0.347***	-0.811***	-0.452***	-0.922***	-0.319***	-1.258***
S4	-1.434***	-0.448***	-0.348***	-0.817***	-0.455***	-0.921***	-0.320***	-1.267***
Compensated								
S1	-1.342***	-0.390***	-0.328***	-0.764***	-0.430***	-0.889***	-0.284***	-0.548***
S2	-1.342***	-0.386***	-0.326***	-0.775***	-0.433***	-0.888***	-0.288***	-0.561***
S3	-1.346***	-0.388***	-0.326***	-0.763***	-0.433***	-0.889***	-0.287***	-0.556***
S4	-1.343***	-0.388***	-0.327***	-0.769***	-0.436***	-0.889***	-0.287***	-0.564***

Note: Standard errors are presented in parentheses and; *, **, *** defined significance at 10, 5 and 1 %, respectively

S1-Summer period
S2-Winter period
S3-Spring period
S4-Autumn period

Table 4.14: **Rural-** Uncompensated and compensated own-price elasticities over seasons (2013-2014)*(Pooled estimation (seasonal QUAIDS model) - censoring adjusted)*

	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
Uncompensated								
S1	-2.271***	-0.447***	-0.436***	-0.306***	-0.418***	-0.751***	-0.295***	-1.343***
S2	-2.276***	-0.446***	-0.436***	-0.307***	-0.421***	-0.750***	-0.297***	-1.362***
S3	-2.278***	-0.447***	-0.436***	-0.300***	-0.421***	-0.751***	-0.295***	-1.359***
S4	-2.271***	-0.447***	-0.436***	-0.304***	-0.422***	-0.750***	-0.296***	-1.358***
Compensated								
S1	-2.153***	-0.398***	-0.423***	-0.269***	-0.400***	-0.714***	-0.253***	-0.649***
S2	-2.158***	-0.396***	-0.423***	-0.270***	-0.402***	-0.713***	-0.254***	-0.667***
S3	-2.159***	-0.398***	-0.423***	-0.263***	-0.403***	-0.714***	-0.253***	-0.664***
S4	-2.152***	-0.398***	-0.423***	-0.267***	-0.403***	-0.713***	-0.254***	-0.664***

Note: Standard errors are presented in parentheses and; *, **, *** defined significance at 10, 5 and 1 %, respectively

S1-Summer period
S2-Winter period
S3-Spring period
S4-Autumn period

4.7 Conclusions

The aim of this chapter was to provide a clear picture of the presence of seasonality in food consumption patterns in Tajikistan. To this end, we estimated a seasonal QUAIDS demand system for food products, aggregated into eight main groups, using quarterly data obtained from the HBS during the years 2013 and 2014. The results of our estimations were widely consistent with well-behaved preferences.

We illustrated how the seasonal estimated coefficients can be used in assessing the impact of any seasonal variation on the quantities demanded of aggregated product groups. The most striking result is that when facing the seasonal variations in the price of food items or any other exogenous seasonal shocks, Tajik households directly attempt to decrease dramatically their calorie consumption by shifting to cheaper and lower calorie intake diets.

The possibility of using variables describing demographic and socio-economic characteristics of the households allows us to suggest how the seasonal variations in household expenditure are distributed within the population. Thus, our results indicate that seasonal effects are less sharp in households living in rural areas and households including children

The empirical outcomes of this study are an important step forward in describing and understanding regular and seasonal consumption of Tajik household across the five regions and at the country level as a whole. But, clearly, further research is needed. The use of a larger dataset based on HBS panel data could be useful to identify changes in seasonal behavior, highly likely in an environment subject to drastic shocks, as is the case of the Tajik economy. In addition, to research the possibility of seasonal-habit formation using time series methods not very dissimilar to the ones we applied in Chapter 2 above. Nevertheless, and despite its shortcomings, we believe the values of the price and expenditure elasticities we obtained have the potential to be key quantitative instruments in helping policy makers to simulate and devise the policies targeted at highly vulnerable and poor households in Tajikistan.

Appendix to Chapter 4

Table A4.1: Composition of the food product groups

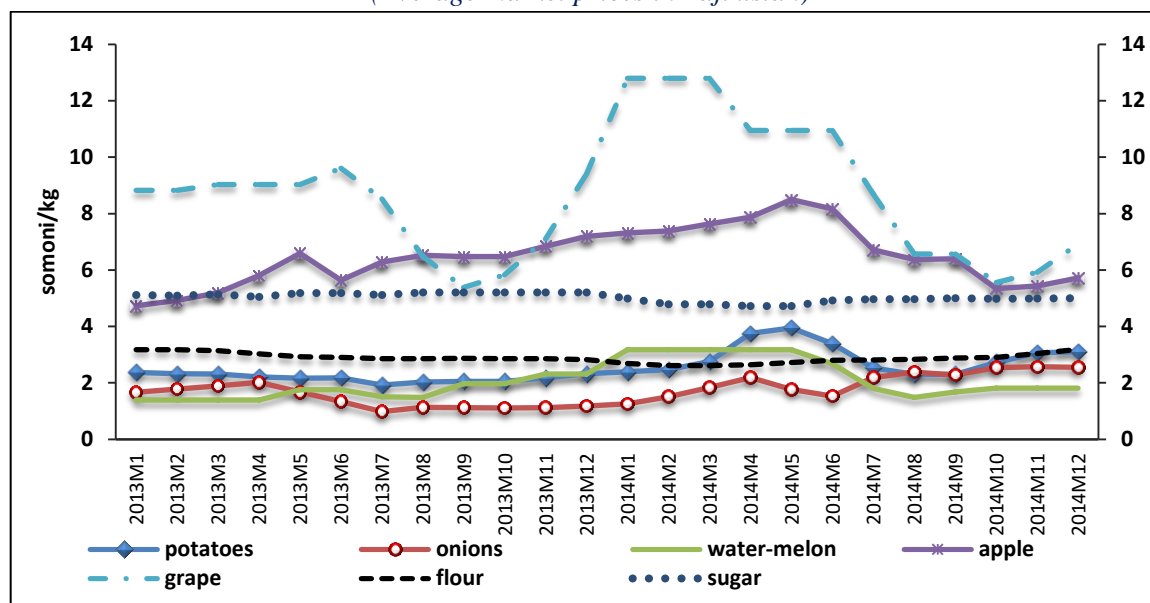
AGGREGATED GROUPS	FOOD PRODUCTS	UNIT
<i>W1-Bread and Cereals products</i>		KG
	Bread	
	Flour	
	Cereals	
	Rice	
	Macaroni products	
	Other grains and dried beans, pulses (beans, peas, lentils, etc.)	
<i>W2-Meat and Fish products</i>		KG
	Beef	
	Chicken	
	Lamb	
	Sausages	
	Canned meat	
	Other preserved or processed meat and meat preparations	
	Fish fresh	
	Fish canned	
	Fish salted	
<i>W3-Dairy products</i>		KG
	Fresh milk	
	Cheese and all other cheese type	
	Powdered and skim milk	
	Yoghurt	
	Eggs	
	Other dairy products	
<i>W4-Vegetables</i>		KG
	Onion	
	Potato	
	Tomato	
	Cabbage, garlic, carrots, and others	
	Cauliflower and others	
	Cucumber	
	Pumpkin and others	
	Mushrooms (fresh, salted, dried, etc.)	
	Preserved vegetables	
	Other vegetables	

AGGREGATED GROUPS	FOOD PRODUCTS	UNIT
W5-Fruits		KG
	Apple and other horticultural fruits	
	Orange and other citrus fruits	
	Grape	
	Watermelon, melon	
	Other fresh fruit	
	Dried fruits	
	Preserved fruit and fruit based products	
	Other fruits	
W6- Oils and animal fats		KG
	Butter	
	Vegetable oil	
	Ghee	
	Animal fat and others fats	
	Soft drinks (coke, and other drinks)	
W7-Other food items		KG
	Coffee	
	Tea	
	Salt	
	Sugar	
	Sweets, and other eastern sweets	
	Jam and honey	
	Ice cream	
	Chocolate	
	Pastries products	
	Other food items	

Source: elaborated based on HBS, Taj STAT, (2013-2014)

Figure A4.2: Monthly price movements of food items between (01/2013 -12/2014)

(Average market prices in Tajikistan)



Source: own elaboration based on Taj STAT, 2015

 Table A4.3: Seasonal-average quantity consumed of the food-grouped items across income-class and location (2013-2014) *Average in (kg)*

Income Quintiles	Food-grouped products	2013				2014					
		Q3-Summer		Q4-Autumn		Q1-Winter		Q2-Spring		Q4-Autumn	
		urban	rural	urban	rural	urban	rural	urban	rural	urban	rural
Poorest	Bread & cereal products	52.3	64.3	55.0	67.4	50.9	65.4	49.0	63.6	47.1	58.2
	Meat & fish products	3.2	3.0	3.2	3.2	3.6	3.2	3.2	3.1	3.4	3.1
	Dairy products	5.0	2.4	4.4	1.7	5.2	1.8	4.8	1.4	5.4	1.8
	Vegetables	53.1	39.6	41.0	36.1	32.6	28.1	43.1	32.5	38.4	30.1
	Fruits	18.2	16.9	3.7	2.7	5.2	3.8	6.4	4.9	5.6	3.2
	Oils & animal fats	6.0	7.4	6.2	7.0	5.7	6.9	5.7	7.0	6.2	7.1
	Other food items	13.2	18.7	12.5	18.5	11.9	17.6	11.4	17.4	12.1	17.2
Middle	Bread & cereal products	62.3	76.4	64.2	80.3	62.3	80.7	61.6	80.7	54.3	74.1
	Meat & fish products	5.0	5.2	5.8	5.1	5.7	5.4	5.2	5.5	5.3	5.2
	Dairy products	6.4	2.7	6.6	2.3	7.2	2.1	7.8	2.5	6.8	2.3
	Vegetables	83.6	50.4	65.0	51.8	49.0	40.5	62.6	47.8	53.4	47.2
	Fruits	37.6	28.3	9.6	11.2	11.8	10.1	14.7	9.6	13.3	11.6
	Oils & animal fats	8.7	10.1	8.3	9.8	7.4	9.1	7.9	9.7	8.6	10.2
	Other food items	18.8	24.8	17.8	24.8	15.5	22.7	17.0	22.8	15.4	22.2
Richest	Bread & cereal products	68.4	84.9	74.0	93.9	72.4	86.9	66.8	83.8	56.6	88.8
	Meat & fish products	8.2	6.7	8.7	7.8	8.9	7.0	7.9	6.6	8.4	7.9
	Dairy products	8.4	2.7	7.8	2.8	10.3	2.4	9.7	2.1	9.9	3.0
	Vegetables	98.0	63.1	92.7	67.2	61.9	42.7	80.5	53.6	86.6	64.8
	Fruits	56.0	53.5	23.4	23.4	28.2	17.3	29.5	42.7	39.1	29.2
	Oils & animal fats	13.1	14.7	11.1	14.5	10.6	11.3	10.8	11.8	11.4	14.1
	Other food items	23.0	26.0	19.5	25.9	19.3	24.5	20.3	24.8	19.6	25.3

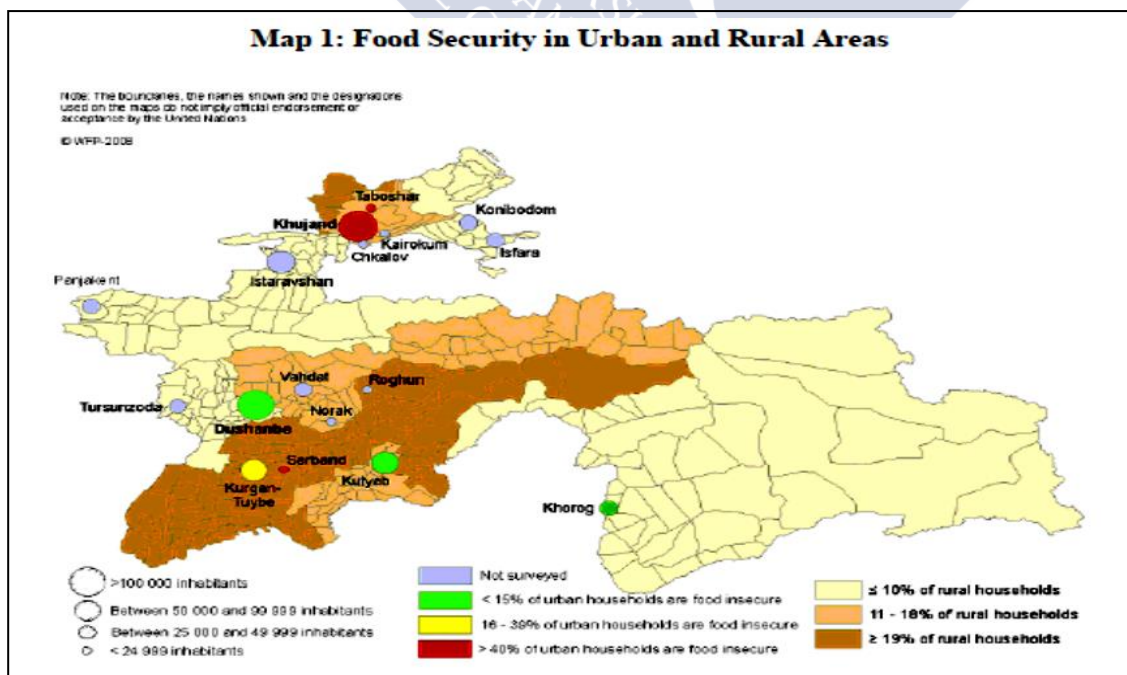
Source: own calculation based on HBS (Q3-Q4, 2013; Q1-Q2-Q4, 2014)

Table A4.4: Tajikistan’s food security indicators (1990-2014)

Years	Value of food production per capita (int\$/ per capita)	Average dietary energy supply adequacy (%)	Prevalence of food inadequacy (%)	Coefficient of variation of habitual caloric consumption distribution
1990-1992	137	97	39.0	0.23
1995-1997	97	91	45.7	0.24
2000-2002	99	90	51.2	0.24
2001-2003	104	89	52.2	0.24
2002-2004	112	89	53.3	0.25
2003-2005	116	90	53.5	0.27
2004-2006	119	91	52.5	0.28
2005-2007	118	92	50.7	0.30
2006-2008	121	92	49.5	0.32
2007-2009	124	92	48.9	0.31
2008-2010	125	93	48.7	0.30
2009-2011	128	93	48.2	0.30
2010-2012	135	94	47.6	0.30
2011-2013	139	95	46.6	0.30
2012-2014	143	95	45.7	0.30
2013-2015	-	96	44.7	0.30
2014-2016	-	97	43.8	0.30

Source: FAOSTAT, 2014

Map A4.5: Food security in urban and rural areas of Tajikistan



Source: adopted from WFP, 2008-2012

Table A4.6: Test for Expenditure Endogeneity Using Instrumental Variables Regression

Log (M)	Q3-2013	Q4-2013	Q1-2014	Q2-2014	Q4-2014	Pooled 2013-2014
Log food expenditure	-0.331** (0.147)	0.034 (0.167)	0.148 (0.278)	0.478*** (0.014)	-0.009 (0.236)	0.266*** (0.067)
Log total income	0.812*** (0.049)	0.691*** (0.063)	0.605*** (0.101)	0.533*** (0.011)	0.712*** (0.101)	0.603*** (0.025)
Log price bread & cereals	-0.022 (0.050)	0.045 (0.045)	0.008 (0.065)	0.107*** (0.031)	0.013 (0.039)	0.080*** (0.015)
Log price meat and fish	0.029 (0.035)	0.036 (0.034)	-0.007 (0.040)	-0.054*** (0.019)	0.002 (0.039)	-0.022* (0.131)
Log price dairy products	0.014 (0.021)	0.012 (0.017)	0.011 (0.017)	0.018 (0.015)	0.027* (0.014)	0.012* (0.007)
Log price vegetables	-0.004 (0.044)	0.011 (0.033)	-0.009 (0.036)	-0.041 (0.025)	0.118** (0.039)	-0.023** (0.011)
Log price fruits	0.086*** (0.024)	0.073*** (0.020)	0.090** (0.048)	0.022** (0.011)	0.053*** (0.020)	0.021*** (0.006)
Log price oils & animal fats	0.058** (0.029)	0.198*** (0.030)	0.154*** (0.033)	-0.010 (0.022)	0.084*** (0.027)	0.068*** (0.010)
Log price other food items	0.223*** (0.033)	0.124*** (0.038)	0.075 (0.053)	0.018 (0.012)	0.077* (0.046)	0.065*** (0.015)
Household size(number)	-0.090 (0.055)	-0.079* (0.044)	-0.098*** (0.046)	-0.062** (0.038)	-0.081 (0.051)	0.002 (0.003)
Employers (number)	0.181*** (0.058)	0.130*** (0.049)	0.147*** (0.056)	0.072** (0.038)	0.123** (0.055)	0.033*** (0.004)
Retirees (number)	0.048*** (0.015)	0.029** (0.012)	0.014 (0.015)	-0.015** (0.007)	0.020 (0.013)	0.002 (0.004)
Scholarship holders (number)	0.222** (0.08)	0.113** (0.057)	0.235*** (0.090)	0.074 (0.049)	0.167** (0.070)	0.044*** (0.016)
Children 0-16 age (number)	0.087 (0.054)	0.072* (0.043)	0.093** (0.042)	0.073* (0.039)	0.072 (0.049)	0.003 (0.003)
Adults 16-65 age (number)	0.133** (0.058)	0.101** (0.050)	0.111* (0.059)	0.051 (0.038)	0.103* (0.058)	0.001 (0.004)
Rural	-0.255*** (0.036)	-0.149*** (0.030)	-0.117*** (0.041)	-0.081*** (0.014)	-0.106*** (0.035)	-0.110*** (0.013)
Dushanbe	-0.006 (0.028)	-0.060** (0.024)	-0.015 (0.028)		0.165*** (0.062)	0.019 (0.014)
Sughd	-0.225*** (0.030)	-0.169*** (0.039)	-0.245*** (0.092)	-0.105*** (0.021)		-0.126*** (0.022)
Khatlon		-0.022 (0.019)	-0.050 (0.034)	0.011 (0.020)	0.172** (0.067)	0.018 (0.013)
RRS	0.109*** (0.029)		-0.006 (0.028)	0.008 (0.022)	0.148*** (0.056)	0.034** (0.013)
GBAO	0.186*** (0.047)	0.045 (0.029)		0.086*** (0.027)	0.211*** (0.070)	0.091*** (0.015)
Constant	2.325*** (0.459)	0.696* (0.421)	0.967 (0.732)	0.102 (0.126)	1.063** (0.511)	1.760*** (0.516)
Wald chi2	4917.13	7797.84	7155.85	9292.29	5877.30	40364.08
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.575	0.725	0.718	0.755	0.661	0.746
N	3000	3000	3000	3000	3000	15000

Note: Standard Errors are presented in parentheses and; *, **, *** defined significance at 10, 5 and 1 %, respectively

Table A4.7: Wald tests on the expenditure terms⁷¹

	Bread & cereals	Meat & fish	Dairy products	Vegetables	Fruits	Oils & animals fats	Other foods items
Expenditure term $H_0: \beta_{ij} - \beta_{ji} = 0$							
Meat & fish products	58.28 (0.000)						
Dairy products	124.03 (0.000)	142.58 (0.000)					
Vegetables products	101.27 (0.000)	113.58 (0.000)	56.83 (0.000)				
Fruits	68.60 (0.000)	70.72 (0.000)	156.43 (0.000)	137.26 (0.000)			
Oils & animals fats	68.48 (0.000)	49.40 (0.000)	169.48 (0.000)	164.79 (0.000)	36.27 (0.000)		
Other foods items	109.81 (0.000)	119.91 (0.000)	170.99 (0.000)	138.91 (0.000)	137.75 (0.000)	162.53 (0.000)	
Other products & service	128.18 (0.000)	87.95 (0.000)	113.18 (0.000)	102.29 (0.000)	109.11 (0.000)	244.51 (0.000)	114.41 (0.000)
$H_0: \beta_i = 0$	28.60 (0.000)	43.66 (0.000)	124.01 (0.000)	98.76 (0.000)	35.97 (0.000)	0.57 (0.451)	103.39 (0.000)
Quadratic expenditure term $H_0: \lambda_{ij} - \lambda_{ji} = 0$							
Meat & fish products	217.55 (0.000)						
Dairy products	223.67 (0.000)	9.36 (0.009)					
Vegetables products	237.10 (0.000)	24.79 (0.000)	24.63 (0.000)				
Fruits	226.46 (0.000)	22.23 (0.000)	28.16 (0.000)	41.74 (0.000)			
Oils & animals fats	429.41 (0.000)	259.19 (0.000)	261.47 (0.000)	278.21 (0.000)	265.14 (0.000)		
Other foods items	221.96 (0.000)	3.78 (0.151)	5.61 (0.060)	19.88 (0.000)	23.25 (0.000)	262.61 (0.000)	
Other products & service	267.77 (0.000)	295.57 (0.000)	189.88 (0.000)	190.96 (0.000)	267.55 (0.000)	353.44 (0.000)	202.56 (0.000)
$H_0: \lambda_i = 0$	215.53 (0.000)	3.03 (0.008)	5.27 (0.002)	19.55 (0.000)	21.37 (0.000)	258.82 (0.000)	0.37 (0.541)

Source: own calculation based on the HBS, Taj STAT, (2013-2014)
 Note: p-values are presented in parentheses

⁷¹ The null hypothesis is defined as follows:

$$\begin{aligned}
 \text{Symmetry expenditure term} & \begin{cases} H_0: \beta_{ij} - \beta_{ji} = 0 & \text{for } i > j \text{ and } i, j = 1, 2, 3 \dots m \\ H_0: \lambda_{ij} - \lambda_{ji} = 0 & \text{for } i > j \text{ and } i, j = 1, 2, 3 \dots m \end{cases} \\
 \text{Individual expenditure term} & \begin{cases} H_0: \beta_i = 0 & \text{for } i = 1, 2, 3 \dots m \\ H_0: \lambda_i = 0 & \text{for } i = 1, 2, 3 \dots m \end{cases}
 \end{aligned}$$

Table A4.8: Wald tests on the estimated demographic parameters

Demographics parameters – $H_0: \eta_i$ vs. $\rho_i = 0$	Wald Test Statistic	P-values
$\eta_{\text{rural}}_{1-8}$ and $\rho_{\text{rural}} = 0$	580.80	0.0000
$\eta_{\text{household size}}_{1-8}$ and $\rho_{\text{household size}} = 0$	100.34	0.0000
$\eta_{\text{n_employer}}_{1-8}$ and $\rho_{\text{n_employer}} = 0$	129.32	0.0000
$\eta_{\text{n_retiree}}_{1-8}$ and $\rho_{\text{n_retiree}} = 0$	65.07	0.0000
$\eta_{\text{n_scholarship holder}}_{1-8}$ and $\rho_{\text{n_scholarship holder}} = 0$	18.99	0.0149
$\eta_{\text{n_children <16}}_{1-8}$ and $\rho_{\text{n_children <16}} = 0$	62.73	0.0000
$\eta_{\text{n_adults >16}}_{1-8}$ and $\rho_{\text{n_adults >16}} = 0$	106.22	0.0000
$\eta_{\text{Dushanbe}}_{1-8}$ and $\rho_{\text{Dushanbe}} = 0$	22.31	0.0044
$\eta_{\text{Sughd}}_{1-8}$ and $\rho_{\text{Sughd}} = 0$	148.38	0.0000
$\eta_{\text{Khatlon}}_{1-8}$ and $\rho_{\text{Khatlon}} = 0$	392.63	0.0000
η_{RRS}_{1-8} and $\rho_{\text{RRS}} = 0$	212.90	0.0000
η_{GBAO}_{1-8} and $\rho_{\text{GBAO}} = 0$	20.71	0.0000
$\eta_{\text{Summer}}_{1-8}$ and $\rho_{\text{Summer}} = 0$	157.84	0.0000
$\eta_{\text{Winter}}_{1-8}$ and $\rho_{\text{Winter}} = 0$	300.34	0.0000
$\eta_{\text{Spring}}_{1-8}$ and $\rho_{\text{Spring}} = 0$	278.61	0.0000
$\eta_{\text{Autumn}}_{1-8}$ and $\rho_{\text{Autumn}} = 0$	116.68	0.0000

