# CENTRAL ASIA BUSINESS JOURNAL
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# Estimation of Food Demand Systems: Evidence from the LSMS Data of Tajikistan

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*Abstract: This paper 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 the Tajikistan Living Standard Measurement Survey (LSMS) in 2003, 2007, and 2009. The study also estimates a food demand system for Tajikistan using microdata from the LSMS, providing precise information about household food consumption behavior. This takes into account the effects of socioeconomic characteristics in 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.*

*JEL Codes: D12; D16, E21, M30*

*Key words*: *Food Demand System, QUAIDS Model, Censoring Approach, Food Prices, Food Security, Household Consumption, Tajikistan*

## 1. Introduction

Researchers and policymakers studied food consumption in Tajikistan due to the collapse of traditional production linkages and trading systems. The breakup of the Soviet Union in 1991 and the subsequent civil war in Tajikistan resulted in the country's sharp economic deterioration and political instability. As a result, food demand has declined drastically in quantitative and

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qualitative terms, and the poverty headcount has grown substantially.[2] This situation has raised a wide range of development policy issues like poverty elimination, improvement in nutritional and food security, and the adequacy of food subsidies. After the civil war ended in 1997, food consumption of Tajik households gradually improved as home-food production increased. Targeted international food aid also rose, as well as did real income of households from internal and external sources.[3] Demographic changes also caused structural shifts.

In spite of these positive recent changes in food consumption, the risks for food security are still high due to instable trends in nutrition composition and levels for households. Tajik households allocate more than 65% of their consumption to food purchases (Taj STAT, 2014). Population growth at an annual average rate of 2.3% has increased food demand as well as changed food composition. Analysts must assess changes in food consumption, including its response to shocks. Such international organizations as the World Bank, the International Monetary Fund, the Food and Agriculture Organization, and the World Food Programme, and individual researchers (Falkingham, 2000; Raghbendra & Tashrifov, 2008; Akramov & Shreedhar, 2012; Asadov, 2013; and Anríquez, Daidone, & Mane, 2013) have done substantial descriptive assessments of food consumption, including the effects of shocks on the living standards of Tajik households. However, most of these studies have focused on poverty elimination and the construction of food security indicators. We know of no previous econometric estimations of the response of food demand to shocks.

We need quantitative knowledge about food demand to design and implement agricultural development strategies and appropriate government social security policies that improve living standards. This paper provides a first step towards a complete estimation of a food demand system for Tajikistan, using microdata from the Living Standard Measurement Survey (LSMS) that the World Bank conducted in Tajikistan in 2003, 2007, and 2009.

To deal with the many products involved, we aggregated the major components of food consumption into six groups: Bread and cereals; meat and fish products; dairy products; vegetables and fruits; oils and animal fats; and other food items. A seventh group includes all other nonfood products and services. A two-step procedure estimated the demand parameters. The first step estimated a censored demand system taking into account zero values in expenditures,[4] using simulation based on maximum likelihood probit regression. The second step estimated the food demand system with the most frequently used model for nonlinear demand, the Quadratic Almost Ideal Demand System (QUAIDS) model, incorporating the predicted results of the probit estimation obtained from the first stage.[5]

This paper is organized as follows: Section 1 reviews the literature on demand system estimation. Section 2 discusses the theoretical framework and specifies the demand model. Sections 3 and 4 describe the data. Section 5 discusses the household consumption patterns and

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

[3] Internal income sources of Tajik households include wage income, home food production income, social benefit and assistance, and private transfers, whereas external income sources are the export of agricultural commodities by households and remittance incomes from abroad by household members.

[4] Despite the aggregation into seven group categories, some groups still contained many zero-value observations for consumption expenditure, e.g., meat and fish products, dairy products, and vegetables and fruits. Products in these groups can be considered as luxuries for most Tajik households.

[5] The particular specification of the models was tested applying the Wald test with the intention of describing 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, Blundell, & Lewbel, 1997; Bopape, 2006).

income sources, while Section 6 describes the estimation approach. Section 7 states our empirical results, and the last section draws conclusions.

## 1.1 Literature Review

Studies have estimated food demand systems to obtain income and price elasticities, with results widely variable across countries. These studies focus on how households adjust consumption in response to changes in prices and incomes, as well as on the estimation of welfare effects of shocks in food prices. The estimation of income-expenditure and price elasticities is required for conducting policy simulations. Many studies were conducted for poor and developing countries where households spend much of their income on food.