Source: own calculation based on the HBS, Taj STAT, (2013-2014)



Table A4.9: QUAIDS estimated parameters: **Summer Season** – (Quarter 3, 2013)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.4413*** (0.0337)	-0.4413*** (0.0337)	0.0595*** (0.0106)	0.1520*** (0.0232)	0.0877*** (0.0124)	0.0286** (0.0139)	0.1180*** (0.0121)	0.7950*** (0.0650)
β_i	-0.0252*** (0.0093)	-0.0079 (0.0056)	-0.0145*** (0.0024)	-0.0235*** (0.0048)	0.0001 (0.0037)	-0.0032 (0.0032)	-0.0331*** (0.0037)	0.1076*** (0.0164)
γ_1	-0.1666*** (0.0080)	0.0248*** (0.0038)	-0.0010 (0.0020)	0.0097*** (0.0039)	0.0025 (0.0023)	-0.0065** (0.0026)	-0.0137*** (0.0023)	0.1508*** (0.0105)
γ_2		0.0365*** (0.0036)	-0.0051*** (0.0013)	-0.0012 (0.0027)	0.0023*** (0.0015)	-0.0013 (0.0017)	0.0058*** (0.0015)	-0.0618*** (0.0070)
γ_3			0.0126*** (0.0010)	0.0029** (0.0015)	-0.0021*** (0.0007)	0.0016* (0.0009)	-0.0012 (0.0007)	-0.0078** (0.0033)
γ_4				0.0236*** (0.0043)	0.0019 (0.0015)	-0.0017 (0.0020)	-0.006*** (0.0014)	-0.028*** (0.0070)
γ_5					0.0091*** (0.0013)	-0.0026*** (0.0009)	0.0068*** (0.0009)	-0.0180*** (0.0039)
γ_6						0.0113*** (0.0018)	-0.0004 (0.0009)	-0.0002 (0.0045)
γ_7							0.0455*** (0.0013)	-0.0364*** (0.0039)
γ_8								0.0026 (0.0209)
λ_i	0.0184*** (0.0032)	-0.0055** (0.0023)	-0.0006** (0.0010)	0.0002 (0.0019)	-0.0033** (0.0016)	0.0043*** (0.0012)	-0.0065*** (0.0016)	-0.0069 (0.0062)
$\eta_{Dushanbe}$	-0.0132 (0.0082)	-0.0088*** (0.0030)	-0.0006 (0.0015)	-0.0166*** (0.0037)	-0.0107*** (0.0022)	-0.0054** (0.0023)	0.0071*** (0.0022)	0.0484*** (0.0143)
η_{Sughd}	-0.0358*** (0.0073)	-0.0312*** (0.0039)	-0.0028 (0.0017)	-0.0221*** (0.0035)	-0.0171*** (0.0026)	-0.0068*** (0.0023)	0.0063** (0.0026)	0.1095*** (0.0126)
$\eta_{Khatlon}$	-0.0609*** (0.0071)	-0.0142*** (0.0034)	0.0032** (0.0015)	-0.0391*** (0.0034)	-0.0048** (0.0024)	-0.0125*** (0.0022)	-0.0051** (0.0024)	0.1336*** (0.0117)
η_{RRS}	-0.0385*** (0.0066)	0.0070** (0.0029)	-0.0030** (0.0014)	-0.0305*** (0.0030)	-0.0119*** (0.0021)	-0.0063*** (0.0020)	-0.006*** (0.0022)	0.0895*** (0.0106)
η_{rural}	0.0072** (0.0035)	-0.0118*** (0.0017)	0.0072*** (0.0008)	0.0268*** (0.0019)	0.0004 (0.0012)	-0.0046*** (0.0011)	-0.0041*** (0.0012)	-0.0211*** (0.0063)
$\eta_{household\ size}$	-0.0024** (0.0010)	-0.0010** (0.0005)	-0.0007*** (0.0002)	-0.0003 (0.0004)	-0.0005 (0.0003)	-0.0001 (0.0003)	-0.0006* (0.0003)	0.0053*** (0.0017)
$\eta_{employer}$	0.0042** (0.0017)	-0.0002 (0.0008)	0.0017*** (0.0003)	0.0006 (0.0008)	0.0002 (0.0005)	0.0005 (0.0005)	0.0014** (0.0006)	-0.0086*** (0.0029)
$\eta_{retiree}$	-0.0009 (0.0020)	-0.0008 (0.0009)	0.0011*** (0.0004)	0.0011 (0.0009)	-0.0004 (0.0006)	-0.0010 (0.0006)	-0.0019*** (0.0007)	0.0028 (0.0034)
$\eta_{schoolar}$	-0.0027 (0.0152)	-0.0004 (0.0083)	0.0031 (0.0038)	-0.0119 (0.0089)	0.0080 (0.0060)	0.0027 (0.0049)	0.0017 (0.0061)	-0.0005 (0.0267)
$\eta_{children<16}$	-0.0009** (0.0013)	0.0013** (0.0006)	0.0003 (0.0002)	-0.0015*** (0.0006)	0.0000 (0.0004)	-0.0000 (0.0004)	-0.0000 (0.0004)	0.0009** (0.0023)
$\eta_{adults>16}$	-0.0010 (0.0013)	0.0012* (0.0006)	0.0012*** (0.0003)	0.0002 (0.0006)	0.0007 (0.0004)	0.0000 (0.0004)	0.0005 (0.0004)	-0.0029 (0.0023)
	rho1	rho2	rho3	rho4	rho5	rho6	rho7	rho8
ρ_i	-0.6909*** (0.0529)	-0.8838*** (0.0180)	-0.8662*** (0.0195)	-0.7159*** (0.0367)	-0.0086 (0.0101)	0.0274*** (0.0056)	0.0119* (0.0064)	0.0082 (0.0073)
	rho9	rho10	rho11					
ρ_i	-0.0092 (0.0334)	-0.0295*** (0.0057)	0.0184*** (0.0064)					

Note: Standard Errors are presented in parentheses and; *, **, *** defined significance at 10, 5 and 1 %, respectively

Table A4.10: QUAIDS Demand Elasticities for **Summer Season**, (Quarter 3, 2013)

<i>Compensated Price Elasticities</i>									
	Bread and cereals	Meat and fish	Dairy products	Vegetables	Fruits	Oils and animals fats	Other foods items	Other products and service	Expenditure Elasticities
Bread & cereals	-1.741 (0.042)	0.208 (0.020)	0.014 (0.011)	0.106 (0.021)	0.050 (0.012)	0.010 (0.014)	-0.017 (0.012)	1.369 (0.056)	0.469 (0.015)
Meat and fish	0.445 (0.044)	-0.501 (0.041)	-0.038 (0.015)	0.047 (0.031)	0.064 (0.018)	0.034 (0.020)	0.128 (0.017)	-0.179 (0.081)	0.761 (0.022)
Dairy products	0.115 (0.087)	-0.141 (0.058)	-0.433 (0.045)	0.190 (0.066)	-0.054 (0.033)	0.121 (0.043)	0.010 (0.032)	0.191 (0.144)	0.744 (0.037)
Vegetables	0.278 (0.056)	0.059 (0.038)	0.062 (0.022)	-0.613 (0.062)	0.063 (0.022)	0.021 (0.029)	-0.034 (0.021)	0.164 (0.100)	0.545 (0.023)
Fruits	0.234 (0.060)	0.142 (0.039)	-0.032 (0.020)	0.112 (0.039)	-0.730 (0.034)	-0.016 (0.025)	0.240 (0.024)	0.050 (0.102)	0.858 (0.034)
Oils & fats	0.036 (0.047)	0.056 (0.032)	0.051 (0.018)	0.029 (0.037)	-0.010 (0.018)	-0.748 (0.034)	0.052 (0.017)	0.535 (0.082)	0.625 (0.019)
Other food items	-0.048 (0.032)	0.156 (0.021)	0.003 (0.010)	-0.033 (0.021)	0.131 (0.013)	0.039 (0.013)	-0.314 (0.018)	0.065 (0.054)	0.617 (0.019)
Other products and service	0.563 (0.023)	-0.036 (0.015)	0.010 (0.007)	0.025 (0.015)	0.003 (0.009)	0.065 (0.010)	0.010 (0.008)	-0.639 (0.045)	1.461 (0.011)
<i>Uncompensated Price Elasticities</i>									
Bread & cereals	-1.830 (0.042)	0.167 (0.020)	0.004 (0.011)	0.073 (0.021)	0.032 (0.012)	-0.016 (0.014)	-0.051 (0.012)	1.152 (0.056)	
Meat and fish	0.301 (0.044)	-0.567 (0.042)	-0.056 (0.015)	-0.007 (0.031)	0.034 (0.018)	-0.008 (0.020)	0.073 (0.018)	-0.532 (0.080)	
Dairy products	-0.025 (0.087)	-0.206 (0.058)	-0.450 (0.045)	0.137 (0.066)	-0.083 (0.033)	0.080 (0.043)	-0.044 (0.033)	-0.153 (0.145)	
Vegetables	0.175 (0.057)	0.012 (0.038)	0.049 (0.022)	-0.652 (0.062)	0.042 (0.022)	-0.009 (0.029)	-0.074 (0.021)	-0.088 (0.100)	
Fruits	0.072 (0.060)	0.068 (0.040)	-0.052 (0.020)	0.051 (0.039)	-0.764 (0.035)	-0.064 (0.026)	0.178 (0.025)	-0.347 (0.102)	
Oils& animal fats	-0.082 (0.047)	0.002 (0.032)	0.036 (0.018)	-0.016 (0.037)	-0.035 (0.018)	-0.782 (0.034)	0.007 (0.018)	0.246 (0.082)	
Other food items	-0.165 (0.032)	0.103 (0.021)	-0.011 (0.010)	-0.077 (0.021)	0.107 (0.013)	0.005 (0.013)	-0.358 (0.018)	-0.220 (0.054)	
Other products and service	0.287 (0.023)	-0.163 (0.015)	-0.024 (0.007)	-0.079 (0.015)	-0.054 (0.009)	-0.016 (0.010)	-0.095 (0.009)	-1.316 (0.045)	

Source: own calculation based on the HBS, Taj STAT (Quarter 3, 2013);
Note: Standard Errors in brackets

Table A4.11: QUAIDS estimated parameters: Autumn Season – (Quarter 4, 2013)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.6711** (0.0432)	0.2828***	0.0753*** (0.0113)	0.1089*** (0.0251)	0.0658*** (0.0101)	0.0248 (0.0167)	0.1199*** (0.0123)	0.9933*** (0.0775)
β_i	-0.0616*** (0.0065)	0.0087** (0.0037)	-0.0052*** (0.0013)	-0.0215*** (0.0029)	0.0062*** (0.0012)	-0.0092*** (0.0022)	-0.0130*** (0.0029)	0.0957*** (0.0138)
γ_1	-0.1944*** (0.0093)	0.0273*** (0.0041)	-0.0072*** (0.0022)	0.0083* (0.0043)	-0.0009 (0.0020)	-0.0019 (0.0032)	-0.0067*** (0.0023)	0.1755*** (0.0120)
γ_2		0.0463*** (0.0036)	-0.0046*** (0.0013)	0.0098*** (0.0026)	0.0016 (0.0012)	0.0039** (0.0019)	0.0058*** (0.0014)	-0.0903*** (0.0072)
γ_3			0.0147*** (0.0011)	0.0052*** (0.0015)	-0.0012** (0.0007)	0.0064*** (0.0012)	0.0011 (0.0007)	-0.0144*** (0.0035)
γ_4				0.0243*** (0.0043)	-0.0025* (0.0014)	-0.0053** (0.0023)	-0.0061*** (0.0014)	-0.0033*** (0.0073)
γ_5					0.0149*** (0.0009)	-0.0029*** (0.0010)	0.0039*** (0.0006)	-0.0129*** (0.0032)
γ_6						0.0121*** (0.0025)	-0.0033*** (0.0010)	-0.0090* (0.0053)
γ_7							0.0495*** (0.0011)	-0.0443*** (0.0040)
γ_8								0.0293 (0.0229)
λ_i	0.0048*** (0.0007)	0.0038*** (0.0006)	0.0008*** (0.0002)	0.0015*** (0.0003)	0.0007*** (0.0002)	0.0018*** (0.0003)	0.0031*** (0.0004)	-0.0168*** (0.0019)
$\eta_{Dushanbe}$	0.0296** (0.0121)	0.0034 (0.0037)	0.0028* (0.0015)	0.0093** (0.0040)	-0.0002 (0.0005)	0.0077** (0.0030)	0.0152*** (0.0041)	-0.0680** (0.0281)
η_{Sughd}	0.0722*** (0.0073)	0.0177*** (0.0028)	0.0086*** (0.0009)	0.0225*** (0.0025)	0.0009 (0.0007)	0.0184*** (0.0021)	0.0340*** (0.0023)	-0.1746*** (0.0157)
$\eta_{Khatlon}$	-0.0314*** (0.0065)	-0.0102*** (0.0017)	0.0025*** (0.0005)	-0.0119*** (0.0022)	0.0013*** (0.0005)	-0.0083*** (0.0016)	-0.0071*** (0.0020)	0.0650*** (0.0134)
η_{GBAO}	0.0767*** (0.0097)	0.0293*** (0.0040)	0.0105*** (0.0013)	0.0305*** (0.0030)	0.0028*** (0.0011)	0.0222*** (0.0028)	0.0398*** (0.0034)	0.0398*** (0.0034)
η_{rural}	0.0027*** (0.0009)	-0.0005 (0.0005)	0.0023*** (0.0003)	0.0026*** (0.0005)	0.0006*** (0.0002)	-0.0001 (0.0003)	-0.0010*** (0.0003)	-0.0066*** (0.0020)
$\eta_{household\ size}$	-0.0010** (0.0003)	-0.0003 (0.0002)	-0.0001 (0.0001)	-0.0002 (0.0001)	-0.0001 (0.0000)	-0.0002** (0.0001)	-0.0001 (0.0001)	0.0021*** (0.0007)
$\eta_{employer}$	0.0007 (0.0005)	-0.0005** (0.0003)	0.0002* (0.0001)	-0.0004 (0.0002)	-0.0001 (0.0001)	-0.0003** (0.0002)	-0.0000 (0.0002)	0.0004 (0.0010)
$\eta_{retiree}$	-0.0009 (0.0006)	-0.0007** (0.0003)	0.0002 (0.0001)	-0.0001 (0.0003)	-0.0001 (0.0001)	-0.0006*** (0.0002)	-0.0011*** (0.0002)	0.0034*** (0.0013)
$\eta_{scholar}$	-0.0023 (0.0022)	0.00053 (0.0011)	0.0008* (0.0005)	-0.0012 (0.0010)	0.0002 (0.0004)	0.0002 (0.0007)	0.0009 (0.0007)	0.0008 (0.0043)
$\eta_{children<16}$	0.0015*** (0.0004)	0.0005** (0.0002)	0.0000 (0.0001)	0.0000 (0.0002)	0.0001 (0.0001)	0.0000 (0.0001)	0.0002 (0.0001)	-0.0024*** (0.0008)
$\eta_{adults>16}$	-0.0015*** (0.0004)	-0.0003 (0.0002)	0.0001 (0.0001)	0.0001 (0.0002)	0.0001 (0.0001)	-0.0002 (0.0001)	-0.0006*** (0.0001)	0.0025*** (0.0009)
	rho1	rho2	rho3	rho4	rho5	rho6	rho7	rho8
ρ_i	2.5371 (2.2672)	30.6845 (20.0175)	-0.7109*** (0.0571)	6.1971 (5.3134)	0.0240 (0.0208)	0.0546*** (0.0143)	-0.0490*** (0.0163)	-0.0293** (0.0148)
	rho9	rho10	rho11					
ρ_i	0.1109 (0.0927)	-0.0232*** (0.0057)	0.0014 (0.0136)					

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 %, respectively

Table A4.12: QUAIDS Demand Elasticities for Autumn Season, (Quarter 4, 2013)

<i>Compensated Price Elasticities</i>									
	Bread and cereals	Meat and fish	Dairy products	Vegetables	Fruits	Oils and animal fats	Other foods items	Other products and service	Expenditure Elasticities
Bread & cereals	-1.866 (0.047)	0.210 (0.021)	-0.019 (0.011)	0.081 (0.022)	0.014 (0.010)	0.028 (0.016)	0.013 (0.012)	1.537 (0.061)	0.526 (0.156)
Meat and fish	0.482 (0.045)	-0.419 (0.040)	-0.031 (0.015)	0.169 (0.029)	0.030 (0.014)	0.094 (0.021)	0.123 (0.016)	-0.449 (0.079)	0.707 (0.023)
Dairy products	-0.133 (0.093)	-0.120 (0.057)	-0.365 (0.047)	0.276 (0.065)	-0.038 (0.031)	0.316 (0.050)	0.104 (0.031)	-0.040 (0.148)	0.683 (0.037)
Vegetables	0.245 (0.067)	0.225 (0.041)	0.099 (0.024)	-0.585 (0.066)	-0.021 (0.022)	-0.043 (0.035)	-0.046 (0.022)	0.126 (0.113)	0.545 (0.027)
Fruits	0.206 (0.125)	0.181 (0.077)	-0.053 (0.045)	-0.071 (0.088)	-0.072 (0.059)	-0.112 (0.067)	0.325 (0.042)	-0.404 (0.198)	1.037 (0.050)
Oils & animal fats	0.105 (0.055)	0.140 (0.033)	0.129 (0.020)	-0.045 (0.040)	-0.034 (0.019)	-0.749 (0.044)	-0.006 (0.018)	0.460 (0.091)	0.584 (0.022)
Other foods items	0.047 (0.032)	0.148 (0.020)	0.033 (0.010)	-0.037 (0.020)	0.070 (0.009)	-0.004 (0.015)	-0.263 (0.016)	0.006 (0.053)	0.534 (0.019)
Other products and service	0.633 (0.026)	-0.078 (0.015)	0.000 (0.007)	0.013 (0.016)	-0.011 (0.007)	0.056 (0.011)	0.001 (0.008)	-0.615 (0.049)	1.454 (0.012)
<i>Uncompensated Price Elasticities</i>									
Bread & cereals	-1.970 (0.047)	0.162 (0.021)	-0.031 (0.011)	0.047 (0.022)	0.005 (0.010)	-0.002 (0.016)	-0.025 (0.012)	1.288 (0.060)	
Meat and fish	0.342 (0.046)	-0.483 (0.040)	-0.048 (0.015)	0.123 (0.029)	0.019 (0.014)	0.053 (0.021)	0.072 (0.016)	-0.785 (0.078)	
Dairy products	-0.269 (0.093)	-0.183 (0.057)	-0.381 (0.047)	0.232 (0.066)	-0.049 (0.031)	0.276 (0.050)	0.055 (0.031)	-0.364 (0.146)	
Vegetables	0.137 (0.068)	0.176 (0.041)	0.086 (0.024)	-0.621 (0.066)	-0.029 (0.022)	-0.075 (0.036)	-0.086 (0.023)	-0.133 (0.112)	
Fruits	0.009 (0.126)	0.086 (0.077)	-0.077 (0.045)	-0.138 (0.088)	-0.089 (0.059)	-0.172 (0.067)	0.250 (0.043)	-0.896 (0.196)	
Oils & animal fats	-0.011 (0.056)	0.087 (0.033)	0.115 (0.020)	-0.083 (0.040)	-0.043 (0.019)	-0.783 (0.044)	-0.048 (0.018)	0.182 (0.090)	
Other food items	-0.058 (0.033)	0.099 (0.020)	0.020 (0.010)	-0.072 (0.020)	0.061 (0.009)	-0.036 (0.015)	-0.302 (0.016)	-0.247 (0.053)	
Other products and service	0.345 (0.026)	-0.211 (0.015)	-0.035 (0.007)	-0.081 (0.016)	-0.035 (0.007)	-0.028 (0.011)	-0.103 (0.008)	-1.305 (0.048)	

Source: own calculation based on the HBS, Taj STAT (Quarter 4, 2013);

Note: Standard Errors in brackets

Table A4.13: QUAIDS estimated parameters: Winter Season – (Quarter 1, 2014)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.5528*** (0.0341)	0.2590*** (0.0193)	0.0641*** (0.0107)	0.1627*** (0.0173)	0.1728*** (0.0108)	0.0011 (0.0141)	0.1342*** (0.0113)	0.7584*** (0.0628)
β_i	-0.0681*** (0.0100)	-0.0267*** (0.0066)	-0.0202*** (0.0027)	-0.0205*** (0.0041)	-0.0144*** (0.0026)	0.0001 (0.0033)	-0.0120*** (0.0040)	0.1622*** (0.0196)
γ_1	-0.2037*** (0.0082)	0.0288*** (0.0039)	-0.0034 (0.0021)	0.0129*** (0.0033)	0.0090*** (0.0022)	-0.0065** (0.0028)	-0.0013 (0.0023)	0.1643*** (0.0111)
γ_2		0.0468*** (0.0036)	-0.0052*** (0.0014)	0.0055** (0.0021)	0.0014 (0.0014)	0.0034* (0.0018)	0.0052*** (0.0015)	-0.0861*** (0.0069)
γ_3			0.0148*** (0.0011)	0.0014 (0.0013)	0.0010 (0.0009)	0.0027** (0.0011)	-0.0004 (0.0008)	-0.0109*** (0.0034)
γ_4				0.0279*** (0.0031)	0.0041*** (0.0015)	-0.0056*** (0.0019)	-0.0048*** (0.0012)	-0.0415*** (0.0055)
γ_5					0.0286*** (0.0014)	0.0009 (0.0013)	0.0045*** (0.0008)	-0.0498*** (0.0036)
γ_6						0.0014** (0.0024)	-0.0034*** (0.0010)	0.0069 (0.0047)
γ_7							0.0460*** (0.0012)	-0.0457*** (0.0040)
γ_8								0.0629*** (0.0215)
λ_i	-0.0075** (0.0042)	-0.0075*** (0.0028)	-0.0035*** (0.0012)	-0.0013 (0.0018)	-0.0046*** (0.0012)	0.0056*** (0.0014)	0.0007 (0.0016)	0.0183** (0.0080)
η_{Sughd}	-0.0116*** (0.0045)	-0.0236*** (0.0029)	-0.0020* (0.0011)	0.0009 (0.0017)	0.0005 (0.0010)	-0.0083*** (0.0018)	-0.0098*** (0.0019)	0.0539*** (0.0101)
$\eta_{Khatlon}$	-0.0087** (0.0041)	-0.0006 (0.0016)	0.0037*** (0.0008)	-0.0105*** (0.0019)	0.0012 (0.0008)	-0.0069*** (0.0017)	-0.0062*** (0.0016)	0.0028*** (0.0084)
η_{RRS}	-0.0186*** (0.0047)	0.0058*** (0.0021)	-0.0024** (0.0010)	-0.0072*** (0.0019)	0.0004 (0.0009)	-0.0072*** (0.0017)	-0.0120*** (0.0019)	0.0413*** (0.0091)
η_{GBAO}	-0.0524*** (0.0083)	-0.0075*** (0.0028)	-0.0017 (0.0013)	0.0130*** (0.0021)	0.0126*** (0.0016)	-0.0221*** (0.0030)	-0.0066*** (0.0024)	0.0647*** (0.0139)
η_{rural}	0.0023 (0.0023)	-0.0030** (0.0013)	0.0069*** (0.0007)	0.0032*** (0.0010)	0.0011* (0.0006)	-0.0002** (0.0009)	-0.0073*** (0.0010)	-0.0030 (0.0043)
$\eta_{household\ size}$	-0.0044*** (0.0010)	-0.0001 (0.0005)	-0.0002 (0.0002)	-0.0003 (0.0003)	0.0008*** (0.0002)	-0.0011*** (0.0003)	-0.0015*** (0.0004)	0.0068*** (0.0017)
$\eta_{employer}$	0.0056*** (0.0012)	0.0009 (0.0007)	0.0017*** (0.0003)	-0.0002 (0.0005)	-0.0000 (0.0003)	0.0016*** (0.0004)	0.0012** (0.0005)	-0.0109*** (0.0023)
$\eta_{retiree}$	0.0038*** (0.0013)	0.0000 (0.0007)	0.0007** (0.0003)	0.0003 (0.0005)	-0.0007** (0.0003)	0.0007 (0.0005)	0.0018*** (0.0005)	-0.0066*** (0.0025)
$\eta_{schoolar}$	-0.0043 (0.0071)	0.0006 (0.0042)	-0.0033* (0.0019)	0.0035 (0.0030)	0.0016 (0.0019)	-0.0040 (0.0028)	0.0030 (0.0028)	0.0028 (0.01248)
$\eta_{children\ 0-16}$	0.0007 (0.0007)	0.0005** (0.0004)	-0.0001 (0.0002)	-0.0002** (0.0003)	0.0002 (0.0002)	-0.0001 (0.0003)	0.0000 (0.0003)	-0.0010 (0.0014)
$\eta_{adults\ 16-65}$	0.0008** (0.0011)	0.0003 (0.0006)	0.0003* (0.0006)	-0.0002 (0.0004)	-0.0007** (0.0002)	0.0007 (0.0004)	0.0007 (0.0004)	-0.0021 (0.0020)
	rho1	rho2	rho3	rho4	rho5	rho6	rho7	rho8
ρ_i	-0.7960*** (0.0349)	-0.4245*** (0.0917)	-0.5543*** (0.0642)	-0.6457*** (0.0656)	0.0293 (0.0195)	-0.0186*** (0.0073)	0.0396*** (0.0119)	0.0705*** (0.0175)
	rho9	rho10	rho11					
ρ_i	-0.0066 (0.0579)	-0.0241*** (0.0094)	0.0565*** (0.0118)					

Note: Standard Errors are presented in parentheses and; *, **, *** defined significance at 10, 5 and 1 %, respectively

Table A4.14: QUAIDS demand elasticities for **Winter Season, (Quarter 1, 2014)**

	<i>Compensated Price Elasticities</i>								Expenditure Elasticities
	Bread and cereals	Meat and fish	Dairy products	Vegetables	Fruits	Oils and animals fats	Other foods items	Other products and service	
Bread and cereals	-1.866 (0.039)	0.220 (0.018)	0.003 (0.010)	0.107 (0.016)	0.067 (0.011)	0.015 (0.014)	0.041 (0.010)	1.411 (0.051)	0.614 (0.015)
Meat and fish	0.457 (0.039)	-0.433 (0.036)	-0.031 (0.014)	0.109 (0.022)	0.039 (0.015)	0.089 (0.019)	0.112 (0.015)	-0.343 (0.068)	0.838 (0.218)
Dairy products	0.019 (0.078)	-0.110 (0.051)	-0.432 (0.043)	0.099 (0.049)	0.060 (0.033)	0.153 (0.043)	0.035 (0.029)	0.175 (0.126)	0.801 (0.036)
Vegetables	0.342 (0.051)	0.167 (0.033)	0.042 (0.021)	-0.519 (0.047)	0.087 (0.023)	-0.038 (0.030)	-0.023 (0.019)	-0.057 (0.084)	0.643 (0.022)
Fruits	0.505 (0.083)	0.141 (0.054)	0.060 (0.033)	0.208 (0.055)	-0.085 (0.053)	0.093 (0.049)	0.231 (0.031)	-1.326 (0.131)	1.012 (0.036)
Oils and animals fats	0.054 (0.047)	0.146 (0.030)	0.069 (0.019)	-0.040 (0.032)	0.042 (0.022)	-0.923 (0.408)	0.001 (0.017)	0.651 (0.077)	0.642 (0.020)
Other foods items	0.118 (0.031)	0.153 (0.020)	0.014 (0.011)	-0.021 (0.017)	0.087 (0.011)	0.001 (0.015)	-0.310 (0.016)	-0.041 (0.051)	0.583 (0.018)
Other products and service	0.642 (0.023)	-0.076 (0.014)	0.010 (0.007)	-0.007 (0.012)	-0.080 (0.007)	0.088 (0.010)	-0.006 (0.008)	-0.571 (0.044)	1.388 (0.012)
	<i>Uncompensated Price Elasticities</i>								
Bread and cereals	-1.992 (0.040)	0.161 (0.019)	-0.014 (0.011)	0.068 (0.016)	0.051 (0.011)	-0.022 (0.014)	-0.003 (0.011)	1.136 (0.051)	
Meat and fish	0.287 (0.040)	-0.515 (0.037)	-0.054 (0.014)	0.055 (0.022)	0.017 (0.015)	0.039 (0.019)	0.052 (0.016)	-0.719 (0.068)	
Dairy products	-0.144 (0.079)	-0.189 (0.052)	-0.454 (0.044)	0.048 (0.050)	0.038 (0.034)	0.105 (0.044)	-0.022 (0.030)	-0.183 (0.126)	
Vegetables	0.211 (0.051)	0.105 (0.034)	0.025 (0.021)	-0.561 (0.048)	0.070 (0.023)	-0.077 (0.030)	-0.070 (0.020)	-0.346 (0.084)	
Fruits	0.300 (0.083)	0.043 (0.055)	0.033 (0.034)	0.143 (0.056)	-0.058 (0.054)	0.032 (0.050)	0.159 (0.032)	-1.780 (0.131)	
Oils and animals fats	-0.076 (0.047)	0.083 (0.031)	0.052 (0.020)	-0.082 (0.032)	0.025 (0.022)	-0.963 (0.041)	-0.045 (0.018)	0.363 (0.077)	
Other foods items	-0.001 (0.031)	0.097 (0.021)	-0.002 (0.011)	-0.060 (0.017)	0.072 (0.012)	-0.035 (0.015)	-0.352 (0.017)	-0.303 (0.051)	
Other products and service	0.360 (0.024)	-0.212 (0.015)	-0.028 (0.008)	-0.097 (0.012)	-0.118 (0.008)	0.005 (0.011)	-0.106 (0.008)	-1.193 (0.044)	

Source: own calculation based on the HBS, Taj STAT (Quarter 1, 2014); *Note:* Standard Errors in brackets

Table A4.15: QUAIDS estimated parameters: Spring Season – (Quarter 2, 2014)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.4492*** (0.0319)	0.2760*** (0.0191)	0.0710*** (0.0104)	0.2292*** (0.0203)	0.0077 (0.0100)	0.0478*** (0.0126)	0.1116*** (0.0116)	0.7057*** (0.0611)
β_i	-0.0497*** (0.0093)	-0.0559*** (0.0074)	-0.0226*** (0.0026)	-0.0300*** (0.0055)	-0.0102*** (0.0032)	-0.0061* (0.0033)	-0.0242*** (0.0041)	0.1988*** (0.0207)
γ_1	-0.1687*** (0.0076)	0.0306*** (0.0038)	-0.0018 (0.0020)	0.0064* (0.0037)	0.0044** (0.0020)	0.0017 (0.0025)	-0.0074*** (0.0023)	0.1347*** (0.0103)
γ_2		0.0482*** (0.0036)	-0.0026** (0.0013)	0.0097*** (0.0025)	0.0038*** (0.0013)	0.0001 (0.0016)	0.0073*** (0.0015)	-0.0972*** (0.0071)
γ_3			0.0162*** (0.0012)	0.0021 (0.0015)	-0.0006 (0.0007)	0.0000 (0.0011)	0.0006 (0.0008)	-0.0139*** (0.0033)
γ_4				0.0599*** (0.0038)	-0.0099*** (0.0014)	-0.0018** (0.0019)	-0.0045*** (0.0015)	-0.0619*** (0.0066)
γ_5					0.0007 (0.0010)	-0.0000 (0.0009)	0.0007 (0.0008)	0.0009 (0.0034)
γ_6						0.0106*** (0.0020)	-0.0007 (0.0010)	-0.0097** (0.0042)
γ_7							0.0393*** (0.0013)	-0.0352*** (0.0041)
γ_8								0.0823*** (0.0213)
λ_i	-0.0019 (0.0044)	-0.0244*** (0.0039)	-0.0061*** (0.0015)	-0.0004 (0.0027)	-0.0052*** (0.0017)	0.0019 (0.0015)	-0.0079*** (0.0022)	0.0442*** (0.0107)
η_{Sughd}	-0.0154*** (0.0046)	-0.0125*** (0.0025)	-0.0025** (0.0011)	-0.0118*** (0.0029)	0.0062*** (0.0014)	-0.0102*** (0.0017)	-0.0033** (0.0015)	0.0497*** (0.0088)
$\eta_{Khatlon}$	-0.0171*** (0.00429)	0.0052*** (0.0019)	0.0032*** (0.0008)	-0.0180*** (0.0029)	0.0021* (0.0011)	-0.0074*** (0.0014)	-0.0021* (0.0012)	0.0341*** (0.0072)
η_{RRS}	-0.0153*** (0.0047)	0.0160*** (0.0024)	-0.0021** (0.0010)	-0.0152 (0.0030)	-0.0022* (0.0012)	-0.0029** (0.0014)	-0.0057*** (0.0014)	0.0276*** (0.0078)
η_{GBAO}	-0.0525*** (0.0080)	0.0063** (0.0027)	-0.0021 (0.0013)	0.0091*** (0.0030)	0.0067*** (0.0017)	-0.0167*** (0.0025)	-0.0030 (0.0019)	0.0522*** (0.0119)
η_{rural}	-0.0071*** (0.0024)	-0.0098*** (0.0014)	0.0064*** (0.0007)	0.0108*** (0.0016)	0.0039*** (0.0008)	-0.0036*** (0.0008)	-0.0094*** (0.0010)	0.0088** (0.0041)
$\eta_{household\ size}$	-0.0043*** (0.0009)	-0.0003 (0.0005)	0.0001 (0.0002)	-0.0005 (0.0005)	0.0004 (0.0003)	-0.0012*** (0.0003)	-0.0001 (0.0003)	0.0060*** (0.0016)
$\eta_{employer}$	0.0051*** (0.0012)	0.0008 (0.0007)	0.0009*** (0.0003)	0.0006 (0.0007)	0.0003 (0.0004)	0.0009** (0.0004)	0.0011** (0.0004)	-0.0098*** (0.0021)
$\eta_{retiree}$	0.0039*** (0.0013)	0.0002 (0.0007)	0.0005 (0.0003)	-0.0007 (0.0008)	-0.0003 (0.0005)	0.0007 (0.0004)	-0.0000 (0.0005)	-0.0043** (0.0022)
$\eta_{schoolar}$	-0.0031 (0.0053)	0.0037 (0.0028)	0.0009 (0.0013)	0.0043 (0.0028)	0.0015 (0.0017)	0.0019 (0.0017)	0.0004 (0.0018)	-0.0100 (0.0079)
$\eta_{children\ 0-16}$	0.0011** (0.0008)	0.0001* (0.0004)	-0.0000 (0.0002)	0.0003 (0.0005)	0.0004** (0.0002)	-0.0003 (0.0002)	-0.0004 (0.0003)	-0.0012 (0.0013)
$\eta_{adults\ 16-65}$	0.0008* (0.0011)	0.0009 (0.0006)	0.0003 (0.0003)	-0.0007 (0.0006)	-0.0004 (0.0004)	0.0011*** (0.0004)	0.0000 (0.0004)	-0.0021 (0.0018)
	rho1	rho2	rho3	rho4	rho5	rho6	rho7	rho8
ρ_i	-0.7985*** (0.0300)	-0.5054*** (0.0659)	-0.4659*** (0.0718)	-0.5932*** (0.0647)	-0.0034 (0.0162)	-0.0108* (0.0061)	0.0210** (0.0094)	0.0620*** (0.0137)
	rho9	rho10	rho11					
ρ_i	0.0500 (0.0427)	-0.0349*** (0.0087)	0.0605*** (0.0107)					

Note: Standard Errors are presented in parentheses and;
 *, **, *** defined significance at 10, 5 and 1 %, respectively

Table A4.16: QUAIDS demand elasticities for Spring Season, (Quarter 2, 2014)

<i>Compensated Price Elasticities</i>									
	Bread and cereals	Meat and fish	Dairy products	Vegetables	Fruits	Oils and animal fats	Other food items	Other products and service	Expenditure Elasticities
Bread & cereals	-1.721 (0.038)	0.224 (0.019)	0.009 (0.010)	0.098 (0.019)	0.040 (0.010)	0.051 (0.013)	0.013 (0.011)	1.285 (0.050)	0.590 (0.015)
Meat and fish	0.471 (0.040)	-0.418 (0.038)	-0.013 (0.015)	0.173 (0.028)	0.057 (0.015)	0.045 (0.018)	0.128 (0.016)	-0.443 (0.071)	0.856 (0.022)
Dairy products	0.064 (0.080)	-0.045 (0.053)	-0.347 (0.047)	0.151 (0.060)	-0.008 (0.029)	0.044 (0.043)	0.073 (0.032)	0.068 (0.130)	0.819 (0.036)
Vegetables	0.206 (0.040)	0.173 (0.027)	0.042 (0.016)	-0.297 (0.041)	-0.089 (0.015)	0.023 (0.020)	0.003 (0.016)	-0.060 (0.069)	0.592 (0.020)
Fruits	0.485 (0.124)	0.318 (0.083)	-0.013 (0.046)	-0.514 (0.088)	-0.941 (0.065)	0.060 (0.057)	0.111 (0.052)	0.495 (0.204)	1.408 (0.072)
Oils & animal fats	0.176 (0.045)	0.076 (0.029)	0.020 (0.019)	0.037 (0.034)	0.017 (0.016)	-0.769 (0.036)	0.041 (0.018)	0.401 (0.073)	0.619 (0.019)
Other food items	0.035 (0.032)	0.172 (0.022)	0.027 (0.012)	0.002 (0.022)	0.026 (0.012)	0.033 (0.015)	-0.382 (0.019)	0.086 (0.055)	0.734 (0.019)
Other products and service	0.566 (0.022)	-0.094 (0.015)	0.003 (0.007)	-0.011 (0.014)	0.018 (0.007)	0.051 (0.009)	0.013 (0.008)	-0.546 (0.427)	1.380 (0.012)
<i>Uncompensated Price Elasticities</i>									
Bread & cereals	-1.837 (0.038)	0.170 (0.019)	-0.006 (0.010)	0.043 (0.019)	0.031 (0.010)	0.018 (0.013)	-0.028 (0.012)	1.020 (0.050)	
Meat and fish	0.303 (0.040)	-0.497 (0.038)	-0.034 (0.015)	0.092 (0.028)	0.043 (0.015)	-0.004 (0.018)	0.068 (0.017)	-0.827 (0.071)	
Dairy products	-0.098 (0.081)	-0.120 (0.054)	-0.368 (0.046)	0.074 (0.060)	-0.021 (0.029)	-0.002 (0.043)	0.016 (0.033)	-0.299 (0.130)	
Vegetables	0.089 (0.040)	0.118 (0.027)	0.027 (0.016)	-0.353 (0.041)	-0.098 (0.015)	-0.011 (0.021)	-0.038 (0.017)	-0.325 (0.069)	
Fruits	0.208 (0.125)	0.188 (0.083)	-0.049 (0.046)	-0.646 (0.088)	-0.964 (0.065)	-0.021 (0.057)	0.013 (0.053)	-0.137 (0.204)	
Oils & animal fats	0.054 (0.045)	0.018 (0.029)	0.005 (0.019)	-0.021 (0.034)	0.007 (0.016)	-0.804 (0.036)	-0.002 (0.018)	0.123 (0.074)	
Other food items	-0.109 (0.033)	0.104 (0.022)	0.008 (0.012)	-0.067 (0.022)	0.014 (0.012)	-0.008 (0.015)	-0.433 (0.019)	-0.243 (0.055)	
Other products and service	0.294 (0.022)	-0.221 (0.015)	-0.032 (0.007)	-0.141 (0.015)	-0.005 (0.007)	-0.027 (0.009)	-0.083 (0.009)	-1.166 (0.042)	

Source: own calculation based on the HBS, Taj STAT (Quarter 2, 2014);
Note: Standard Errors in brackets

Table A4.17: QUAIDS estimated parameters: Autumn Season – (Quarter 4, 2014)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.5561*** (0.0336)	0.2087*** (0.0234)	0.0202* (0.0108)	0.1002*** (0.0268)	0.0587*** (0.0104)	-0.0074 (0.0147)	0.0466*** (0.0125)	1.1287*** (0.0752)
β_i	0.0031 (0.0094)	-0.0526*** (0.0081)	-0.0211*** (0.0031)	-0.0111** (0.0057)	-0.0152*** (0.0033)	-0.0090*** (0.0032)	-0.0266*** (0.0041)	0.1326*** (0.0156)
γ_1	-0.1891*** (0.0070)	0.0285*** (0.0037)	-0.0012 (0.0018)	0.0079** (0.0041)	0.0042** (0.0017)	-0.0003 (0.0024)	-0.0134*** (0.0021)	0.1634*** (0.0101)
γ_2		0.0572*** (0.0041)	-0.0005 (0.0013)	0.0123*** (0.0029)	0.0011 (0.0013)	-0.0014 (0.0017)	0.0089*** (0.0016)	-0.1064*** (0.0077)
γ_3			0.0132*** (0.0009)	-0.0009 (0.0015)	-0.0004 (0.0006)	0.0024** (0.0009)	-0.0002 (0.0007)	-0.0126*** (0.0032)
γ_4				0.0229*** (0.0052)	-0.0042*** (0.0015)	-0.0013* (0.0023)	-0.0057*** (0.0016)	-0.0309*** (0.0078)
γ_5					0.0197*** (0.0009)	-0.0019** (0.0009)	0.0068*** (0.0007)	-0.0255*** (0.0032)
γ_6						0.0019 (0.0021)	-0.0009 (0.0009)	0.0015 (0.0045)
γ_7							0.0466*** (0.0012)	-0.0422*** (0.0041)
γ_8								0.0528** (0.0217)
λ_i	0.0123*** (0.0016)	-0.0047*** (0.0015)	-0.0017*** (0.0006)	0.0026*** (0.0009)	-0.0023*** (0.0006)	0.0020*** (0.0005)	0.0001 (0.0007)	-0.0084*** (0.0024)
$\eta_{Dushanbe}$	0.0148** (0.0069)	0.0066*** (0.0014)	-0.0001 (0.0007)	0.0053** (0.0024)	-0.0008** (0.0005)	0.0055*** (0.0017)	0.0043** (0.0020)	-0.0357*** (0.0139)
$\eta_{Khatlon}$	0.0348*** (0.0076)	0.0061*** (0.0018)	0.0017** (0.0007)	0.0097*** (0.0028)	-0.0033*** (0.00069)	0.0087*** (0.0020)	0.0072*** (0.0024)	-0.0650*** (0.0157)
η_{RRS}	0.0255*** (0.0062)	0.0102*** (0.0016)	-0.0001 (0.0007)	0.0111*** (0.0021)	-0.0026*** (0.0005)	0.0075*** (0.0016)	0.0044** (0.0021)	-0.0562*** (0.0129)
η_{GBAO}	-0.0230*** (0.0054)	0.0026 (0.0016)	-0.0021*** (0.0007)	0.0106*** (0.0016)	0.0020*** (0.0005)	-0.0050*** (0.0015)	-0.0028 (0.0017)	0.0176 (0.0107)
η_{rural}	-0.0034*** (0.0011)	-0.0028*** (0.0005)	0.0022*** (0.0002)	0.0015*** (0.0005)	0.0006*** (0.0002)	-0.0009*** (0.0003)	-0.0025*** (0.0004)	0.0053*** (0.0019)
$\eta_{household\ size}$	-0.0016*** (0.0004)	0.0002 (0.0002)	-0.0001*** (0.0001)	-0.0002 (0.0002)	0.0000 (0.0001)	-0.0003** (0.0001)	-0.0002* (0.0001)	0.0022*** (0.0008)
$\eta_{employer}$	0.0025*** (0.0006)	-0.0002 (0.0003)	0.00013 (0.0001)	0.0005** (0.0003)	-0.0000 (0.0001)	0.0003* (0.0001)	0.0005*** (0.0002)	-0.0037*** (0.0010)
$\eta_{retiree}$	0.0014** (0.0006)	-0.0007** (0.0003)	0.0001 (0.0001)	0.0003 (0.0003)	-0.0001 (0.0001)	0.0002 (0.0002)	-0.0001 (0.0002)	-0.0011 (0.0011)
$\eta_{schoolar}$	0.0014 (0.0033)	0.0019 (0.0018)	-0.0006 (0.0007)	0.0015 (0.0018)	-0.0011 (0.0008)	-0.0014 (0.0010)	0.0003 (0.0011)	-0.0021 (0.0055)
$\eta_{children\ 0-16}$	0.0000 (0.0003)	0.0003 (0.0002)	-0.0000 (0.0000)	0.0002 (0.0002)	0.0000 (0.0001)	-0.0000 (0.0001)	-0.0002* (0.0001)	-0.00026 (0.0006)
$\eta_{adults\ 16-65}$	-0.0008** (0.0005)	-0.0002 (0.0002)	0.0002** (0.0001)	-0.0005 (0.0002)	0.0000 (0.0001)	0.0000 (0.0001)	0.0000 (0.0002)	0.0012 (0.0009)
	rho1	rho2	rho3	rho4	rho5	rho6	rho7	rho8
ρ_i	2.5520** (1.2939)	8.8516** (4.239)	4.8022** (1.9723)	0.1552 (0.2231)	-0.1880*** (0.0632)	-0.0449** (0.0198)	0.0899** (0.0394)	0.1577*** (0.0479)
	rho9	rho10	rho11					
ρ_i	-0.2023** (0.1193)	-0.0905*** (0.0341)	0.1665*** (0.0362)					

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 %, respectively

Table A4.18: QUAIDS demand elasticities for Autumn Season (Quarter 4, 2014)