In most developing countries, food is a necessity that makes up the largest share of household expenditure (Ivanic & Martin, 2008; Mitchell, 2008; Aksoy & Isik-Dikmelik, 2008; Wood & Nelson, 2009; and Ivanic, Martin, & Zaman, 2011). Several research papers apply food demand models to obtain income-expenditure and price elasticities, as well as calorie and micronutrient consumption to investigate food security, nutrition, and diet (Bouis, Haddad, & Kennedy, 1992; Subramanian & Deaton, 1996; Abdulai & Aubert, 2004; Ecker & Qaim, 2008; and Pangaribowo & Tsegai, 2011).

Many empirical studies have employed AIDS and QUAIDS demand models (Musyoka & Bauer, 2012; Tefera et al., 2012; Sekhampu & Dubihlela, 2012; and Shittu, Oluwakemi, & Kabir, 2015). Deaton (1989) applied a nonparametric analysis and examined rice prices and income distribution in Thailand. Using the Ethiopia Agricultural Marketing Household Survey (EAMHS-2008) with nonparametric Net Benefit Ratio (NBR) analysis and a QUAIDS model, Tefera, Demeke, and Shahidur (2012) found that higher cereal prices raise 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 socioeconomic variables on food demand and nutrients amongst households. With significant effects of income and other socioeconomic 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, relative to cereals and pulses. A similar situation was remarked in the case of Malawi (Ecker & Qaim, 2008).

Similarly, Attanasio, Di Maro, Lechene, and Phillips (2013) used individual household data from Mexico to estimate the welfare effect of rising food prices using a QUAIDS model. They found that poor households have been relatively more affected by changes in relative prices of food. Shittu, Oluwakemi, and Kabir (2015) have studied the welfare impacts of high, rising, and sometimes-volatile food prices on Nigeria's farm households.[6] Finally, Tefera, Kavitakire, Demeke, and Rashid (2015) estimated the habit-forming behavior of food demand for ten food commodities using both dynamic QUAIDS and generalized dynamic Almost Ideal Demand System (AIDS) models in the case of Ethiopia.

## 1.2 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 & Moneta, 2010; Singh, I., L. Squire, and J. Strauss,1986). Engel's Law (1857) stated that when household income increases, the 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,

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

goods with income elasticities below zero, between zero and one, and higher than one was called inferior goods, necessities, and luxuries (Lewbel & 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 came to be known as the Working-Leser Condition (WLC), relating the shares of the household budget to the logarithm of household expenditure:[7]

$$\boldsymbol{\delta_i = \alpha_i + \beta_i \ln x} \quad \textbf{(1)}$$

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

The study of consumer demand theory has stimulated the empirical analysis of consumer behavior and consumer preferences with always more developed econometric techniques (Stone, 1954; Deaton & Muellbauer, 1980; Blundell, Pashardes, & Weber, 1993; Banks, Blundell, & Lewbel., 1997; Farrell & Shields, 2007). Over the last few decades, the study of the linkage between household income and expenditure based on Engel's 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, Lawrence, and Stoker (1982); Blundell, Duncan, and Pendakur (1998), Witt (2001) and Charles, Hurst, and Roussanov (2009). 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 & 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, Blundell, & Lewbel, 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.

The literature provides several models that estimate demand systems. The starting point was the Linear Expenditure System (LES) proposed by Stone (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, Jorgenson, and Lau (1975). Later Deaton and Muellbauer (1980) proposed a linear-logarithmic form, known as AIDS.[8]

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, Blundell, and Lewbel (1997), who demonstrated empirically the relevance of non-linear Engel curves. To take into account these nonlinearities, Blundell, Pashardes, and Weber (1993) proposed to estimate flexible demand systems, and stated the properties and advantages of a quadratic extension of the AIDS model, QUAIDS. This model is used in most relevant empirical studies. QUAIDS can be derived from a generalization of the Price-Independent Generalized Logarithmic preferences that incorporate higher orders of expenditure and income in the quadratic term, which positively affects the

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

[8] Jorgenson, Lawrence, and Stoker (1982) developed the Transcendental Logarithmic System (TLS) models, which are not widely used in the literature.

quality of the model results (Fisher et al., 2000). Moreover, it is possible to derive both the TLS model of Jorgenson, Lawrence, and Stoker (1982) and the AIDS model of Deaton and Muellbauer, (1980) by imposing particular restrictions on the parameters of the QUAIDS model. Banks, Blundell, and Lewbel (1997) Banks et al. (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, Eales, Hertel, & Preckel, 2003).