<i>Compensated Price Elasticities</i>									
	Bread and cereals	Meat and fish	Dairy products	Vegetables	Fruits	Oils and animal fats	Other food items	Other products and service	Expenditure Elasticities
Bread & cereals	-1.980 (0.040)	0.251 (0.020)	0.016 (0.010)	0.094 (0.023)	0.049 (0.010)	0.033 (0.014)	-0.029 (0.011)	1.566 (0.056)	0.533 (0.017)
Meat and fish	0.463 (0.038)	-0.359 (0.038)	-0.005 (0.013)	0.191 (0.030)	0.014 (0.013)	0.025 (0.018)	0.124 (0.015)	-0.453 (0.070)	0.846 (0.024)
Dairy products	0.098 (0.068)	-0.016 (0.047)	-0.511 (0.036)	0.014 (0.060)	-0.021 (0.025)	0.128 (0.037)	0.010 (0.026)	0.287 (0.116)	0.753 (0.035)
Vegetables	0.224 (0.056)	0.246 (0.038)	0.006 (0.021)	-0.635 (0.071)	-0.037 (0.020)	0.020 (0.032)	-0.032 (0.021)	0.208 (0.105)	0.657 (0.027)
Fruits	0.402 (0.084)	0.060 (0.058)	-0.027 (0.030)	-0.134 (0.072)	-0.065 (0.042)	-0.045 (0.044)	0.350 (0.033)	-0.540 (0.142)	1.048 (0.046)
Oils & animal fats	0.103 (0.044)	0.046 (0.030)	0.061 (0.017)	0.026 (0.042)	-0.016 (0.017)	-0.929 (0.038)	0.024 (0.017)	0.685 (0.080)	0.609 (0.021)
Other food items	-0.078 (0.028)	0.170 (0.020)	0.005 (0.010)	-0.035 (0.022)	0.106 (0.010)	0.018 (0.013)	-0.304 (0.016)	0.118 (0.049)	0.617 (0.019)
Other products and service	0.573 (0.020)	-0.091 (0.014)	0.014 (0.006)	0.033 (0.016)	-0.024 (0.006)	0.079 (0.009)	0.017 (0.007)	-0.601 (0.042)	1.363 (0.011)
<i>Uncompensated Price Elasticities</i>									
Bread & cereals	-2.074 (0.040)	0.201 (0.020)	0.002 (0.010)	0.055 (0.023)	0.038 (0.010)	0.004 (0.014)	-0.066 (0.011)	1.307 (0.056)	
Meat and fish	0.314 (0.038)	-0.438 (0.038)	-0.027 (0.013)	0.128 (0.030)	-0.004 (0.013)	-0.022 (0.018)	0.065 (0.015)	-0.863 (0.070)	
Dairy products	-0.035 (0.068)	-0.086 (0.047)	-0.520 (0.036)	-0.041 (0.060)	-0.037 (0.025)	0.087 (0.037)	-0.043 (0.026)	-0.078 (0.116)	
Vegetables	0.108 (0.056)	0.184 (0.039)	-0.011 (0.021)	-0.683 (0.071)	-0.051 (0.021)	-0.016 (0.032)	-0.078 (0.022)	-0.110 (0.105)	
Fruits	0.218 (0.084)	-0.038 (0.058)	-0.055 (0.030)	-0.212 (0.072)	-0.087 (0.042)	-0.103 (0.044)	0.277 (0.033)	-1.048 (0.143)	
Oils & animal fats	-0.004 (0.044)	-0.011 (0.030)	0.046 (0.017)	-0.019 (0.042)	-0.029 (0.017)	-0.963 (0.038)	-0.019 (0.017)	0.390 (0.080)	
Other food items	-0.187 (0.029)	0.112 (0.020)	-0.011 (0.010)	-0.081 (0.023)	0.093 (0.010)	-0.016 (0.013)	-0.347 (0.016)	-0.181 (0.049)	
Other products and service	0.333 (0.020)	-0.218 (0.014)	-0.021 (0.006)	-0.068 (0.016)	-0.053 (0.006)	0.003 (0.009)	-0.078 (0.007)	-1.262 (0.042)	

Source: own calculation based on the HBS, Taj STAT (Quarter 4, 2014);

Note: Standard Errors in brackets

Table A4.19: Parameters estimates from the seasonal -QUAIDS: Pooled estimation 2013-2014, Country
Level N: 15000 (Censoring not adjusted)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.512*** (0.014)	0.257*** (0.008)	0.063*** (0.005)	0.155*** (0.009)	0.050*** (0.005)	0.028*** (0.006)	0.111*** (0.005)	0.848*** (0.024)
β_i	-0.026*** (0.005)	-0.013*** (0.002)	-0.011*** (0.001)	-0.022*** (0.002)	-0.006*** (0.001)	0.001 (0.002)	-0.016*** (0.002)	0.093*** (0.010)
γ_1	-0.189*** (0.003)	0.027*** (0.002)	-0.003*** (0.001)	0.008*** (0.002)	0.003*** (0.001)	-0.004*** (0.001)	-0.010*** (0.001)	0.168*** (0.004)
γ_2	0.027*** (0.002)	0.045*** (0.002)	-0.004*** (0.001)	0.007*** (0.001)	0.002*** (0.001)	0.000 (0.001)	0.005*** (0.001)	-0.082*** (0.003)
γ_3	-0.003*** (0.001)	-0.004*** (0.001)	0.014*** (0.000)	0.002*** (0.001)	-0.001*** (0.000)	0.003*** (0.000)	-0.000 (0.000)	-0.010*** (0.001)
γ_4	0.008*** (0.002)	0.007*** (0.001)	0.002*** (0.001)	0.031*** (0.002)	-0.004*** (0.001)	-0.003*** (0.001)	-0.005*** (0.001)	-0.036*** (0.003)
γ_5	0.003** (0.001)	0.002*** (0.001)	-0.001*** (0.000)	-0.004*** (0.001)	0.011*** (0.001)	-0.002*** (0.000)	0.005*** (0.000)	-0.014*** (0.002)
γ_6	-0.004*** (0.001)	0.000 (0.001)	0.003*** (0.000)	-0.003*** (0.001)	-0.002*** (0.000)	0.007*** (0.001)	-0.003*** (0.000)	0.001 (0.002)
γ_7	-0.010*** (0.001)	0.005*** (0.001)	-0.000 (0.000)	-0.005*** (0.001)	0.005*** (0.000)	-0.003*** (0.000)	0.044*** (0.001)	-0.037*** (0.002)
γ_8	0.168*** (0.004)	-0.082*** (0.003)	-0.010*** (0.001)	-0.036*** (0.003)	-0.014*** (0.002)	0.001 (0.002)	-0.037*** (0.002)	0.011*** (0.007)
λ_i	0.012*** (0.001)	-0.001* (0.001)	0.001** (0.000)	0.002*** (0.000)	-0.001*** (0.000)	0.006*** (0.000)	0.000 (0.000)	-0.018*** (0.001)
η_{rural}	0.006*** (0.001)	-0.007*** (0.001)	0.007*** (0.000)	0.011*** (0.001)	0.002*** (0.000)	-0.001 (0.000)	-0.003*** (0.000)	-0.016*** (0.002)
$\eta_{household\ size}$	-0.002*** (0.000)	-0.000 (0.000)	-0.001*** (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.002*** (0.000)	-0.001* (0.000)	0.003*** (0.001)
$\eta_{employer}$	0.003*** (0.001)	0.000 (0.000)	0.001*** (0.000)	0.000 (0.001)	0.000 (0.000)	0.001** (0.001)	0.001*** (0.000)	-0.006*** (0.001)
$\eta_{retiree}$	0.000 (0.001)	-0.001 (0.000)	0.001*** (0.001)	0.000 (0.000)	0.000 (0.000)	-0.001** (0.000)	-0.000 (0.000)	-0.001 (0.001)
$\eta_{schoolar}$	-0.007* (0.004)	0.004** (0.002)	0.001 (0.001)	-0.001 (0.002)	0.001 (0.001)	-0.001 (0.001)	0.002 (0.001)	0.000 (0.007)
$\eta_{children<16}$	-0.000 (0.000)	0.001*** (0.000)	-0.000 (0.000)	-0.001** (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.001*** (0.000)	0.001 (0.001)
$\eta_{adults>16}$	-0.002*** (0.000)	0.000 (0.000)	0.001*** (0.000)	-0.000 (0.000)	0.002* (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.001 (0.001)
$\eta_{Dushanbe}$	0.004 (0.007)	0.001 (0.001)	-0.000 (0.001)	0.005* (0.003)	-0.001** (0.001)	0.003 (0.002)	0.002 (0.002)	-0.013 (0.014)
η_{Sughd}	-0.027*** (0.005)	-0.024*** (0.002)	-0.004*** (0.001)	-0.007*** (0.002)	0.000 (0.001)	-0.011*** (0.002)	-0.008*** (0.001)	0.082*** (0.010)
$\eta_{Khatlon}$	-0.043*** (0.005)	-0.004*** (0.001)	0.002*** (0.001)	-0.020*** (0.002)	0.001 (0.001)	-0.013*** (0.002)	-0.015*** (0.001)	0.092*** (0.010)
η_{RRS}	-0.023*** (0.005)	0.009*** (0.001)	-0.004*** (0.001)	-0.008*** (0.002)	-0.002*** (0.001)	-0.005*** (0.001)	-0.012*** (0.001)	0.044*** (0.010)
η_{GBAO}	0.055*** (0.007)	0.006** (0.002)	0.004*** (0.001)	0.026*** (0.003)	-0.003** (0.001)	0.023*** (0.002)	0.010*** (0.002)	-0.122*** (0.012)

Continued: Country Level (pooled 2013-2014) censoring not adjusted

	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
η_{Summer}	0.002 (0.003)	-0.001 (0.001)	-0.000 (0.001)	0.007*** (0.001)	0.028*** (0.001)	-0.001 (0.001)	0.008*** (0.001)	-0.042*** (0.006)
η_{Winter}	-0.008*** (0.003)	0.006*** (0.002)	0.002*** (0.001)	-0.005*** (0.001)	0.011*** (0.001)	0.001 (0.001)	0.001 (0.001)	-0.008 (0.007)
η_{Spring}	-0.014*** (0.003)	0.001 (0.002)	0.001 (0.001)	0.018*** (0.002)	0.003*** (0.001)	-0.001 (0.001)	0.005*** (0.001)	-0.013** (0.007)
η_{Autumn}	-0.012*** (0.003)	0.000 (0.002)	0.002*** (0.001)	0.006*** (0.002)	0.004*** (0.001)	-0.000 (0.001)	-0.001 (0.001)	-0.002 (0.007)
	rho1	rho2	rho3	rho4	rho5	rho6	rho7	rho8
ρ_i	0.048*** (0.011)	0.036*** (0.007)	0.001 (0.006)	0.026*** (0.008)	0.021 (0.031)	-0.047*** (0.008)	0.037*** (0.008)	0.275 (0.261)
	rho9	rho10	rho11	rho12	rho13	rho14	rho15	rho16
ρ_i	-0.771*** (0.033)	-0.630*** (0.051)	-0.309*** (0.093)	14.467*** (3.588)	-0.065*** (0.021)	-0.040** (0.020)	-0.053*** (0.021)	0.006 (0.021)
RMSE	0.074	0.050	0.022	0.043	0.027	0.028	0.032	
R-sq	0.885	0.781	0.616	0.763	0.499	0.813	0.847	-

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 %, respectively



Table A4.20: Estimated Parameter of the Univariate Probit Model: Pooled estimation HBS (2013-2014)

	Bread & cereal		Meat & fish products		Dairy products		Vegetables		Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Intot_income	0.064	0.078	0.411***	0.039	0.120***	0.023	0.018**	0.035	0.351***	0.022	0.047	0.037	0.271***	0.096
lnp1	-0.039	0.273	0.257**	0.123	0.149**	0.078	0.468***	0.128	0.580***	0.071	-0.746***	0.120	-0.283	0.260
lnp2	0.247	0.190	-0.134**	0.075	-0.297***	0.048	0.141	0.087	-0.030	0.044	0.213**	0.098	0.180	0.176
lnp3	-0.065	0.107	-0.094**	0.055	-0.433***	0.036	0.235***	0.058	-0.011	0.032	0.234***	0.071	-0.029	0.112
lnp4	-0.202	0.199	0.217	0.100	0.231***	0.062	-0.480***	0.098	-0.264***	0.057	0.107	0.109	0.332	0.249
lnp5	-0.023	0.100	-0.003	0.050	0.126***	0.032	0.145**	0.057	-0.164***	0.028	0.084	0.055	-0.023	0.115
lnp6	-0.092	0.162	0.150	0.099	0.452***	0.061	-0.207**	0.091	-0.204***	0.053	-0.038	0.090	-0.193	0.177
lnp7	-0.230***	0.101	0.276***	0.043	0.268***	0.028	0.073	0.049	0.400***	0.025	-0.025	0.050	-0.038	0.102
Household size	-0.051	0.041	-0.009	0.019	0.044***	0.013	-0.015	0.018	-0.018	0.012	0.029	0.027	0.001	0.054
Num. of Employer	0.097	0.066	0.067**	0.028	-0.025	0.017	-0.001	0.028	0.088***	0.016	0.032	0.034	0.026	0.074
Num. of Retiree	0.019	0.073	-0.017	0.031	-0.071***	0.019	-0.007	0.032	0.037**	0.018	0.024	0.039	-0.146**	0.072
Num. of Schoolars			0.042	0.142	0.000	0.093	-0.118	0.129	-0.057	0.075	0.323	0.285		
Num. of Child 0-16	-0.042	0.055	-0.059***	0.018	-0.031***	0.012	-0.017	0.021	0.009	0.011	0.058**	0.024	-0.007	0.054
Num. of Adults 16>	0.178***	0.056	0.013	0.024	-0.047***	0.015	0.029	0.023	-0.003	0.014	-0.069**	0.032	0.030	0.066
Region: 1 if Dushanbe	-0.090	0.367	0.282***	0.104	0.577***	0.087	1.187***	0.297	0.360***	0.057	-0.164	0.171	-0.126	0.213
Region: 1 if Sughd	-0.790***	0.229	0.241***	0.086	0.357***	0.056	0.487***	0.078	0.123***	0.047	-1.163***	0.128	-0.471**	0.188
Region: 1 if Khatlon	-0.224***	0.257	0.030	0.078	-0.568***	0.053	1.380***	0.088	0.111**	0.046	-0.240*	0.134	0.006	0.207
Region: 1 if RRS	-0.772	0.233	-0.225***	0.080	0.280***	0.057	1.273***	0.091	0.477***	0.049	-0.077	0.143	-0.268	0.211
Season: 1 if Summer	0.272***	0.159	0.059	0.059	-0.006	0.038	0.399***	0.067	0.651***	0.038	-0.064	0.071	0.191	0.172
Season: 1 if Winter	0.098***	0.125	0.064	0.055	-0.085**	0.035	0.242***	0.057	0.351***	0.033	-0.130**	0.064	-0.070	0.130
Season: 1 if Spring	0.416***	0.170	-0.100*	0.061	-0.145***	0.040	0.987***	0.085	-0.521***	0.035	-0.015	0.078	-0.174	0.153
_Constant	2.701	0.979	-2.386***	0.468	-0.408	0.299	0.779**	0.477	-2.755***	0.264	2.432***	0.515	0.772	0.976
LR chi2	80.93		471.38		3102.9		1232.88		2686.24		528.4		65.41	
Prob>chi2	0.000		0.000		0.000		0.000		0.000		0.000		0.000	
Pseudo R2	0.1049		0.0088		0.1881		0.2265		0.1455		0.1395		0.0929	
N			15000		15000		15000		15000		15000		15000	

Source: own calculation based on data from HBS, (2013-2014)
 *, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A4.21: Parameters estimates from the seasonal -QUAIDS: Pooled estimation 2013-2014 at Country Level, N: 15000 (Censoring adjusted)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.5387*** (0.0159)	0.2380*** (0.0094)	0.0731*** (0.0052)	0.1846*** (0.0099)	0.0673*** (0.0057)	0.0200*** (0.0063)	0.1007*** (0.0054)	0.8550*** (0.0308)
β_i	-0.0307*** (0.0045)	-0.0301*** (0.0031)	-0.0165*** (0.0014)	-0.0134*** (0.0026)	-0.0178*** (0.0017)	-0.0017* (0.0018)	-0.0215*** (0.0019)	0.1318*** (0.0097)
γ_1	-0.1870*** (0.0036)	0.0237*** (0.0018)	-0.0037*** (0.0010)	0.0065*** (0.0018)	-0.0021*** (0.0011)	-0.0037*** (0.0013)	-0.0084*** (0.0011)	0.1749*** (0.0050)
γ_2	0.0237*** (0.0018)	0.0500*** (0.0017)	-0.0019*** (0.0007)	0.0041*** (0.0012)	0.0010*** (0.0008)	-0.0003 (0.0008)	0.0010 (0.0008)	-0.0776*** (0.0033)
γ_3	-0.0037*** (0.0010)	-0.0019*** (0.0007)	0.0206*** (0.0006)	-0.0002 (0.0008)	-0.0018*** (0.0004)	0.0010* (0.0006)	-0.0022*** (0.0004)	-0.0118*** (0.0017)
γ_4	0.0065*** (0.0018)	0.0041*** (0.0012)	-0.0002 (0.0008)	0.0405*** (0.0019)	-0.0029*** (0.0008)	-0.0024** (0.0009)	-0.0051*** (0.0007)	-0.0404*** (0.0031)
γ_5	-0.0021** (0.0011)	0.0010 (0.0008)	-0.0018*** (0.0004)	-0.0029*** (0.0008)	0.0183*** (0.0007)	-0.0013** (0.0005)	0.0019*** (0.0005)	-0.0129*** (0.0020)
γ_6	-0.0037*** (0.0013)	-0.0003 (0.0008)	0.0010* (0.0006)	-0.0024** (0.0009)	-0.0013** (0.0005)	0.0078*** (0.0010)	-0.0019*** (0.0005)	0.0009 (0.0021)
γ_7	-0.0084*** (0.0011)	0.0010 (0.0008)	-0.0022*** (0.0004)	-0.0051*** (0.0007)	0.0019*** (0.0005)	-0.0019*** (0.0005)	0.0459*** (0.0006)	-0.0311*** (0.0018)
γ_8	0.1749*** (0.0050)	-0.0776*** (0.0033)	-0.0118*** (0.0017)	-0.0404*** (0.0031)	-0.0129*** (0.0020)	0.0009 (0.0021)	-0.0311*** (0.0018)	-0.0021 (0.0105)
λ_i	0.0043** (0.0018)	-0.0046*** (0.0013)	-0.0023*** (0.0006)	0.0032*** (0.0011)	-0.0055*** (0.0008)	0.0042*** (0.0007)	-0.0044*** (0.0008)	0.0051 (0.0036)
d_i	-0.0279*** (0.0035)	0.0453*** (0.0043)	-0.5550*** (0.0509)	-0.8480*** (0.0133)	-0.6997*** (0.0230)	-0.6572*** (0.0258)	-0.7195*** (0.0242)	
η_{rural}	-0.0018 (0.0015)	-0.0056*** (0.0009)	0.0035*** (0.0007)	0.0048*** (0.0009)	-0.0002 (0.0006)	-0.0028*** (0.0005)	-0.0076*** (0.0006)	0.0098*** (0.0031)
$\eta_{household\ size}$	-0.0050*** (0.0006)	-0.0006** (0.0003)	0.0000 (0.0002)	-0.0004 (0.0003)	-0.0002 (0.0002)	-0.0011*** (0.0002)	-0.0006*** (0.0002)	0.0080*** (0.0011)
$\eta_{employer}$	0.0070*** (0.0007)	0.0031*** (0.0005)	0.0016*** (0.0002)	0.0005 (0.0004)	0.0015*** (0.0003)	0.0011*** (0.0003)	0.0013*** (0.0003)	-0.0161*** (0.0015)
$\eta_{retiree}$	0.0056*** (0.0008)	0.0003 (0.0005)	0.0006** (0.0003)	0.0010** (0.0004)	0.0002 (0.0003)	0.0008*** (0.0003)	0.0002 (0.0003)	-0.0088*** (0.0017)
$\eta_{schoolar}$	-0.0057 (0.0043)	0.0059*** (0.0021)	0.0002 (0.0012)	-0.0012 (0.0021)	0.0020 (0.0019)	-0.0007 (0.0014)	0.0018 (0.0014)	-0.0024 (0.0080)
$\eta_{children<16}$	0.0001 (0.0005)	-0.0010*** (0.0003)	-0.0004*** (0.0001)	-0.0005** (0.0002)	0.0003* (0.0002)	-0.0004** (0.0002)	-0.0004** (0.0002)	0.0022** (0.0010)
$\eta_{adults>16}$	0.0018*** (0.0007)	0.0015*** (0.0004)	0.0004** (0.0002)	-0.0001 (0.0003)	0.0004*** (0.0003)	0.0010*** (0.0002)	0.0005** (0.0002)	-0.0055*** (0.0013)
$\eta_{Dushanbe}$	-0.0197*** (0.0037)	0.0020 (0.0014)	-0.0018** (0.0007)	-0.0071*** (0.0019)	0.0011 (0.0009)	-0.0048*** (0.0012)	-0.0020** (0.0010)	0.0324*** (0.0074)
η_{Sughd}	-0.0283*** (0.0031)	-0.0229*** (0.0020)	-0.0030*** (0.0009)	-0.0122 (0.0017)	0.0008*** (0.0011)	-0.0106*** (0.0014)	-0.0045*** (0.0012)	0.0808*** (0.0069)
$\eta_{Khatlon}$	-0.0352*** (0.0030)	-0.0069*** (0.0016)	-0.0032*** (0.0009)	-0.0175*** (0.0017)	0.0016 (0.0010)	-0.0117*** (0.0011)	-0.0081*** (0.0010)	0.0811*** (0.0063)
η_{RRS}	-0.0331*** (0.0031)	0.0003 (0.0017)	-0.0042*** (0.0008)	-0.0103*** (0.0016)	0.0023** (0.0010)	-0.0081*** (0.0010)	-0.0112*** (0.0011)	0.0643*** (0.0062)

Continued: **Country Level** (pooled 2013-2014) *censoring adjusted*

	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
η_{GBAO}	-0.0677*** (0.0047)	-0.0047** (0.0019)	-0.0063*** (0.0010)	0.0050*** (0.0019)	0.0106*** (0.0014)	-0.0209*** (0.0016)	-0.0075*** (0.0013)	0.0913*** (0.0086)
θ_{Summer}	0.0037*** (0.0013)	-0.0042*** (0.0009)	-0.0019*** (0.0005)	0.0026*** (0.0008)	0.0127*** (0.0009)	-0.0013** (0.0005)	0.0025*** (0.0006)	-0.0141*** (0.0025)
θ_{Winter}	-0.0006 (0.0012)	0.0031*** (0.0008)	0.0016*** (0.0005)	-0.0108*** (0.0008)	-0.0055*** (0.0007)	0.0010*** (0.0005)	-0.0018*** (0.0005)	0.0128*** (0.0022)
θ_{Spring}	-0.0089*** (0.0013)	0.0012 (0.0009)	0.0003 (0.0005)	0.0064*** (0.0009)	0.0044*** (0.0012)	-0.0010** (0.0005)	0.0009** (0.0005)	-0.0034 (0.0025)
θ_{Autumn}	0.0057*** (0.0010)	-0.0001 (0.0007)	0.0000 (0.0004)	0.0018*** (0.0007)	-0.0116*** (0.0005)	0.0012*** (0.0004)	-0.0016*** (0.0004)	0.0047*** (0.0018)
	rho1	rho2	rho3	rho4	rho5	rho6		
ρ_i	-0.0633 (0.0728)	-0.1673*** (0.0141)	-0.0028 (0.0028)	-0.0256*** (0.0065)	-0.0126*** (0.0030)	0.0484*** (0.0088)		
	rho7	rho8	rho9	rho10	rho11	rho12		
ρ_i	0.0071 (0.0344)	-0.0123** (0.0074)	-0.0010*** (0.0027)	0.0199*** (0.0042)	0.0484*** (0.0060)	0.0203 (0.0156)		
RMSE	0.0743	0.0497	0.0223	0.0442	0.0267	0.0282	0.0320	
R-sq	0.8851	0.7863	0.6151	0.7596	0.5039	0.8146	0.8501	

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 %, respectively



Table A4.22: Estimated Parameter of the Univariate Probit Model for Urban: Pooled estimation HBS (2013-2014)

	Bread & cereal		Meat & fish products		Dairy products		Vegetables		Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Intot_income	-0.255	0.179	0.547***	0.089	0.449***	0.071	0.289**	0.143	0.337***	0.048	0.028**	0.090	0.092**	0.140
lnp1	0.371	0.485	0.162	0.217	0.465**	0.182	-0.105	0.315	0.268**	0.117	0.501**	0.247	0.164	0.362
lnp2	-0.033	0.406	-0.096***	0.127	-0.585***	0.102	0.227	0.211	-0.045***	0.072	-0.113	0.170	0.230	0.213
lnp3	-0.174	0.157	0.011	0.082	0.585***	0.082	-0.273***	0.103	0.062	0.044	0.174**	0.094	0.110	0.144
lnp4	0.210	0.317	0.361**	0.195	-0.024	0.150	0.621**	0.291	-0.056***	0.102	0.439**	0.199	0.880**	0.351
lnp5	-0.043	0.144	-0.224***	0.076	-0.160**	0.063	-0.349***	0.112	0.056	0.046	0.116	0.083	0.098	0.150
lnp6	-0.042	0.242	0.519***	0.150	0.476***	0.113	-0.753***	0.201	-0.114	0.077	0.438***	0.141	-0.329	0.210
lnp7	-0.313**	0.160	0.245***	0.065	0.288***	0.050	-0.025	0.105	0.245***	0.036	-0.182**	0.071	-0.003	0.118
Household size	-0.037	0.088	-0.013	0.044	-0.043	0.034	-0.187***	0.051	0.069***	0.026	0.058	0.055	0.052	0.085
Num. of Employer	0.284	0.140	0.068	0.057	-0.018	0.044	0.049	0.080	-0.081**	0.033	-0.075	0.066	0.092	0.108
Num. of Retiree	-0.087	0.128	0.000	0.065	-0.030	0.049	0.032	0.087	-0.068**	0.036	0.061	0.075	-0.047	0.107
Num. of Schoolars					0.031	0.166			-0.259***	0.098	0.068	0.340		
Num. of Child 0-16	-0.059	0.112	-0.012	0.032	0.048*	0.026	-0.023	0.062	0.014	0.020	-0.008	0.045	-0.112	0.075
Num. of Adults 16>	0.237**	0.106	-0.050	0.050	-0.011	0.039	0.179***	0.065	-0.101***	0.030	-0.024	0.063	0.060	0.099
Region: 1 if Sughd	-0.969***	0.253	0.174	0.138	0.130	0.100	0.047	0.172	-0.051	0.061	-0.289**	0.114	-0.453***	0.170
Region: 1 if Khatlon			-0.392***	0.085	-0.764***	0.068			-0.437***	0.053	0.791***	0.180	0.180	0.200
Region: 1 if RRS	-1.113***	0.286	-0.254**	0.125	0.031	0.112	0.468	0.342	0.123	0.077	0.108	0.155	-0.065	0.268
Season: 1 if Summer			-0.075	0.093	-0.079	0.076			0.480***	0.062	-0.090	0.112	0.152	0.209
Season: 1 if Winter			0.089	0.096	0.041	0.077			0.252***	0.056	0.098	0.125	-0.148	0.164
Season: 1 if Spring			-0.134	0.106	-0.071	0.086			-0.648***	0.059	0.089	0.141	-0.250	0.206
_Constant	4.870***	1.848	-3.619***	0.814	-2.273***	0.640	2.221**	1.138	-2.227***	0.430	-0.339	0.909	-0.031	1.259
LR chi2	63.78		270.67		852.96		64.21		865.85		111.40		38.36	
Prob>chi2	0.000		0.000		0.000		0.000		0.000		0.000		0.0053	
Psuedo R2	0.2297		0.1388		0.2354		0.1177		0.1348		0.0943		0.0858	
N	5750		5750		5750		5750		5750		5750		5750	

Source: own calculation based on data from HBS, (2013-2014)

*, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A4.23: Parameters estimates from the seasonal -QUAIDS: Pooled estimation 2013-2014 Urban
Sample, N: 5750 (Censoring adjusted)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.2820*** (0.0227)	0.2260*** (0.0186)	0.0873*** (0.0082)	0.0406*** (0.0153)	0.0692*** (0.0101)	0.0007 (0.0089)	0.0908*** (0.0105)	0.7674*** (0.0618)
β_i	-0.0659*** (0.0118)	-0.0998*** (0.0104)	-0.0362*** (0.0049)	-0.0590*** (0.0079)	-0.0523*** (0.0066)	-0.0163*** (0.0050)	-0.0602*** (0.0065)	0.3895*** (0.0280)
γ_1	-0.0655*** (0.0053)	0.0199*** (0.0035)	-0.0011 (0.0016)	0.0004 (0.0029)	0.0031 (0.0020)	-0.0066*** (0.0019)	-0.0056*** (0.0021)	0.0554*** (0.0115)
γ_2	0.0199*** (0.0035)	0.0620*** (0.0047)	0.0052*** (0.0016)	0.0104*** (0.0026)	0.0072*** (0.0020)	0.0073*** (0.0015)	0.0156*** (0.0023)	-0.1276*** (0.0128)
γ_3	-0.0011 (0.0016)	0.0052*** (0.0016)	0.0265*** (0.0012)	0.0002 (0.0013)	-0.0002 (0.0009)	0.0018** (0.0008)	0.0001 (0.0009)	-0.0324*** (0.0048)
γ_4	0.0004 (0.0029)	0.0104*** (0.0026)	0.0002 (0.0013)	0.0187*** (0.0031)	0.0005 (0.0014)	0.0005 (0.0014)	0.0016 (0.0015)	-0.0324*** (0.0081)
γ_5	0.0031* (0.0020)	0.0072*** (0.0020)	-0.0002 (0.0009)	0.0005 (0.0014)	0.0227*** (0.0015)	0.0000 (0.0008)	0.0070*** (0.0013)	-0.0402*** (0.0067)
γ_6	-0.0066*** (0.0019)	0.0073*** (0.0015)	0.0018** (0.0008)	0.0005 (0.0014)	0.0000 (0.0008)	0.0043*** (0.0013)	0.0007 (0.0008)	-0.0079* (0.0044)
γ_7	-0.0056*** (0.0021)	0.0156*** (0.0023)	0.0001 (0.0009)	0.0016 (0.0015)	0.0070*** (0.0013)	0.0007 (0.0008)	0.0448*** (0.0016)	-0.0643*** (0.0074)
γ_8	0.0554*** (0.0115)	-0.1276*** (0.0128)	-0.0324*** (0.0048)	-0.0324*** (0.0081)	-0.0402*** (0.0067)	-0.0079** (0.0044)	-0.0643*** (0.0074)	0.2495*** (0.0417)
λ_i	-0.0013 (0.0056)	-0.0390*** (0.0063)	-0.0098*** (0.0027)	-0.0134*** (0.0043)	-0.0229*** (0.0040)	0.0016 (0.0024)	-0.0197*** (0.0037)	0.1044*** (0.0192)
d_i	-0.0909*** (0.0253)	0.1218*** (0.0320)	-0.0891 (0.1199)	-0.6418*** (0.0582)	-0.3702*** (0.0861)	-0.5611*** (0.0748)	-0.1013 (0.2598)	
$\eta_{\text{household size}}$	-0.0015*** (0.0005)	0.0003 (0.0002)	0.0004*** (0.0001)	0.0003 (0.0002)	-0.0004** (0.0002)	-0.0003 (0.0002)	-0.0001 (0.0002)	0.0012 (0.0009)
η_{employer}	0.0014** (0.0006)	0.0003 (0.0003)	0.0008*** (0.0002)	0.0002 (0.0003)	0.0010*** (0.0003)	0.0006*** (0.0002)	0.0005** (0.0002)	-0.0047*** (0.0011)
η_{retiree}	-0.0001 (0.0007)	-0.0004 (0.0003)	-0.0004** (0.0002)	-0.0006** (0.0003)	0.0007*** (0.0003)	-0.0003 (0.0003)	0.0006** (0.0003)	0.0005 (0.0012)
η_{schoolar}	-0.0021 (0.0026)	0.0009 (0.0011)	-0.0002 (0.0007)	-0.0017 (0.0013)	0.0022** (0.0011)	-0.0002 (0.0008)	0.0007 (0.0008)	0.0003 (0.0045)
$\eta_{\text{children}<16}$	0.0009** (0.0004)	-0.0001 (0.0002)	-0.0008*** (0.0001)	0.0001 (0.0002)	-0.0001 (0.0002)	-0.0004*** (0.0001)	-0.0001 (0.0001)	0.0005 (0.0007)
$\eta_{\text{adults}>16}$	0.0001 (0.0006)	0.0005* (0.0003)	0.0001 (0.0002)	-0.0002 (0.0003)	0.0006** (0.0002)	0.0004** (0.0002)	0.0001 (0.0002)	-0.0016* (0.0010)
η_{Dushanbe}	-0.0007 (0.0018)	0.0007 (0.0008)	0.0020*** (0.0005)	-0.0001 (0.0010)	-0.0003 (0.0006)	0.0007 (0.0006)	-0.0005 (0.0005)	-0.0019 (0.0026)
η_{Sughd}	0.0003 (0.0016)	-0.0070*** (0.0008)	0.0022*** (0.0004)	0.0026*** (0.0008)	-0.0006 (0.0006)	0.0013 (0.0009)	-0.0002 (0.0006)	0.0013 (0.0025)
η_{Khatlon}	-0.0134*** (0.0022)	0.0018** (0.0008)	-0.0041*** (0.0008)	0.0003 (0.0011)	0.0021*** (0.0006)	-0.0020*** (0.0007)	-0.0003 (0.0005)	0.0156*** (0.0034)
η_{RRS}	-0.0138*** (0.0027)	0.0047*** (0.0012)	0.0027*** (0.0006)	-0.0077*** (0.0015)	0.0027*** (0.0008)	-0.0009 (0.0008)	-0.0068*** (0.0010)	0.0191*** (0.0047)
η_{GBO}	-0.0177*** (0.0045)	0.0088*** (0.0014)	-0.0035*** (0.0008)	0.0008 (0.0013)	0.0042*** (0.0011)	-0.0042*** (0.0014)	-0.0024*** (0.0008)	0.0140** (0.0060)

Continued: **Urban Sample**, (pooled 2013-2014) *censoring adjusted*

	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
θ_{Summer}	0.0029 (0.0018)	-0.0057*** (0.0014)	-0.0030*** (0.0008)	0.0085*** (0.0012)	0.0155*** (0.0016)	-0.0025*** (0.0008)	0.0056*** (0.0010)	-0.0213*** (0.0040)
θ_{Winter}	0.0033** (0.0017)	0.0071*** (0.0013)	0.0022*** (0.0007)	-0.0177*** (0.0011)	-0.0019** (0.0011)	0.0018*** (0.0007)	-0.0036*** (0.0009)	0.0089*** (0.0034)
θ_{Spring}	-0.0067*** (0.0017)	-0.0010 (0.0014)	0.0016** (0.0007)	0.0118*** (0.0013)	0.0001 (0.0020)	-0.0014** (0.0008)	-0.0007 (0.0009)	-0.0037 (0.0039)
θ_{Autumn}	0.0005 (0.0014)	-0.0004 (0.0010)	-0.0009 (0.0006)	-0.0026*** (0.0010)	-0.0137*** (0.0008)	0.0021*** (0.0006)	-0.0012** (0.0007)	0.0161*** (0.0027)
	rho1	rho2	rho3	rho4	rho5	rho6		
ρ_i	-0.1138 (0.1033)	-0.0150 (0.0266)	-0.0645*** (0.0083)	-0.0871** (0.0389)	0.0022 (0.0057)	0.0904*** (0.0196)		
	rho7	rho8	rho9	rho10	rho11			
ρ_i	0.13747*** (0.04760)	0.04613** (0.02520)	0.07893** (0.03118)	0.07499** (0.03535)	0.04398 (0.08399)			
RMSE	0.06145	0.0447	0.0245	0.0401	0.0282	0.0259	0.0314	
R-sq	0.8896	0.7865	0.7021	0.8170	0.5283	0.8082	0.8020	

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 %, respectively



Table A4.24: Estimated Parameter of the Univariate Probit Model for Rural: Pooled estimation HBS (2013-2014)

	Bread & cereal		Meat & fish products		Dairy products		Vegetables		Fruits		Oils & fats products		Other food items	
	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er	Coef.	Std. Er
Intot_income	0.119	0.091	0.375***	0.044	0.066***	0.024	0.051**	0.035	0.373***	0.025	0.001	0.042	0.401***	0.148
lnp1	-0.202	0.319	0.084	0.150	-0.046	0.089	0.394***	0.135	0.654***	0.091	-0.964***	0.141	-0.914**	0.409
lnp2	0.250	0.229	-0.112***	0.096	-0.192***	0.055	0.228**	0.092	0.005	0.056	0.126	0.121	0.180	0.344
lnp3	0.164	0.176	-0.272***	0.074	-0.957***	0.044	0.286***	0.066	-0.149***	0.046	0.539***	0.107	-0.203	0.173
lnp4	0.225	0.232	0.148**	0.119	0.295***	0.070	-0.751***	0.103	-0.300***	0.069	0.311**	0.134	-0.131	0.343
lnp5	-0.006	0.130	0.132**	0.069	0.205***	0.038	0.130**	0.062	-0.329***	0.038	0.220***	0.076	-0.147	0.195
lnp6	-0.025	0.223	-0.190*	0.127	0.359***	0.070	-0.318***	0.093	-0.264***	0.071	-0.017	0.121	0.202	0.392
lnp7	-0.157	0.141	0.275***	0.059	0.235***	0.036	0.067	0.055	0.559***	0.037	0.051	0.068	-0.186	0.223
Household size	-0.002	0.052	-0.002	0.022	0.066***	0.014	-0.024	0.018	-0.034**	0.013	0.065**	0.031	-0.042	0.067
Num. of Employer	-0.007	0.078	0.066**	0.033	-0.022	0.019	0.007	0.029	0.140***	0.019	0.009	0.041	-0.018	0.118
Num. of Retiree	0.020	0.094	-0.036	0.036	-0.087***	0.022	-0.011	0.034	0.055**	0.022	-0.024	0.045	-0.294***	0.108
Num. of Child 0-16	-0.051	0.064	-0.079***	0.022	-0.059***	0.013	-0.009	0.023	0.011	0.014	0.045	0.029	0.144	0.090
Num. of Adults 16>	0.114	0.071	0.020	0.028	-0.060***	0.017	0.027	0.024	0.006	0.017	-0.091**	0.036	-0.009	0.087
Region: 1 if Sughd	-0.209	0.168	-0.116	0.104	0.110**	0.056	0.282***	0.071	0.037	0.055	-0.369***	0.089	-0.912**	0.366
Region: 1 if Khatlon	0.497**	0.210	-0.034	0.091	-0.868***	0.048	1.139***	0.074	0.217***	0.049	0.568***	0.092	-0.051	0.423
Region: 1 if RRS	0.059	0.187	-0.457***	0.090	-0.052	0.052	1.050***	0.079	0.529***	0.053	0.916***	0.118	-0.498	0.368
Season: 1 if Summer			0.144**	0.080	0.020	0.045	0.358***	0.073	0.697***	0.049	-0.015	0.091		
Season: 1 if Winter			0.081	0.068	-0.132***	0.041	0.201***	0.062	0.440***	0.041	-0.102	0.080		
Season: 1 if Spring			-0.059	0.077	-0.197***	0.046	0.974***	0.088	-0.454***	0.045	0.005	0.093		
_Constant	0.895	1.194	-0.928	0.584	-0.145	0.341	0.053	0.499	-3.307***	0.343	1.441**	0.646	2.157	1.794
LR chi2	32.22		295.43		1524.86		760.14		1919.98		362.57		40.36	
Prob>chi2	0.0006		0.0000		0.0000		0.0000		0.0000		0.0000		0.0007	
Psuedo R2	0.0673		0.0867		0.1302		0.1675		0.1665		0.1398		0.1714	
N	9250		9250		9250		9250		9250		9250		9250	

Source: own calculation based on data from HBS, (2013-2014)
 *, **, *** defined significance at 10, 5 and 1 percent, respectively

Table A4.25: Parameters estimates from the seasonal -QUAIDS: Pooled estimation 2013-2014 Rural
Sample, N: 9250 (Censoring adjusted)

Parameters	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
α_i	-0.8287*** (0.0256)	0.2685*** (0.0136)	0.0546*** (0.0107)	0.2408*** (0.0153)	0.0964*** (0.0090)	0.0428*** (0.0105)	0.1049*** (0.0089)	1.0207*** (0.0509)
β_i	-0.0473*** (0.0039)	-0.0124*** (0.0030)	-0.0054*** (0.0010)	-0.0242*** (0.0020)	-0.0061*** (0.0013)	-0.0131*** (0.0013)	-0.0103*** (0.0018)	0.1188*** (0.0090)
γ_1	-0.2685*** (0.0053)	0.0403*** (0.0025)	-0.0026* (0.0016)	0.0227*** (0.0026)	0.0024 (0.0016)	0.0043** (0.0020)	-0.0040*** (0.0016)	0.2054*** (0.0073)
γ_2	0.0403*** (0.0025)	0.0526*** (0.0022)	-0.0010 (0.0011)	0.0071*** (0.0016)	0.0014 (0.0011)	-0.0008 (0.0011)	-0.0025** (0.0010)	-0.0972*** (0.0047)
γ_3	-0.0026* (0.0016)	-0.0010 (0.0011)	0.0158*** (0.0023)	0.0018*** (0.0012)	-0.0003 (0.0007)	0.0016 (0.0010)	-0.0015** (0.0007)	-0.0137*** (0.0028)
γ_4	0.0227*** (0.0026)	0.0071*** (0.0016)	0.0018 (0.0012)	0.0517*** (0.0026)	0.0006* (0.0011)	-0.0010 (0.0014)	-0.0047*** (0.0010)	-0.0781*** (0.0045)
γ_5	0.0024* (0.0016)	0.0014 (0.0011)	-0.0003 (0.0007)	0.0006*** (0.0011)	0.0192*** (0.0011)	-0.0007 (0.0008)	0.0022*** (0.0007)	-0.0247*** (0.0028)
γ_6	0.0043** (0.0020)	-0.0008 (0.0011)	0.0016* (0.0010)	-0.0010*** (0.0014)	-0.0007 (0.0008)	0.0154*** (0.0016)	-0.0015** (0.0007)	-0.0172*** (0.0033)
γ_7	-0.0040** (0.0016)	-0.0025*** (0.0010)	-0.0015*** (0.0007)	-0.0047*** (0.0010)	0.0022** (0.0007)	-0.0015*** (0.0007)	0.0550*** (0.0009)	-0.0430*** (0.0029)
γ_8	0.2054*** (0.0073)	-0.0972*** (0.0047)	-0.0137*** (0.0028)	-0.0781*** (0.0045)	-0.0247*** (0.0028)	-0.0172*** (0.0033)	-0.0430*** (0.0029)	0.0685*** (0.0153)
λ_i	0.0044*** (0.0004)	0.0054*** (0.0005)	0.0006*** (0.0001)	0.0015*** (0.0002)	0.0001 (0.0002)	0.0014*** (0.0002)	0.0029*** (0.0003)	-0.0164*** (0.0013)
d_i	0.0938 (0.0918)	-0.0073 (0.0544)	0.0852 (0.0536)	55.8582** (28.5747)	-0.3978*** (0.0762)	0.9627** (0.4054)	-0.5167*** (0.0666)	
$\eta_{\text{household size}}$	0.0100*** (0.0021)	-0.0061*** (0.0016)	-0.0008 (0.0006)	0.0027** (0.0011)	-0.0019** (0.0009)	0.0010 (0.0007)	0.0007 (0.0009)	-0.0057 (0.0051)
η_{employer}	-0.0095*** (0.0021)	0.0062*** (0.0016)	0.0008 (0.0006)	-0.0031*** (0.0011)	0.0021** (0.0009)	-0.0014 (0.0007)	-0.0008 (0.0009)	0.0057 (0.0051)
η_{retiree}	-0.0020*** (0.0004)	-0.0016*** (0.0003)	0.0002* (0.0001)	-0.0006*** (0.0002)	-0.0002*** (0.0001)	-0.0007*** (0.0001)	-0.0014*** (0.0002)	0.0064*** (0.0009)
η_{schoolar}	-0.0159*** (0.0031)	0.0073*** (0.0021)	0.0014* (0.0008)	-0.0012 (0.0015)	0.0023** (0.0012)	-0.0017* (0.0010)	0.0003 (0.0012)	0.0076 (0.0072)
$\eta_{\text{children}<16}$	-0.0089*** (0.0021)	0.0062*** (0.0016)	0.0010* (0.0006)	-0.0026** (0.0011)	0.0022** (0.0009)	-0.0008 (0.0007)	-0.0004 (0.0009)	0.0032 (0.0051)
$\eta_{\text{adults}>16}$	-0.0129*** (0.0022)	0.0055*** (0.0016)	0.0006 (0.0006)	-0.0032*** (0.0011)	0.0018** (0.0009)	-0.0014** (0.0007)	-0.0013 (0.0009)	0.0108** (0.0051)
η_{Sughd}	0.0631*** (0.0051)	0.0473*** (0.0031)	0.0072*** (0.0009)	0.0269*** (0.0024)	0.0050*** (0.0011)	0.0188*** (0.0016)	0.0272*** (0.0020)	-0.1955*** (0.0135)
η_{Khatlon}	-0.0243*** (0.0034)	-0.0028* (0.0016)	0.0013 (0.0009)	-0.0087*** (0.0018)	0.0001 (0.0005)	-0.0047*** (0.0009)	-0.0118*** (0.0014)	0.0509*** (0.0086)
η_{RRS}	-0.0004 (0.0043)	0.0082*** (0.0022)	-0.0005 (0.0006)	0.0045** (0.0019)	0.0011** (0.0005)	0.0024** (0.0011)	-0.0038** (0.0018)	-0.0116 (0.0113)
η_{GBAO}	-0.0497*** (0.0050)	-0.0111*** (0.0022)	-0.0032*** (0.0007)	0.0116*** (0.0015)	0.0050*** (0.0009)	-0.0103*** (0.0013)	-0.0123*** (0.0015)	0.0700*** (0.0107)
θ_{Summer}	0.0059 (0.0018)	-0.0013*** (0.0012)	0.0001 (0.0007)	-0.0034*** (0.0011)	0.0203*** (0.0008)	-0.0013** (0.0007)	0.0018** (0.0007)	-0.0221*** (0.0032)
θ_{Winter}	-0.0047*** (0.0017)	0.0023** (0.0011)	0.0004 (0.0006)	-0.0071*** (0.0010)	-0.0012 (0.0009)	0.0011* (0.0006)	-0.0018*** (0.0007)	0.0111*** (0.0030)

Continued: **Rural Sample**, (pooled 2013-2014) *censoring adjusted*

	Bread & cereal	Meat & fish	Dairy products	Vegetables products	Fruits products	Oils & fats products	Other food items	Other prod. & services
θ_{Spring}	-0.0085*** (0.0017)	-0.0004 (0.0011)	-0.0011* (0.0007)	0.0097*** (0.0011)	-0.0069*** (0.0009)	-0.0001 (0.0007)	0.0015** (0.0007)	0.0058** (0.0031)
θ_{Autumn}	0.0074*** (0.0013)	-0.0005 (0.0009)	0.0006 (0.0005)	0.0008 (0.0008)	-0.0122*** (0.0007)	0.0003 (0.0005)	-0.0016*** (0.0005)	0.0051** (0.0024)
	rho1	rho2	rho3	rho4	rho5			
ρ_i	1.1968*** (0.1687)	-0.2276*** (0.0154)	0.0203*** (0.0051)	0.0171 (0.0170)	-0.0014 (0.0030)			
	rho6	rho7	rho8	rho9	rho10			
ρ_i	0.0292*** (0.0095)	-0.1001** (0.0413)	-0.0070 (0.0535)	-0.0046 (0.0530)	-0.0023 (0.0112)			
RMSE	0.0789	0.0508	0.0208	0.0448	0.0259	0.0295	0.0318	
R-sq	0.8903	0.7881	0.4846	0.7387	0.4752	0.818	0.8731	

Note: Standard Errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 %, respectively



Table A4.26: Average Seasonal Uncompensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W1/s1	-1.935*** (0.046)	0.145*** (0.014)	-0.014*** (0.009)	0.097 (0.040)	0.005 (0.008)	-0.009 (0.008)	-0.031 (0.023)	1.130** (0.516)
W1/s2	-1.936*** (0.048)	0.148*** (0.012)	-0.012*** (0.008)	0.044 (0.016)	-0.002 (0.006)	-0.009 (0.008)	-0.033 (0.025)	1.139** (0.528)
W1/s3	-1.939*** (0.051)	0.147*** (0.012)	-0.013*** (0.009)	0.050 (0.011)	0.002 (0.006)	-0.009 (0.008)	-0.032 (0.024)	1.133** (0.521)
W1/s4	-1.934*** (0.046)	0.146*** (0.013)	-0.013*** (0.009)	0.048 (0.012)	-0.004 (0.007)	-0.009 (0.008)	-0.033 (0.025)	1.136** (0.525)
W2/s1	0.273*** (0.099)	-0.457*** (0.032)	-0.014 (0.018)	0.059*** (0.022)	0.030** (0.014)	0.007 (0.014)	0.020 (0.050)	-0.431 (0.091)
W2/s2	0.271*** (0.102)	-0.454*** (0.026)	-0.013 (0.016)	0.052 (0.032)	0.021** (0.009)	0.008 (0.013)	0.018 (0.054)	-0.418 (0.114)
W2/s3	0.267** (0.110)	-0.455*** (0.028)	-0.013 (0.017)	0.061*** (0.019)	0.026** (0.009)	0.007 (0.014)	0.019 (0.052)	-0.426 (0.100)
W2/s4	0.274*** (0.097)	-0.455*** (0.029)	-0.013 (0.017)	0.059*** (0.022)	0.018 (0.013)	0.008 (0.013)	0.018 (0.054)	-0.422 (0.107)
W3/s1	-0.093 (0.159)	-0.037 (0.058)	-0.373*** (0.034)	0.008 (0.042)	-0.039*** (0.014)	0.038 (0.028)	-0.059 (0.076)	0.005 (1.382)
W3/s2	-0.095 (0.163)	-0.034 (0.052)	-0.372*** (0.032)	0.002 (0.054)	-0.047** (0.019)	0.039 (0.027)	-0.061 (0.080)	0.017 (1.409)
W3/s3	-0.098 (0.171)	-0.034 (0.053)	-0.372*** (0.033)	0.009 (0.039)	-0.042*** (0.013)	0.038 (0.028)	-0.060 (0.078)	0.010 (1.393)
W3/s4	-0.092 (0.157)	-0.035 (0.055)	-0.372*** (0.033)	0.007 (0.043)	-0.049 (0.024)	0.039 (0.026)	-0.061 (0.080)	0.013 (1.401)
W4/s1	0.109 (0.087)	0.070 (0.028)	0.002 (0.018)	-0.463*** (0.029)	-0.028** (0.014)	-0.024 (0.015)	-0.057 (0.042)	-0.404 (0.953)
W4/s2	0.108 (0.090)	0.072*** (0.023)	0.003 (0.016)	-0.466*** (0.035)	-0.031*** (0.011)	-0.024** (0.014)	-0.057 (0.045)	-0.399 (0.974)
W4/s3	0.106 (0.097)	0.071*** (0.025)	0.003 (0.017)	-0.463*** (0.027)	-0.029*** (0.010)	-0.024 (0.015)	-0.057 (0.043)	-0.402 (0.962)
W4/s4	0.109 (0.086)	0.071*** (0.025)	0.003 (0.017)	-0.464*** (0.029)	-0.033** (0.013)	-0.024** (0.014)	-0.057 (0.045)	-0.400 (0.968)
W5/s1	-0.056 (0.383)	0.044 (0.145)	-0.052 (0.071)	-0.075 (0.091)	-0.453*** (0.020)	-0.032 (0.060)	0.054 (0.183)	0.098 (3.073)
W5/s2	-0.058 (0.392)	0.048 (0.129)	-0.050 (0.063)	-0.082 (0.120)	-0.463*** (0.041)	-0.030 (0.055)	0.052 (0.192)	0.112 (3.131)
W5/s3	-0.063 (0.410)	0.047 (0.133)	-0.051 (0.066)	-0.073 (0.084)	-0.457*** (0.025)	-0.031 (0.059)	0.053 (0.186)	0.103 (3.096)
W5/s4	-0.055 (0.379)	0.047 (0.136)	-0.051 (0.067)	-0.075 (0.093)	-0.466*** (0.054)	-0.030 (0.055)	0.052 (0.192)	0.108 (3.113)
W6/s1	-0.041 (0.143)	0.008 (0.041)	0.021 (0.027)	-0.033 (0.029)	-0.016 (0.020)	-0.861*** (0.023)	-0.024 (0.071)	0.035 (1.646)
W6/s2	-0.041 (0.149)	0.008 (0.032)	0.021 (0.022)	-0.034 (0.045)	-0.017 (0.011)	-0.861*** (0.021)	-0.024 (0.077)	0.037 (1.683)
W6/s3	-0.042 (0.160)	0.008 (0.035)	0.021 (0.024)	-0.033 (0.025)	-0.017 (0.011)	-0.861*** (0.023)	-0.024 (0.073)	0.036 (1.661)
W6/s4	-0.041 (0.140)	0.008 (0.036)	0.021 (0.024)	-0.033 (0.030)	-0.018 (0.017)	-0.861*** (0.021)	-0.024 (0.077)	0.037 (1.672)
W7/s1	-0.082 (0.118)	0.045 (0.038)	-0.024 (0.023)	-0.051** (0.023)	0.051*** (0.018)	-0.014 (0.014)	-0.343*** (0.060)	0.048 (1.455)
W7/s2	-0.085 (0.123)	0.049 (0.030)	-0.022 (0.018)	-0.060 (0.038)	0.040 (0.009)	-0.012 (0.011)	-0.346*** (0.065)	0.064 (1.487)

Continued : Average Seasonal Uncompensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W7/s3	-0.090 (0.133)	0.048 (0.032)	-0.023 (0.020)	-0.049*** (0.019)	0.046*** (0.009)	-0.014 (0.014)	-0.344*** (0.062)	0.054 (1.467)
W7/s4	-0.081 (0.115)	0.047 (0.034)	-0.023 (0.020)	-0.052** (0.024)	0.036*** (0.014)	-0.012 (0.011)	-0.346*** (0.065)	0.059 (1.477)
W8/s1	0.341*** (0.024)	-0.196*** (0.010)	-0.032*** (0.005)	-0.106*** (0.008)	-0.049** (0.005)	-0.010** (0.005)	-0.080*** (0.011)	-1.359*** (0.260)
W8/s2	0.344*** (0.024)	-0.199*** (0.009)	-0.034*** (0.005)	-0.099*** (0.009)	-0.040** (0.004)	-0.011** (0.005)	-0.078*** (0.012)	-1.372*** (0.266)
W8/s3	0.348*** (0.026)	-0.198*** (0.009)	-0.033*** (0.005)	-0.108*** (0.007)	-0.045** (0.004)	-0.010** (0.005)	-0.080*** (0.012)	-1.364*** (0.263)
W8/s4	0.340*** (0.023)	-0.198*** (0.009)	-0.033*** (0.005)	-0.106*** (0.008)	-0.037** (0.005)	-0.011*** (0.005)	-0.078*** (0.012)	-1.368*** (0.264)

Source: own calculation based on the HBS,(2013-2014)

Note: Standard errors are presented in parentheses and;

*,**,*** defined significance at 10, 5 and 1 %, respectively

W1- expenditure of bread and cereal products

W2- expenditure of meat and fish products

W3- expenditure of dairy products

W4- expenditure of vegetables

W5- expenditure of fruits

W6- expenditure of oils and animal fats

W7- expenditure of other food items

W8- expenditure of other products and service (non-food items)

S1-Summer period

S2-Winter period

S3-Spring period

S4-Autumn period

Table A4.27: Average Seasonal Compensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W1/s1	-1.807*** (0.126)	0.206*** (0.051)	0.003 (0.019)	0.097** (0.040)	0.020*** (0.007)	0.028 (0.030)	0.016 (0.053)	1.436*** (0.318)
W1/s2	-1.809*** (0.128)	0.208*** (0.048)	0.004 (0.018)	0.093*** (0.046)	0.014 (0.013)	0.029 (0.029)	0.014 (0.055)	1.445*** (0.330)
W1/s3	-1.812*** (0.132)	0.208*** (0.048)	0.004 (0.018)	0.098*** (0.038)	0.017*** (0.010)	0.028 (0.030)	0.015 (0.054)	1.439*** (0.323)
W1/s4	-1.807*** (0.126)	0.207*** (0.049)	0.004 (0.019)	0.097*** (0.040)	0.012 (0.016)	0.029 (0.029)	0.014 (0.055)	1.442*** (0.326)
W2/s1	0.368 (0.275)	-0.412*** (0.113)	-0.002 (0.041)	0.095 (0.087)	0.042*** (0.014)	0.035 (0.065)	0.054 (0.115)	-0.203 (0.663)
W2/s2	0.366 (0.279)	-0.408*** (0.106)	0.000 (0.038)	0.089 (0.098)	0.033 (0.028)	0.036 (0.063)	0.052 (0.119)	-0.190 (0.687)
W2/s3	0.362 (0.287)	-0.409*** (0.108)	-0.001 (0.039)	0.097 (0.083)	0.038** (0.020)	0.035 (0.065)	0.054 (0.117)	-0.198 (0.673)
W2/s4	0.369 (0.274)	-0.410*** (0.109)	-0.001 (0.039)	0.095 (0.087)	0.030 (0.033)	0.036 (0.063)	0.052 (0.119)	-0.194 (0.680)
W3/s1	-0.014 (0.414)	0.001 (0.178)	-0.363*** (0.065)	0.038 (0.135)	-0.029 (0.030)	0.062 (0.101)	-0.030 (0.170)	0.195 (0.765)
W3/s2	-0.016 (0.418)	0.004 (0.171)	-0.361*** (0.062)	0.032 (0.149)	-0.037 (0.047)	0.063 (0.099)	-0.032 (0.174)	0.207 (0.792)
W3/s3	-0.019 (0.427)	0.003 (0.173)	-0.362*** (0.063)	0.040 (0.131)	-0.032 (0.038)	0.062 (0.101)	-0.031 (0.172)	0.200 (0.776)
W3/s4	-0.013 (0.412)	0.003 (0.174)	-0.362*** (0.063)	0.037 (0.136)	-0.040 (0.053)	0.063 (0.098)	-0.032 (0.174)	0.203 (0.784)
W4/s1	0.260 (0.242)	0.143 (0.099)	0.022 (0.037)	-0.406*** (0.079)	-0.009 (0.014)	0.021 (0.057)	-0.001 (0.099)	-0.040 (0.578)
W4/s2	0.259 (0.245)	0.144 (0.093)	0.023 (0.034)	-0.408*** (0.089)	-0.012 (0.026)	0.021 (0.055)	-0.002 (0.102)	-0.034 (0.598)
W4/s3	0.258 (0.251)	0.144 (0.095)	0.022 (0.035)	-0.405*** (0.076)	-0.010 (0.019)	0.021 (0.057)	-0.001 (0.100)	-0.038 (0.586)
W4/s4	0.261 (0.240)	0.144 (0.096)	0.022 (0.035)	-0.406*** (0.079)	-0.014 (0.030)	0.021 (0.055)	-0.002 (0.102)	-0.036 (0.592)
W5/s1	-0.010 (0.981)	0.066 (0.430)	-0.046 (0.148)	-0.057 (0.318)	-0.447*** (0.074)	-0.018 (0.236)	0.071 (0.403)	0.208 (1.635)
W5/s2	-0.012 (0.990)	0.070 (0.414)	-0.044 (0.141)	-0.065 (0.347)	-0.457*** (0.112)	-0.017 (0.231)	0.068 (0.412)	0.222 (1.693)
W5/s3	-0.017 (1.008)	0.069 (0.418)	-0.045 (0.144)	-0.055 (0.310)	-0.452*** (0.092)	-0.018 (0.236)	0.070 (0.406)	0.214 (1.658)
W5/s4	-0.009 (0.977)	0.069 (0.421)	-0.045 (0.144)	-0.058 (0.320)	-0.460*** (0.125)	-0.017 (0.231)	0.069 (0.412)	0.218 (1.675)
W6/s1	0.135 (0.410)	0.091 (0.167)	0.044 (0.061)	0.034 (0.127)	0.006 (0.017)	-0.809*** (0.096)	0.041 (0.169)	0.456 (1.003)
W6/s2	0.134 (0.415)	0.092 (0.158)	0.044 (0.056)	0.033 (0.145)	0.004 (0.040)	-0.809*** (0.093)	0.041 (0.175)	0.459 (1.039)
W6/s3	0.133 (0.427)	0.092 (0.160)	0.044 (0.058)	0.034 (0.122)	0.005 (0.027)	-0.809*** (0.096)	0.041 (0.171)	0.457 (1.017)
W6/s4	0.135 (0.407)	0.092 (0.162)	0.044 (0.058)	0.034 (0.128)	0.004 (0.048)	-0.809*** (0.093)	0.041 (0.175)	0.458 (1.028)
W7/s1	-0.011 (0.350)	0.079 (0.149)	-0.015*** (0.052)	-0.024 (0.110)	0.060*** (0.014)	0.007 (0.082)	-0.317*** (0.145)	0.219 (0.895)
W7/s2	-0.014 (0.355)	0.083 (0.140)	-0.013 (0.048)	-0.032 (0.126)	0.049 (0.035)	0.009 (0.079)	-0.320*** (0.150)	0.236 (0.927)

Continued: **Average** Seasonal Compensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W7/s3	-0.019 (0.365)	0.082 (0.142)	-0.013 (0.050)	-0.022 (0.106)	0.055 (0.023)	0.007 (0.081)	-0.318** (0.147)	0.225 (0.908)
W7/s4	-0.010 (0.348)	0.081 (0.144)	-0.014 (0.050)	-0.025 (0.111)	0.045 (0.042)	0.009 (0.079)	-0.320** (0.150)	0.230 (0.917)
W8/s1	0.629*** (0.063)	-0.058** (0.028)	0.006 (0.010)	0.004 (0.021)	-0.013*** (0.005)	0.075*** (0.015)	0.026 (0.026)	-0.668*** (0.162)
W8/s2	0.631*** (0.064)	-0.062** (0.026)	0.004 (0.009)	0.010 (0.023)	-0.004 (0.007)	0.074*** (0.015)	0.028 (0.027)	-0.681*** (0.167)
W8/s3	0.635*** (0.066)	-0.061** (0.026)	0.004 (0.009)	0.002 (0.020)	-0.009 (0.006)	0.075*** (0.015)	0.026 (0.026)	-0.673*** (0.164)
W8/s4	0.628*** (0.063)	-0.060** (0.027)	0.005 (0.009)	0.004 (0.021)	-0.001 (0.008)	0.074*** (0.015)	0.028 (0.027)	-0.677*** (0.165)

Source: own calculation based on the HBS,(2013-2014)

Note: Standard errors are presented in parentheses and;

*, **, *** defined significance at 10, 5 and 1 %, respectively

W1- expenditure of bread and cereal products

W2- expenditure of meat and fish products

W3- expenditure of dairy products

W4- expenditure of vegetables

W5- expenditure of fruits

W6- expenditure of oils and animal fats

W7- expenditure of other food items

W8- expenditure of other products and service (non-food items)

S1-Summer period

S2-Winter period

S3-Spring period

S4-Autumn period

Table A4.28: Urban- Seasonal Uncompensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W1/s1	-1.433*** (0.029)	0.080*** (0.015)	-0.019** (0.008)	-0.019 (0.016)	0.006 (0.009)	-0.046*** (0.012)	-0.064*** (0.009)	0.940*** (0.040)
W1/s2	-1.433*** (0.029)	0.086*** (0.015)	-0.016** (0.008)	-0.030 (0.016)	-0.002 (0.009)	-0.044*** (0.012)	-0.068*** (0.009)	0.954*** (0.040)
W1/s3	-1.437*** (0.029)	0.082*** (0.015)	-0.017** (0.008)	-0.017 (0.016)	-0.001 (0.009)	-0.046*** (0.011)	-0.066*** (0.009)	0.948*** (0.040)
W1/s4	-1.434*** (0.029)	0.082*** (0.015)	-0.018** (0.008)	-0.024 (0.015)	-0.007 (0.009)	-0.044*** (0.011)	-0.067*** (0.009)	0.957*** (0.040)
W2/s1	0.119*** (0.039)	-0.450*** (0.051)	0.017 (0.019)	0.044 (0.032)	0.021 (0.028)	0.060*** (0.015)	0.091*** (0.026)	-0.595*** (0.086)
W2/s2	0.120*** (0.039)	-0.446*** (0.053)	0.018 (0.020)	0.036 (0.028)	0.016 (0.024)	0.061*** (0.015)	0.089*** (0.024)	-0.586*** (0.091)
W2/s3	0.117*** (0.037)	-0.449*** (0.051)	0.018 (0.020)	0.045 (0.033)	0.016 (0.025)	0.060*** (0.015)	0.089*** (0.025)	-0.590*** (0.089)
W2/s4	0.119*** (0.039)	-0.448*** (0.052)	0.017 (0.019)	0.040 (0.030)	0.012 (0.022)	0.061*** (0.015)	0.089*** (0.024)	-0.584*** (0.092)
W3/s1	-0.099** (0.043)	0.045 (0.037)	-0.348*** (0.029)	-0.044 (0.032)	-0.045** (0.022)	0.031 (0.020)	-0.057*** (0.022)	-0.105 (0.066)
W3/s2	-0.099** (0.043)	0.050 (0.039)	-0.347*** (0.029)	-0.053** (0.030)	-0.052** (0.020)	0.033** (0.020)	-0.061*** (0.021)	-0.094 (0.067)
W3/s3	-0.102** (0.042)	0.047 (0.038)	-0.347*** (0.029)	-0.042 (0.032)	-0.051** (0.021)	0.031** (0.020)	-0.060*** (0.021)	-0.099 (0.066)
W3/s4	-0.100** (0.043)	0.047 (0.038)	-0.348*** (0.029)	-0.048** (0.031)	-0.057*** (0.020)	0.033** (0.020)	-0.060*** (0.021)	-0.091*** (0.067)
W4/s1	-0.054 (0.035)	0.055** (0.027)	-0.020 (0.014)	-0.812*** (0.036)	-0.025 (0.016)	-0.006 (0.017)	-0.029** (0.014)	0.302*** (0.059)
W4/s2	-0.053 (0.035)	0.060** (0.028)	-0.018 (0.014)	-0.823*** (0.035)	-0.032** (0.015)	-0.004 (0.017)	-0.033** (0.014)	0.315*** (0.060)
W4/s3	-0.057 (0.034)	0.056** (0.027)	-0.018 (0.014)	-0.811*** (0.035)	-0.031** (0.015)	-0.005 (0.016)	-0.032** (0.014)	0.309*** (0.060)
W4/s4	-0.055 (0.035)	0.057** (0.027)	-0.019 (0.014)	-0.817*** (0.035)	-0.037** (0.015)	-0.004 (0.017)	-0.032** (0.014)	0.318*** (0.061)
W5/s1	-0.039 (0.069)	0.040 (0.075)	-0.060** (0.030)	-0.080 (0.052)	-0.449*** (0.049)	-0.027 (0.023)	0.094** (0.045)	-0.261*** (0.081)
W5/s2	-0.039 (0.069)	0.043 (0.078)	-0.059** (0.031)	-0.086 (0.046)	-0.453*** (0.045)	-0.027 (0.023)	0.092** (0.043)	-0.254*** (0.080)
W5/s3	-0.041 (0.066)	0.041 (0.076)	-0.059** (0.031)	-0.079 (0.052)	-0.452*** (0.046)	-0.027 (0.023)	0.092** (0.043)	-0.257*** (0.080)
W5/s4	-0.040 (0.068)	0.041 (0.076)	-0.060*** (0.030)	-0.083** (0.049)	-0.455*** (0.043)	-0.026 (0.023)	0.092** (0.043)	-0.253*** (0.080)
W6/s1	-0.145*** (0.035)	0.115*** (0.024)	0.027** (0.015)	-0.003 (0.026)	-0.007 (0.014)	-0.922*** (0.024)	-0.006 (0.012)	0.296*** (0.055)
W6/s2	-0.145*** (0.035)	0.119*** (0.024)	0.029** (0.015)	-0.012 (0.026)	-0.013 (0.014)	-0.921*** (0.024)	-0.009 (0.012)	0.307*** (0.055)
W6/s3	-0.149*** (0.035)	0.116*** (0.024)	0.028** (0.015)	-0.002 (0.026)	-0.013 (0.014)	-0.922*** (0.024)	-0.008 (0.012)	0.303*** (0.055)
W6/s4	-0.146*** (0.035)	0.117*** (0.024)	0.027** (0.015)	-0.007 (0.026)	-0.017 (0.014)	-0.921*** (0.024)	-0.008 (0.012)	0.310*** (0.055)
W7/s1	-0.185*** (0.039)	0.152*** (0.036)	-0.036** (0.015)	-0.036 (0.025)	0.068*** (0.023)	-0.007 (0.012)	-0.317*** (0.022)	-0.195*** (0.066)
W7/s2	-0.185*** (0.039)	0.158*** (0.038)	-0.033** (0.016)	-0.048** (0.021)	0.061*** (0.020)	-0.005 (0.012)	-0.321*** (0.021)	-0.181*** (0.071)

Continued: **Urban**- Seasonal Uncompensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W7/s3	-0.189*** (0.037)	0.154*** (0.037)	-0.033** (0.016)	-0.035 (0.025)	0.062*** (0.021)	-0.007 (0.012)	-0.319*** (0.022)	-0.187*** (0.069)
W7/s4	-0.186*** (0.038)	0.154*** (0.037)	-0.035** (0.016)	-0.041** (0.023)	0.055*** (0.019)	-0.005 (0.012)	-0.320*** (0.021)	-0.178** (0.072)
W8/s1	0.180*** (0.023)	-0.175*** (0.022)	-0.039*** (0.009)	-0.019 (0.016)	-0.045*** (0.014)	-0.002 (0.007)	-0.074*** (0.013)	-1.251*** (0.044)
W8/s2	0.180*** (0.023)	-0.180*** (0.023)	-0.041*** (0.010)	-0.008 (0.014)	-0.038*** (0.012)	-0.004 (0.007)	-0.070*** (0.012)	-1.264*** (0.046)
W8/s3	0.184*** (0.022)	-0.177*** (0.022)	-0.041*** (0.010)	-0.020 (0.016)	-0.039*** (0.012)	-0.003 (0.007)	-0.071*** (0.012)	-1.258*** (0.045)
W8/s4	0.181*** (0.023)	-0.177*** (0.022)	-0.040*** (0.009)	-0.014 (0.015)	-0.033*** (0.011)	-0.004 (0.007)	-0.071*** (0.012)	-1.267*** (0.047)

Source: own calculation based on the HBS,(2013-2014)

Note: Standard errors are presented in parentheses and;

*,**,*** defined significance at 10, 5 and 1 %, respectively

W1- expenditure of bread and cereal products

W2- expenditure of meat and fish products

W3- expenditure of dairy products

W4- expenditure of vegetables

W5- expenditure of fruits

W6- expenditure of oils and animal fats

W7- expenditure of other food items

W8- expenditure of other products and service (non-food items)

S1-Summer period

S2-Winter period

S3-Spring period

S4-Autumn period

Table A4.29: Urban- Seasonal Compensated Demand Elasticities: Pooled Estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W1/s1	-1.342*** (0.028)	0.129*** (0.015)	0.001 (0.008)	0.026* (0.015)	0.021** (0.009)	-0.018 (0.011)	-0.031*** (0.008)	1.213*** (0.041)
W1/s2	-1.342*** (0.028)	0.135*** (0.015)	0.003 (0.008)	0.015* (0.015)	0.013 (0.009)	-0.016 (0.011)	-0.035*** (0.008)	1.226*** (0.041)
W1/s3	-1.346*** (0.028)	0.131*** (0.015)	0.003 (0.008)	0.028* (0.015)	0.014 (0.009)	-0.017 (0.011)	-0.034*** (0.008)	1.221*** (0.040)
W1/s4	-1.343*** (0.028)	0.131*** (0.015)	0.002 (0.008)	0.021** (0.015)	0.008 (0.009)	-0.016 (0.011)	-0.034*** (0.008)	1.230*** (0.040)
W2/s1	0.231*** (0.029)	-0.390*** (0.035)	0.041*** (0.013)	0.099*** (0.020)	0.039* (0.022)	0.095*** (0.014)	0.131*** (0.016)	-0.259*** (0.075)
W2/s2	0.231*** (0.029)	-0.386*** (0.037)	0.042*** (0.014)	0.091*** (0.020)	0.034* (0.019)	0.096*** (0.014)	0.129*** (0.015)	-0.250*** (0.070)
W2/s3	0.228*** (0.030)	-0.388*** (0.035)	0.042*** (0.014)	0.100*** (0.021)	0.035* (0.019)	0.095*** (0.014)	0.129*** (0.015)	-0.254*** (0.072)
W2/s4	0.230*** (0.029)	-0.388*** (0.036)	0.041*** (0.013)	0.096*** (0.020)	0.030* (0.017)	0.096*** (0.014)	0.129*** (0.015)	-0.248*** (0.069)
W3/s1	-0.003 (0.035)	0.097*** (0.030)	-0.328*** (0.027)	0.004 (0.028)	-0.030 (0.020)	0.061*** (0.021)	-0.023*** (0.017)	0.182** (0.078)
W3/s2	-0.003 (0.035)	0.102*** (0.030)	-0.326*** (0.027)	-0.006 (0.028)	-0.036** (0.018)	0.063*** (0.020)	-0.027*** (0.017)	0.194** (0.076)
W3/s3	-0.007 (0.035)	0.099*** (0.030)	-0.326*** (0.027)	0.005 (0.028)	-0.035** (0.018)	0.062*** (0.021)	-0.025*** (0.017)	0.189** (0.077)
W3/s4	-0.004 (0.035)	0.099*** (0.030)	-0.327*** (0.027)	0.000 (0.028)	-0.041** (0.018)	0.063*** (0.020)	-0.026*** (0.017)	0.197*** (0.075)
W4/s1	0.042 (0.031)	0.106*** (0.023)	0.001 (0.013)	-0.764*** (0.034)	-0.009 (0.015)	0.024 (0.017)	0.005 (0.011)	0.590*** (0.059)
W4/s2	0.042 (0.031)	0.112*** (0.023)	0.003 (0.013)	-0.775*** (0.034)	-0.016 (0.014)	0.026 (0.016)	0.002 (0.011)	0.603*** (0.058)
W4/s3	0.038 (0.030)	0.108*** (0.023)	0.003 (0.013)	-0.763*** (0.034)	-0.015 (0.014)	0.025 (0.016)	0.003 (0.011)	0.598*** (0.058)
W4/s4	0.041 (0.031)	0.109*** (0.023)	0.002 (0.013)	-0.769*** (0.034)	-0.021 (0.014)	0.026 (0.017)	0.003 (0.011)	0.606*** (0.057)
W5/s1	0.077* (0.043)	0.103** (0.048)	-0.035** (0.021)	-0.022 (0.032)	-0.430*** (0.042)	0.009 (0.021)	0.135*** (0.028)	0.090 (0.202)
W5/s2	0.078* (0.043)	0.106** (0.050)	-0.034** (0.022)	-0.028 (0.030)	-0.433*** (0.038)	0.010 (0.021)	0.133*** (0.027)	0.097 (0.195)
W5/s3	0.075* (0.043)	0.104** (0.049)	-0.034** (0.021)	-0.021 (0.033)	-0.433*** (0.039)	0.010 (0.021)	0.134*** (0.027)	0.094 (0.198)
W5/s4	0.077* (0.043)	0.104** (0.049)	-0.035** (0.021)	-0.025 (0.031)	-0.436*** (0.036)	0.010 (0.021)	0.134*** (0.027)	0.098 (0.193)
W6/s1	-0.041 (0.035)	0.171*** (0.023)	0.049*** (0.015)	0.049 (0.026)	0.010 (0.014)	-0.889*** (0.024)	0.032*** (0.011)	0.611*** (0.055)
W6/s2	-0.041 (0.035)	0.176*** (0.023)	0.051*** (0.015)	0.040 (0.025)	0.004 (0.013)	-0.888*** (0.024)	0.028** (0.011)	0.622*** (0.055)
W6/s3	-0.044 (0.035)	0.173*** (0.023)	0.051*** (0.015)	0.050 (0.026)	0.005 (0.014)	-0.889*** (0.024)	0.029** (0.011)	0.617*** (0.055)
W6/s4	-0.042 (0.035)	0.173*** (0.023)	0.050*** (0.015)	0.045 (0.026)	0.000 (0.013)	-0.888*** (0.024)	0.029** (0.011)	0.624*** (0.055)
W7/s1	-0.095*** (0.022)	0.201*** (0.024)	-0.016 (0.011)	0.009 (0.016)	0.083*** (0.019)	0.021** (0.011)	-0.284*** (0.015)	0.077 (0.058)
W7/s2	-0.094*** (0.022)	0.207*** (0.026)	-0.014 (0.012)	-0.003 (0.015)	0.076*** (0.017)	0.023** (0.011)	-0.288*** (0.014)	0.091* (0.054)

Continued: **Urban-** Seasonal Compensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W7/s3	-0.099*** (0.022)	0.203*** (0.025)	-0.014 (0.012)	0.010 (0.016)	0.077*** (0.017)	0.022** (0.011)	-0.287*** (0.014)	0.085* (0.056)
W7/s4	-0.096*** (0.022)	0.203*** (0.025)	-0.015 (0.012)	0.004 (0.015)	0.070*** (0.015)	0.023*** (0.011)	-0.287*** (0.014)	0.094* (0.054)
W8/s1	0.414*** (0.013)	-0.048*** (0.013)	0.011*** (0.006)	0.097*** (0.010)	-0.007 (0.011)	0.071*** (0.006)	0.010 (0.007)	-0.548*** (0.038)
W8/s2	0.413*** (0.013)	-0.054*** (0.014)	0.009*** (0.006)	0.109*** (0.009)	0.001 (0.009)	0.069*** (0.006)	0.014** (0.006)	-0.561*** (0.036)
W8/s3	0.418*** (0.013)	-0.050*** (0.014)	0.009*** (0.006)	0.096*** (0.010)	0.000 (0.009)	0.071*** (0.006)	0.012** (0.007)	-0.556*** (0.037)
W8/s4	0.415*** (0.013)	-0.050*** (0.014)	0.010*** (0.006)	0.102*** (0.009)	0.006 (0.008)	0.069*** (0.006)	0.013** (0.006)	-0.564*** (0.035)

Source: own calculation based on the HBS,(2013-2014)

Note: Standard errors are presented in parentheses and;

*,**,*** defined significance at 10, 5 and 1 %, respectively

W1- expenditure of bread and cereal products

W2- expenditure of meat and fish products

W3- expenditure of dairy products

W4- expenditure of vegetables

W5- expenditure of fruits

W6- expenditure of oils and animal fats

W7- expenditure of other food items

W8- expenditure of other products and service (non-food items)

S1-Summer period

S2-Winter period

S3-Spring period

S4-Autumn period

Table A4.30: Rural- Seasonal Uncompensated Demand Elasticities: Pooled Estimation (2013-2014)

Un	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W1/s1	-2.271*** (0.025)	0.205*** (0.012)	-0.013** (0.007)	0.101*** (0.012)	0.030*** (0.007)	0.023** (0.010)	-0.016** (0.007)	1.378*** (0.036)
W1/s2	-2.276*** (0.025)	0.207*** (0.012)	-0.013** (0.007)	0.099*** (0.012)	0.021*** (0.007)	0.024** (0.010)	-0.017** (0.007)	1.393*** (0.036)
W1/s3	-2.278*** (0.025)	0.206*** (0.012)	-0.014** (0.007)	0.107*** (0.012)	0.018** (0.007)	0.023** (0.010)	-0.016** (0.007)	1.390*** (0.036)
W1/s4	-2.271*** (0.025)	0.206*** (0.012)	-0.013** (0.007)	0.103*** (0.012)	0.016** (0.007)	0.023** (0.010)	-0.017 (0.007)	1.390*** (0.036)
W2/s1	0.445*** (0.025)	-0.447*** (0.022)	-0.008 (0.011)	0.081*** (0.016)	0.037*** (0.011)	0.003 (0.011)	-0.012 (0.010)	-0.643*** (0.050)
W2/s2	0.440*** (0.025)	-0.446*** (0.022)	-0.007 (0.011)	0.079*** (0.016)	0.028** (0.011)	0.004 (0.012)	-0.013 (0.010)	-0.628*** (0.051)
W2/s3	0.438*** (0.025)	-0.447*** (0.022)	-0.008 (0.011)	0.087*** (0.016)	0.025** (0.011)	0.004 (0.012)	-0.012 (0.010)	-0.630*** (0.051)
W2/s4	0.446*** (0.025)	-0.447*** (0.022)	-0.007 (0.011)	0.083*** (0.016)	0.023** (0.011)	0.004 (0.011)	-0.013 (0.010)	-0.631*** (0.051)
W3/s1	-0.082 (0.055)	-0.026 (0.039)	-0.436*** (0.082)	0.065 (0.042)	0.000 (0.025)	0.060* (0.036)	-0.049** (0.026)	-0.321*** (0.099)
W3/s2	-0.084 (0.055)	-0.025 (0.039)	-0.436*** (0.082)	0.064 (0.042)	-0.004 (0.025)	0.060* (0.036)	-0.050** (0.026)	-0.314*** (0.099)
W3/s3	-0.085 (0.055)	-0.026 (0.039)	-0.436*** (0.082)	0.068 (0.042)	-0.006 (0.025)	0.060* (0.036)	-0.049** (0.026)	-0.315*** (0.099)
W3/s4	-0.082 (0.055)	-0.026 (0.039)	-0.436*** (0.082)	0.066 (0.042)	-0.007 (0.025)	0.060* (0.036)	-0.050** (0.026)	-0.315*** (0.099)
W4/s1	0.303*** (0.035)	0.111*** (0.022)	0.023 (0.016)	-0.306*** (0.035)	0.026* (0.015)	-0.012 (0.019)	-0.061*** (0.014)	-0.653*** (0.062)
W4/s2	0.299*** (0.035)	0.112*** (0.022)	0.023 (0.016)	-0.307*** (0.035)	0.017* (0.015)	-0.011 (0.019)	-0.062*** (0.014)	-0.639*** (0.062)
W4/s3	0.297*** (0.035)	0.111*** (0.022)	0.023 (0.016)	-0.300*** (0.035)	0.015* (0.015)	-0.011 (0.019)	-0.061*** (0.014)	-0.641*** (0.061)
W4/s4	0.304*** (0.035)	0.111*** (0.022)	0.023 (0.016)	-0.304*** (0.035)	0.012* (0.015)	-0.011 (0.019)	-0.062*** (0.014)	-0.642*** (0.062)
W5/s1	0.068 (0.048)	0.046 (0.032)	-0.009 (0.021)	0.015 (0.034)	-0.418*** (0.033)	-0.022 (0.023)	0.065*** (0.022)	-0.645*** (0.084)
W5/s2	0.067 (0.048)	0.047 (0.032)	-0.009 (0.021)	0.014 (0.034)	-0.421*** (0.033)	-0.022 (0.023)	0.065*** (0.022)	-0.642*** (0.084)
W5/s3	0.066 (0.048)	0.046 (0.032)	-0.009 (0.021)	0.016 (0.034)	-0.421*** (0.033)	-0.022 (0.023)	0.065*** (0.022)	-0.642*** (0.084)
W5/s4	0.068 (0.048)	0.046 (0.032)	-0.009 (0.021)	0.015 (0.034)	-0.422*** (0.033)	-0.022 (0.023)	0.065*** (0.022)	-0.643*** (0.084)
W6/s1	0.071** (0.032)	0.000 (0.018)	0.025 (0.016)	-0.019 (0.023)	0.005 (0.012)	-0.751*** (0.025)	-0.020** (0.012)	0.068 (0.053)
W6/s2	0.067** (0.032)	0.002 (0.018)	0.025 (0.016)	-0.021 (0.023)	-0.003 (0.012)	-0.750*** (0.025)	-0.022** (0.012)	0.080 (0.053)
W6/s3	0.065** (0.032)	0.001 (0.018)	0.024 (0.016)	-0.014 (0.023)	-0.005 (0.012)	-0.751*** (0.025)	-0.021** (0.012)	0.078 (0.053)
W6/s4	0.071** (0.032)	0.000 (0.018)	0.025 (0.016)	-0.018 (0.023)	-0.007 (0.012)	-0.750*** (0.025)	-0.022** (0.012)	0.078 (0.053)
W7/s1	-0.036* (0.019)	-0.013 (0.013)	-0.019** (0.009)	-0.059*** (0.013)	0.049*** (0.009)	-0.013 (0.009)	-0.295*** (0.011)	-0.153 (0.037)
W7/s2	-0.041** (0.019)	-0.012 (0.013)	-0.018** (0.009)	-0.061*** (0.013)	0.039*** (0.009)	-0.012 (0.009)	-0.297*** (0.011)	-0.138 (0.038)

Continued : **Rural-** Seasonal Uncompensated Demand Elasticities: Pooled Estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W7/s3	-0.043** (0.019)	-0.013 (0.013)	-0.019** (0.009)	-0.053*** (0.013)	0.036*** (0.009)	-0.012 (0.009)	-0.295*** (0.011)	-0.140 (0.038)
W7/s4	-0.036* (0.019)	-0.013 (0.013)	-0.018** (0.009)	-0.057*** (0.013)	0.034*** (0.009)	-0.012 (0.009)	-0.296*** (0.011)	-0.141 (0.037)
W8/s1	0.454*** (0.016)	-0.239*** (0.010)	-0.031*** (0.007)	-0.172*** (0.010)	-0.081*** (0.006)	-0.044*** (0.007)	-0.103*** (0.006)	-1.343*** (0.037)
W8/s2	0.460*** (0.016)	-0.241*** (0.010)	-0.031*** (0.007)	-0.170*** (0.010)	-0.069*** (0.006)	-0.046*** (0.007)	-0.101*** (0.006)	-1.362*** (0.037)
W8/s3	0.462*** (0.016)	-0.239*** (0.010)	-0.030*** (0.007)	-0.179*** (0.010)	-0.066*** (0.006)	-0.045*** (0.007)	-0.103*** (0.006)	-1.359*** (0.037)
W8/s4	0.453*** (0.016)	-0.239*** (0.010)	-0.031*** (0.007)	-0.175*** (0.010)	-0.063*** (0.006)	-0.045*** (0.007)	-0.101*** (0.006)	-1.358*** (0.037)

Source: own calculation based on the HBS,(2013-2014)

Note: Standard errors are presented in parentheses and;

*,**,*** defined significance at 10, 5 and 1 %, respectively

W1- expenditure of bread and cereal products

W2- expenditure of meat and fish products

W3- expenditure of dairy products

W4- expenditure of vegetables

W5- expenditure of fruits

W6- expenditure of oils and animal fats

W7- expenditure of other food items

W8- expenditure of other products and service (non-food items)

S1-Summer period

S2-Winter period

S3-Spring period

S4-Autumn period

Table A4.31: Rural- Seasonal Compensated Demand Elasticities: Pooled Estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W1/s1	-2.153*** (0.025)	0.258*** (0.012)	-0.002 (0.007)	0.140*** (0.012)	0.042*** (0.007)	0.057*** (0.010)	0.028*** (0.007)	1.628*** (0.035)
W1/s2	-2.158*** (0.025)	0.260*** (0.012)	-0.002 (0.007)	0.138*** (0.012)	0.033*** (0.007)	0.058*** (0.010)	0.027*** (0.007)	1.643*** (0.035)
W1/s3	-2.159*** (0.025)	0.259*** (0.012)	-0.003 (0.007)	0.145*** (0.012)	0.031*** (0.007)	0.057*** (0.010)	0.028*** (0.007)	1.640*** (0.035)
W1/s4	-2.152*** (0.025)	0.259*** (0.012)	-0.002 (0.007)	0.141*** (0.012)	0.028*** (0.007)	0.057*** (0.010)	0.027*** (0.007)	1.640*** (0.035)
W2/s1	0.555*** (0.025)	-0.398*** (0.022)	0.002 (0.011)	0.117*** (0.016)	0.049*** (0.011)	0.035*** (0.011)	0.029*** (0.011)	-0.411*** (0.047)
W2/s2	0.550*** (0.025)	-0.396*** (0.022)	0.002 (0.011)	0.115*** (0.016)	0.039*** (0.011)	0.036*** (0.011)	0.028*** (0.011)	-0.396*** (0.047)
W2/s3	0.548*** (0.025)	-0.398*** (0.022)	0.002 (0.011)	0.123*** (0.016)	0.036*** (0.011)	0.036*** (0.011)	0.029*** (0.011)	-0.398*** (0.047)
W2/s4	0.556*** (0.025)	-0.398*** (0.022)	0.002 (0.011)	0.119*** (0.016)	0.034*** (0.011)	0.036*** (0.011)	0.028*** (0.011)	-0.398*** (0.047)
W3/s1	0.063 (0.056)	0.039 (0.039)	-0.423*** (0.082)	0.112*** (0.042)	0.015 (0.025)	0.101*** (0.036)	0.005* (0.027)	-0.015*** (0.101)
W3/s2	0.061 (0.056)	0.040 (0.039)	-0.423*** (0.082)	0.111*** (0.042)	0.011 (0.025)	0.102*** (0.036)	0.004* (0.027)	-0.008*** (0.100)
W3/s3	0.060 (0.056)	0.039 (0.039)	-0.423*** (0.082)	0.115*** (0.042)	0.010 (0.025)	0.102*** (0.036)	0.005* (0.027)	-0.009*** (0.100)
W3/s4	0.063 (0.056)	0.039 (0.039)	-0.423*** (0.082)	0.113*** (0.042)	0.008 (0.025)	0.102*** (0.036)	0.004* (0.027)	-0.009*** (0.100)
W4/s1	0.416*** (0.035)	0.162*** (0.022)	0.033** (0.016)	-0.269*** (0.035)	0.038** (0.015)	0.021 (0.019)	-0.018 (0.014)	-0.414*** (0.061)
W4/s2	0.412*** (0.035)	0.163*** (0.022)	0.033** (0.016)	-0.270*** (0.035)	0.029** (0.015)	0.022 (0.019)	-0.020 (0.014)	-0.400*** (0.061)
W4/s3	0.410*** (0.035)	0.162*** (0.022)	0.033** (0.016)	-0.263*** (0.035)	0.026** (0.015)	0.022 (0.019)	-0.019 (0.013)	-0.402*** (0.061)
W4/s4	0.417*** (0.035)	0.162*** (0.022)	0.034** (0.016)	-0.267*** (0.035)	0.024** (0.015)	0.022 (0.019)	-0.020 (0.014)	-0.403*** (0.061)
W5/s1	0.247*** (0.048)	0.126*** (0.032)	0.007 (0.021)	0.073** (0.033)	-0.400*** (0.033)	0.029 (0.023)	0.132*** (0.022)	-0.267*** (0.085)
W5/s2	0.246*** (0.048)	0.127*** (0.032)	0.007 (0.021)	0.073** (0.033)	-0.402*** (0.033)	0.030 (0.023)	0.132*** (0.022)	-0.264*** (0.085)
W5/s3	0.245*** (0.048)	0.127*** (0.032)	0.007 (0.021)	0.074** (0.033)	-0.403*** (0.033)	0.030 (0.023)	0.132*** (0.022)	-0.265*** (0.085)
W5/s4	0.247*** (0.048)	0.127*** (0.032)	0.007 (0.021)	0.074** (0.033)	-0.403*** (0.033)	0.030 (0.023)	0.132*** (0.022)	-0.265*** (0.085)
W6/s1	0.199*** (0.032)	0.058*** (0.018)	0.036** (0.016)	0.023 (0.023)	0.018 (0.012)	-0.714*** (0.025)	0.027** (0.011)	0.339*** (0.052)
W6/s2	0.195*** (0.032)	0.059*** (0.018)	0.036** (0.016)	0.021 (0.023)	0.010 (0.012)	-0.713*** (0.025)	0.026** (0.011)	0.352*** (0.052)
W6/s3	0.194*** (0.032)	0.058*** (0.018)	0.036** (0.016)	0.028 (0.023)	0.008 (0.012)	-0.714*** (0.025)	0.027** (0.012)	0.350*** (0.052)
W6/s4	0.200*** (0.032)	0.058*** (0.018)	0.036** (0.016)	0.024 (0.023)	0.006 (0.012)	-0.713*** (0.025)	0.026** (0.011)	0.350*** (0.052)
W7/s1	0.077*** (0.020)	0.038*** (0.013)	-0.008 (0.009)	-0.022* (0.013)	0.061*** (0.009)	0.020** (0.009)	-0.253*** (0.011)	0.086** (0.035)
W7/s2	0.072*** (0.020)	0.039*** (0.013)	-0.008 (0.009)	-0.024* (0.013)	0.051*** (0.009)	0.021** (0.009)	-0.254*** (0.011)	0.102*** (0.035)

Continued: **Rural**- Seasonal Compensated Demand Elasticities: Pooled estimation (2013-2014)

	P1-Bread & cereal	P2-Meat & fish	P3-Dairy products	P4-Vegetables products	P5-Fruits products	P6-Oils & fats products	P7-Other food items	P8-Other prod. & services
W7/s3	0.071*** (0.020)	0.038*** (0.013)	-0.009 (0.009)	-0.016 (0.013)	0.048*** (0.009)	0.020** (0.009)	-0.253*** (0.011)	0.099*** (0.035)
W7/s4	0.078*** (0.020)	0.038*** (0.013)	-0.008 (0.009)	-0.020 (0.013)	0.046*** (0.009)	0.021** (0.009)	-0.254*** (0.011)	0.099*** (0.035)
W8/s1	0.783*** (0.017)	-0.092*** (0.010)	-0.001 (0.007)	-0.065*** (0.010)	-0.047*** (0.006)	0.050*** (0.007)	0.019*** (0.006)	-0.649*** (0.035)
W8/s2	0.789*** (0.017)	-0.094*** (0.010)	-0.001 (0.007)	-0.063*** (0.010)	-0.035*** (0.006)	0.049*** (0.007)	0.021*** (0.006)	-0.667*** (0.035)
W8/s3	0.791*** (0.017)	-0.092*** (0.010)	-0.001 (0.007)	-0.072*** (0.010)	-0.031*** (0.006)	0.050*** (0.007)	0.020*** (0.006)	-0.664*** (0.035)
W8/s4	0.782*** (0.016)	-0.092*** (0.010)	-0.002 (0.007)	-0.067*** (0.010)	-0.028*** (0.006)	0.049*** (0.007)	0.021*** (0.006)	-0.664*** (0.034)

Source: own calculation based on the HBS,(2013-2014)

Note: Standard errors are presented in parentheses and;

*,**,*** defined significance at 10, 5 and 1 %, respectively

W1- expenditure of bread and cereal products

W2- expenditure of meat and fish products

W3- expenditure of dairy products

W4- expenditure of vegetables

W5- expenditure of fruits

W6- expenditure of oils and animal fats

W7- expenditure of other food items

W8- expenditure of other products and service (non-food items)

S1-Summer period

S2-Winter period

S3-Spring period

S4-Autumn period



General Conclusion



General Conclusion

Tajikistan's demand for food has undergone severe upheavals during the transition period after the collapse of the USSR in 1991. After the end of the civil war in 1997, the increase in agricultural production has had a positive contribution to households' diet composition and nutrition levels. The majority of rural households have started to derive their main income source from home food agricultural production and overall food consumption patterns have been changing to better diet year by year. The demand for food, however, is still highly sensitive to any kind of shocks and shows considerable seasonality.

The behaviour of poor households is one of main policy interests for the Tajik government and its development partners (international institutions like FAO, IMF, World Bank etc.). Tajikistan remains the Central Asian country where food insecurity is higher. Accordingly, rising food prices have significant impacts on the well-being of Tajik households, since a substantial share of their budget goes to food consumption. On the other hand, due to the limited arable land for agriculture, difficulties in food accessibility and seasonal food availability, the effects of any shocks to the level and variability of food prices are directly transmitted to the consumption patterns of households. Upsurges in food prices have then the potential to change food consumption demand patterns in both urban and rural areas in Tajikistan.

This dissertation presented estimations of the food demand system in Tajikistan. Measuring household responses to changes in food price and income requires a precise and careful econometric analysis of household consumption patterns. As a first step, we investigated the price transmission between international and domestic markets with the aim to understand the extent and speed of import prices pass-through and its welfare consequences in Tajikistan. The price transmission mechanism was estimated using cointegration techniques, such as vector error correction models (VEC) and threshold co-integration models, using data consisting of 120 world and domestic price series for wheat, rice, beef, chicken and sheep meat, sugar and soybean oil. These selected food items have high significance in the food consumption of Tajik households. The period of estimation covered from January 2004 until December 2014.

According to the results obtained from price mechanism tests, Tajikistan as a net food importer country is a "price taker" in the global and regional trade. There is a cointegrating

relationship between world and Tajik prices of wheat, rice, sugar, and soy oil. A long run relationship for these individual food commodities was observed at a statistically significant level. According to the outcomes of the error correction models for selected agriculture commodities, it can be noted that prices in Tajikistan react with somewhat different speed to positive and negative deviations. These results are not surprising in light of the fact that Tajikistan relies heavily on imports for more than 60% of food demand in the domestic markets, after the liberalization of agricultural trade adopted by the government of Tajikistan. Thus, Tajikistan is a highly vulnerable country where any volatility in world food prices is directly transmitted to the domestic market, threatening its food security.

However, we could not detect cointegration between world and domestic meat prices. There might be several reasons behind this result. First, there is bigger product differentiation in meats than in crops. Second, poor transport infrastructure, lack of logistics services of refrigerated vans and underdeveloped packaging services are all factors that may drive wedges between global and domestic prices, and all of them have a stronger impact on the trade with animal products than on the trade with crops. In the same vein, the price transmission we found for the prices of wheat, sugar, rice, and soybean oil might be explained by several factors. Therefore, more research on the food price mechanism is needed that can help to mitigate the effects of potential negative price shocks on the well-being of the population in Tajikistan.

Furthermore, the present dissertation reports the first food demand system estimation for Tajikistan as far as we know. We use the QUAIDS model to estimate a complete food demand system, including the effect of socio-demographics characteristics of Tajik households as well as geographical aspects. In addition, we developed and estimated a seasonal QUAIDS model to take into account seasonal changes in food expenditure.

We estimated the QUAIDS model using two types of micro data, coming from the Living Standard Measurement Survey (LSMS) in Chapter 3 and the Household Budget Survey (HBS) in Chapter 4 for the seasonal model. In both cases, we run separate and pooled estimation for the different rounds available of the surveys, and in Chapter 4 additional estimations of rural and urban sub-samples were included. We disaggregated total real expenditures into food-grouped and non-food expenditures in order to facilitate a smooth empirical estimation process and to uncover the causes of the strong seasonal changes in the household consumption expenditures.

Thus, the demand system for food was estimated for six food products (bread & cereals, meat & fish products, dairy products, vegetables and fruits, other food items) and one non-food group in Chapter 3, while in Chapter 4, vegetables, and fruits were disaggregated into two different groups.

We confronted the problem of a high number of zero-valued consumption observations in that is known as a censoring issue in demand estimation. The problem raised in our samples mostly in the consumption of meat & fish, dairy products, but also in the consumption of vegetables, fruits and oils. To deal with this zero consumption problem, we employed a two-step estimation procedure, using simulation based on maximum likelihood probit regression.

The parameters estimates of the QUAIDS models estimated in both chapters were obtained with statistical significance at 5% or better level. The statistical analysis indicate that food consumption patterns in Tajikistan are affected by changes in prices and income as well as by socio-economic and geographic factors, respectively and vary considerably across seasons and locations. The results forcefully suggest that rural and low-income households are more expenditure and price sensitive compared to urban and high-income households, respectively. We also found that seasonal income behavior significantly affects the consumption decisions of Tajik households, with a reduction in the quality and quantity of purchased food commodities in the lean season. The results of seasonality estimation specified that much of the observed seasonal variation in consumption expenditures could be attributed to changes in food expenditures patterns, while non-food expenditures are relatively unchanged across seasons. This is likely related to the seasonal behavior in several important components of the real income of households, like remittances from migrants and home production of food, but on the other hand also to the seasonal food price volatility and seasonal food availability. The households in our samples reduced their consumption expenditure during the lean season, in a way that probably resulted in a poor diet with severe risk of malnutrition, especially in rural areas. This evidence points to a relative inefficiency of the social-security programs of the government, whose implementation is widely questioned.

The estimated coefficients are used to compute price and expenditure elasticities. The expenditure elasticities were computed segmenting households by income class in order to ascertain the extent to which demand responses to changes in income are different for different

income groups. These elasticities are powerful quantitative instruments in helping policy makers to devise policies targeted at low-income and vulnerable households, aimed at stabilizing their food intake under severe circumstances. Expenditure elasticities for all aggregated products were obtained positive at statistically significant levels for all samples; and some of them displayed unitary values. The expenditure elasticity of fruits is the highest; both for poor and rich households while the poorest households in rural areas are expenditure-elastic on all food items, in contrast to urban households. All groups of food products showed negative uncompensated and compensated own-price elasticities at statistically significant levels. The estimation of the seasonal model showed that both expenditure and price elasticities of all food products are fluctuate highly over the season, but especially those of vegetables and fruits.

The estimated demand elasticities can inform policy implementation, such as in prediction of future demand and in prescription of taxes and subsidies across regions by national and international development institutions. On the other hand, their knowledge might contribute to help food producers and food processing enterprises on enhancing the quality of food trading in the domestic food market and to mitigate possible negative shocks and volatility in food prices.

Seemingly, household income growth in Tajikistan is likely to have higher effects on food consumption rather than in prices. Our results point out that for Tajik people, the meat and fish products, dairy, vegetables, fruits and non-food products are considered luxuries, while on the other hand, bread & cereals, vegetables are a necessities, and hence play a more significant role in household diets and consumption expenditure patterns. In general, policy formulation should be careful with respect to import subsidises and taxes in those groups of products which displayed high elasticity. Increasing production capacity and productivity of the rural poor and unemployed households are the plausible option since their food consumption significantly rely on their own home-food production.

These empirical results also suggest that the government should focus on the social security and nutrition stability programs as well as monetary aid policy including food for the most vulnerable and limited food accessible regions, specifically to the low-income households with a large number of family members and the poor households during all seasons chiefly the lean season. Besides, the aid should be product-specific within infant-child nutrition education

program especially to those households who have many children in order to guarantee a better access to nutritious food and to reduce as well “*child -food insecurity level*”.

To sum up, policy makers can use our empirical results with attempt to shape food policy direction for improved food diets and to improve the implementation of the targeting safety net programs in Tajikistan within framework of anti-poverty and nutrient enhancement programs at region-specific level, with taking into account the behavioral differences in food expenditures patterns.







Postscript



Postscript

Life is a lesson to be learnt...

Why this topic?

In the present page, I would like to refer to one of the main incentives that motivated me to do my PhD research work exactly on this topic. It is, in fact, in direct relation with my personal life experience during the outrageous period of Civil War lasting from 1992 to 1997 that took place in my home country Tajikistan.

I was only a 9-year old when the Civil war had started. However, some terrible images of hard life of that period remained clung to my memory and that can never be consigned to oblivion. During the war, my home country was split into two parts of military forces: Governments and the Opponent side. I am not going to judge any of them. However, I can state that it was one of the huge mistakes of Tajik community that followed some political actors who had their own personal interests void of any sense of patriotism.

The situation was aggravating day by day. Between 20.000 and 60.000 people were murdered in the first year of battle, where most commentators claimed that about 50.000 human souls were dead between May and December 1992. During that period, we were living in the southern part of Tajikistan, in Khatlon region.

Approximately, in the period between 1992 and 1993, the southern part of Tajikistan was isolated from the Centre, the capital Dushanbe. As a consequence, all the transportations, food supplies basically the international humanitarian aids were obstructed. From another angle, Tajikistan was one of the food-deficit countries during the Soviet Union. Thus, the food stocks were in drastic condition when Civil war started. As a result, people suffered day-to-day from a severe deficit in food and gradually began to reduce their daily consumption to the minimum leading to an undernourishment state. Some of the Tajik people had nothing to eat; they even started to eat inedible food such as beans that early are only used for animal feeding and that resulted in the death of several people.

The circumstances in that period worsened daily. Some children even forgot that what is it real bread, as their parents cooked bread with beans, which made the loaf of bread black and tasteless. But, my parents fortunately strived to provide us with piece of bread almost every day. At the same time, they did their best to help our relatives and neighbours and to share together a

loaf of bread. Nobody knew when the obstruction would be finished knowing that the food stock was not enough and limited, the thing that worried parents every single day.

During all that tough era, one memorable day changed a lot in my life, that day, my father had somehow aids from his friends who gave him one package of flour. My mother immediately started to prepare bread that was called at that time "**White Bread**", which was a super luxurious product for most of Tajik people in those years. As far as I remember, there were only three loafs of this bread: two loafs for us and one for my grandmother who was living in my uncle's house. The two loafs we had were not enough to be shared with the other neighbours. My mother, thus, ordered me to finish eating my part at home and not to go out with it in front of the other children and not to make them feel bad. As I was a little child, my mother's words seemed nonsense for me and I was willing to go out to play with my friends regardless of what I had in my hands. As soon as I went out with a small piece of bread in my hand, all my friends stopped playing and gathered around me. Some of them were staring at the piece of bread; it seemed really weird to them. I was helpless, not knowing what to do, or to whom I can give some. The piece of bread was too small to give everyone a bite. At that moment, one of my friends said to me, "*please do not worry, we would not eat your bread, it is enough for us just to look at it, to touch or just to smell it*". Because the most of them, even forgot how it tasted or some of small ones even did not know what it is. By the end, I was happy to let them touch, smell or even eat that teeny piece of this "**White Bread**". That day was a significant childhood memory. As a result, the struggle for survival and the huge suffering and difficulties were so tremendous that I wish the children all over the world would never-never be exposed to such hardships and torment.

FAO (2012) estimated 870 million people worldwide are thought to be undernourished. Among them, some 165 million children under 5 years old are stunted, or chronically undernourished, and more than 100 million are considered underweight. Between 250,000 and 500,000 children are considered to be at risk of becoming blind each year from vitamin A deficiency.

On behalf of my two sweet Kids, Dilnoza and Faroiz I dedicate this PhD research to the Children all over the world hoping for a better-regulated diet and nutrition.



Resumen



Resumen

La demanda de alimentos en Tayikistan se ha visto sometida a severos problemas durante el período de transición que inició el colapso de la Unión Soviética en 1991. Después del período de guerra civil que se extendió hasta 1997, la nueva situación de estabilidad permitió que se produjesen incrementos en la producción agrícola que contribuyeron positivamente a la composición de la dieta de las familias tayikas y a mejorar sus niveles nutricionales. Como resultado de este proceso, la mayoría de las familias rurales han comenzado a obtener la mayor parte de su renta de la producción agrícola doméstica, en especial en forma de autoconsumo de alimentos. La mejora de los patrones de consumo en Tayikistan ha sido gradual, mejorando año a año. Sin embargo, la demanda de alimentos continúa siendo muy sensible a todo tipo de alteraciones, además de mostrar un grado considerable de estacionalidad.

El comportamiento de las familias más pobres con respecto de su demanda de alimentos es una de las variables más relevantes para las políticas de desarrollo y de seguridad alimentaria promovidas por el gobierno de Tayikistan y sus socios internacionales (instituciones como la FAO, el Fondo Monetario Internacional, el Banco Mundial, etc.). Tayikistan continúa siendo el país de Asia Central con mayor grado de inseguridad alimentaria. Por lo tanto, los incrementos en el precio de los alimentos causan impactos muy significativos en el bienestar de las familias Tayikas, para quienes una parte substancial de su presupuesto se destina al consumo de alimentos. Por otra parte, debido a la limitada superficie de suelo cultivable en el país, las dificultades de acceso a los alimentos y la variabilidad estacional en la disponibilidad de alimentos, los efectos de cualquier alteración en el nivel y/o la variabilidad de los precios de los alimentos se transmiten directamente a los patrones de consumo de las familias. Los episodios de incremento agudo de los precios de los alimentos (como los experimentados en 2007-2008) presentan el potencial de alterar drásticamente los patrones de la demanda de alimentos, tanto en las zonas rurales como en las urbanas.

Esta tesis doctoral presenta estimaciones del sistema de demanda de alimentos en Tayikistan. La medición de las respuestas de las familias ante variaciones en el precio de los alimentos, la renta y otros factores requiere de un análisis econométrico preciso y cuidadoso de los patrones de consumo de las familias. Como primer paso, se investigó la transmisión de los precios desde los mercados internacionales a los interiores, con la intención de llegar a

comprender la amplitud y velocidad del paso de los precios de importación a los mercados internos, y cuáles son sus consecuencias para el bienestar de los ciudadanos de Tayikistan. El mecanismo de transmisión de precios se estimó utilizando técnicas de cointegración, como los modelos vectoriales de corrección de errores (VCE) y los modelos de co-integración con valores umbral, utilizando datos provenientes de ciento veinte series de precios internacionales e interiores para el trigo, arroz, carne de cordero, pollo y vacuno, azúcar y aceite de soja, todos ellos artículos con una presencia importante en el gasto en consumo de las familias tayikas. El período de estimación abarca desde enero de 2004 hasta diciembre de 2014.

De acuerdo con los resultados que se obtienen en los contrastes sobre el mecanismo de transmisión de precios, Tayikistan como país importador de alimentos es “precio aceptante” tanto en el comercio global como en el regional. Se encuentra una relación de cointegración entre los precios mundiales y los precios tayikos para los siguientes productos: trigo, arroz, azúcar y aceite de soja. La relación de largo plazo entre estas mercancías individuales se observa para un nivel estadísticamente significativo. En consonancia con los resultados de los modelos vectoriales de corrección de errores para los productos agrícolas seleccionados, es necesario observar que los precios en Tayikistan reaccionan a velocidades diferentes frente a desviaciones de signo positivo o negativo. Estos resultados no son sorprendentes, a la luz de la evidencia de que Tayikistan es un país que depende en gran medida de importaciones para satisfacer más de la mitad de la demanda de alimentos en sus mercados internos, tras las medidas liberalizadoras del comercio agrícola adoptadas por su gobierno. De este modo, Tayikistan es un país altamente vulnerable frente a la volatilidad en los precios mundiales de los alimentos, ya que cualquier alteración en los mismos se transmite directamente al mercado interior, amenazando su seguridad alimentaria.

A pesar de todo, no ha sido posible detectar cointegración entre los precios mundiales e interiores de los productos cárnicos. Pueden aportarse varias razones para justificar este resultado. En primer lugar puede mencionarse la mayor diferenciación de producto entre los productos cárnicos frente a los agrícolas. Por ejemplo, la mayor parte de la población de Tayikistan sigue la religión islámica y, por lo tanto, consume productos cárnicos de tipo “Halal”. En segundo lugar, las deficientes infraestructuras de transporte, la carencia de servicios logísticos (como puede ser el caso de furgonetas con sistemas de refrigeración), y el escaso desarrollo de los servicios de empaquetado y etiquetado, son todos ellos factores que pueden introducir diferenciales entre los

precios globales y los interiores, y que afectan en mayor medida al comercio con productos derivados de los animales que al comercio de productos obtenidos mediante cultivo. En este mismo sentido, la excelente transmisión de los precios que se observa para los precios del trigo, el azúcar, el arroz y el aceite de soja pueden explicarse a partir de diferentes causas. Por lo tanto, se hace necesaria una mayor investigación sobre los mecanismos de formación y transmisión de los precios de los alimentos, que pueda contribuir a los esfuerzos para mitigar los potenciales efectos negativos de las variaciones de precios sobre el bienestar de la población de Tayikistan.

Esta tesis doctoral, además, presenta la primera estimación disponible en la literatura (hasta donde alcanza nuestro conocimiento) de un sistema de demanda de alimentos para Tayikistan. Se utiliza el modelo casi ideal cuadrático de sistema de demanda (conocido por sus siglas en inglés, QUAIDS) para estimar un sistema de demanda de alimentos completo, incluyendo los efectos de las características socio económicas, demográficas y de localización geográfica de las familias tayikas. Además, se ha desarrollado y estimado un modelo QUAIDS estacional para poder tener en cuenta las variaciones estacionales en el gasto en alimentación.

La estimación del modelo QUAIDS se ha realizado utilizando dos tipos de microdatos, provenientes de la Encuesta de Medición de Niveles de Vida (conocida por sus siglas en inglés, LSMS) en el capítulo 3, y de la Encuesta de Presupuestos Familiares (conocida por sus siglas en inglés, HBS) en el capítulo 4 (para el modelo estacional). En ambos casos, se han realizado estimaciones separadas para cada ronda disponible de la encuesta correspondiente, y también estimaciones que agrupan los datos de todas las rondas disponibles (*pooled estimations*). Además, en el capítulo 4 se incluyen también estimaciones adicionales de las submuestras de familias localizadas en áreas urbanas y rurales. El gasto en consumo total se desagrega entre la parte destinada al consumo de alimentos y la parte destinada al consumo de productos no alimentarios para facilitar el proceso de estimación y contribuir a descubrir las causas de las fuertes variaciones estacionales en los gastos de consumo de las familias. Así, el sistema de demanda de alimentos se ha estimado en el capítulo 3 para seis grupos de productos alimentarios (pan y cereales, pescado y productos cárnicos, productos lácteos, frutas y verduras, aceites, otros productos alimentarios) y un grupo que contiene a todos los productos no alimentarios, mientras que en el capítulo 4 el grupo de frutas y verduras se ha desagregado en dos grupos diferentes.

Un obstáculo importante para la estimación de sistemas de demanda de alimentos en países poco desarrollados es la proliferación de valores nulos en las variables que representan el gasto en consumo de las familias en productos específicos. Esta situación se conoce como un problema de censura (*censoring*) en los datos en la terminología econométrica. Este problema aparece en nuestras muestras principalmente en los datos referidos al gasto en consumo en pescado y en productos cárnicos y en productos lácteos, pero también en menor medida en las variables que representan el gasto en consumo en frutas, verduras (o frutas y verduras en el capítulo 3), y en aceites. Para solucionar los problemas de inconsistencia en los estimadores que generan estos valores nulos en el consumo (que podrían dar lugar a estimaciones sesgadas de los parámetros de interés), se ha recurrido a un procedimiento de estimación en dos etapas. En la primera etapa se han realizado estimaciones *probit* por el método de máxima verosimilitud de los niveles de gasto en consumo a partir de un conjunto de variables explicativas. A partir de estas estimaciones se han realizado simulaciones de los parámetros de interés de las funciones de densidad correspondientes, que luego se han introducido como factores de ajuste en la segunda etapa, consistente en la estimación del sistema de demanda cuadrático (QUAIDS).

Los resultados obtenidos en las estimaciones que se han realizado en ambos capítulos son estadísticamente significativos a un nivel del 5% o mejor. Estos resultados indican que los patrones de consumo de alimentos en Tayikistan se ven afectados por cambios en los precios y la renta, pero también por otros factores socioeconómicos y geográficos, mostrando una considerable variabilidad tanto entre localizaciones como estacionalmente. Estos resultados sugieren poderosamente que las familias rurales y de baja renta son más sensibles frente a variaciones en su renta (inferida a través del gasto a partir de los datos de la muestra) y en los precios que las familias urbanas y de renta elevada. Por otra parte, se encuentra evidencia de que el comportamiento estacional de la renta afecta significativamente a las decisiones de consumo de las familias tayikas, llevándolas a reducir la cantidad y calidad de sus compras de alimentos en otoño y en invierno. Los resultados de las estimaciones incluyendo estacionalidad que se realizan en el capítulo 4 especifican que una buena parte de la variación estacional que se observa en los gastos en consumo pueden atribuirse a la parte de ese gasto que se realiza en productos alimentarios, resultando mucho más estable en gasto en productos no alimentarios. Con toda probabilidad, esto es debido a la influencia del comportamiento estacional de diferentes

componentes importantes de la renta real que perciben las familias, como es el caso de las remesas recibidas de los miembros de la familia emigrados en el exterior, o la renta obtenida a partir de la producción doméstica de alimentos para autoconsumo familiar. Por otra parte, también la variabilidad estacional de los precios de los alimentos y la disponibilidad de los productos alimentarios pueden influir significativamente. Las familias incluidas en las muestras que se han utilizado redujeron sus gastos en consumo durante las estaciones de otoño e invierno en un modo que probablemente haya tenido como resultado una dieta pobre sujeta a un riesgo severo de malnutrición, especialmente en las áreas rurales. La evidencia obtenida de nuestras estimaciones apunta a una relativa ineficiencia de los programas de seguridad social gubernamentales, cuya puesta en práctica es sujeto de un amplio debate.

Los coeficientes estimados se utilizan para calcular elasticidades de gasto (renta) y precios. Las elasticidades de gasto se han calculado también segmentando a las familias de acuerdo con categorías de niveles de renta, con el fin de discernir hasta qué punto la respuesta de la demanda frente a cambios en la renta difiere de acuerdo con los niveles de renta percibidos por las familias. Estas elasticidades son instrumentos cuantitativos poderosos que pueden contribuir al diseño de políticas dirigidas a las familias de baja renta y más vulnerables, con el fin de conseguir estabilidad su ingesta de alimentos cuando se enfrentan a circunstancias adversas. Las estimaciones de las elasticidades de gasto para los grupos de productos alimentarios proporcionan todas ellas valores positivos y estadísticamente significativos, para todas las muestras y submuestras utilizadas. En algunos casos, estos valores han resultado mayores que la unidad. En concreto, la elasticidad de gasto de las frutas presenta los valores más elevados, tanto para las familias pobres como para las familias de mayor renta. Las familias con menor renta en las áreas rurales presentan valores de la elasticidad de gasto mayores que la unidad para todos los grupos de productos excepto el que contiene pan y cereales. Todos los grupos de productos alimentarios presentan elasticidades precio, tanto compensadas como no compensadas, de signo negativo y estadísticamente significativas. La estimación del modelo estacional muestra que tanto las elasticidades precio como las elasticidades de gasto de todos los grupos de productos alimentarios presentan grandes fluctuaciones estacionales, en especial en el caso de las frutas y verduras.





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