The empirical estimation approach we use in this paper is based on a QUAIDS model for several food commodity groups including household demographic characteristics. Assuming the simple household model of Singh, Squire, and Strauss (1986), the household maximizes utility $\boldsymbol{max\ u_h^{\phi} = u_h(c_i, c_j, \dots, c_n)}$ 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 $pq_i \leq w_i$. However, Blundell et al. noted that there is a systematic variance in household consumption behavior 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.[9] Taking into account the sociodemographic characteristics $z_h$, the household utility maximization problem can be written as:

$$\boldsymbol{max\ u_h^{\phi} = u_h(c_i, c_j, \dots, c_n; z_h)} \qquad \textbf{(2)}$$

where $c_i$ is a consumption good. Indeed, there are different ways to incorporate the household demographic characteristics into the utility function (Moro & 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 $\boldsymbol{e(p, z, u) = m_0(p, z, u) \times e^R(p, u)}$, which scaled by function $\boldsymbol{m_0(p, z, u) = \bar{m}(z) \times \phi(p, z, u)}$ 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 controlled by changes in consumption patterns. That is, for a given composition of consumed goods, a household with four members will have higher expenditures than one with a single member. The second term $\boldsymbol{\phi(p, z, u)}$ 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 $\gamma'$ given by $\boldsymbol{\bar{m}_0(z) = 1 + \gamma' z}$. [10]

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

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

[9] In particular, we consider heterogeneity in age, number of household members, employment status, and other socio-demographics variables (Dybczak, Tóth, & Voňka, 2010; Zheng & Henneberry, 2010).

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

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

If $\boldsymbol{\lambda}$ is set to zero, the household cost function will be the same as in QUAIDS (Banks, Blundell, & Lewbel., 1997) as in the AIDS model.

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

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

and $b(p) = \prod_i p_i^{\beta_i}$ with $\boldsymbol{\lambda(p) = \sum_{i=1}^{n} \lambda_i \text{In } p_i}$ where $\sum_{i=1}^{n} \lambda_i = 0$. Demographic characteristics are obtained in this way: $c(p, z_h) = \prod_i p_i^{\beta_i + \sum_{k=1}^{k} \beta_{ik} z_h k}$ where $\boldsymbol{\lambda(p, z_h)}$ is defined as follows: $\lambda(p, z_h) = \sum_{i=1}^{n} (\lambda_{i0} + \sum_{k=1}^{k} \lambda_{ik}, z_{hk}) \text{In } p_i$. Likewise, applying Roy's identity or Shephard's Lemma[11] to the indirect utility function yields the budget share equations in the QUAIDS model with demographics as follows:

$$\omega_i = \alpha_i + \sum_j \gamma_{ij} \text{In } p_j + (\beta_i + \eta_i' z_h) \ln\left[\frac{m}{\bar{m} z_h a(p)}\right] + \frac{\lambda_i}{b(p) c(p, z_h)} \ln\left[\frac{\text{m}}{\bar{\text{m}} \text{z}_\text{h} \text{a(p)}}\right]^2 \qquad \textbf{(5)}$$

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

Two potential problems might bias the econometric estimation. First, zero values for the household expenditure might occur on any commodity. Second, endogeneity might occur between household total expenditure and income (Mukasa & Berloffa, 2013).

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

$$\mu_i \equiv \frac{\partial \omega_i}{\partial \text{In } p_i} = -\delta_{ij} + \frac{1}{w_i}\left(\gamma_{ij} - \left[\beta_i + \eta_i' z + \frac{2\lambda_i}{b(p) c(p, z_h)} \ln\left[\frac{m}{\bar{m} z_h a(p)}\right]\right] \text{x} \left(\alpha_j + \frac{1}{2}\sum_k \gamma_{jk} \text{In } p_i\right) - \frac{\lambda_i(\beta_j + \eta_i' z_h)}{b(p) c(p, z_h)} \ln\left[\frac{m}{\bar{m} z_h a(p)}\right]^2\right) \qquad \textbf{(6)}$$

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

$$\varepsilon_i = \frac{\mu_i}{(\omega_i + 1)} \quad (\textit{budget elasticities}) \qquad \textbf{(7)}$$

$$\eta_i = \frac{\mu_i}{\omega_i} + 1 \quad (\textit{income elasticities}) \qquad \textbf{(8)}$$

These express the proportionate change in the quantity demanded by the household of a food product. When a proportionate change occurs in the household income, prices and household characteristics remain constant. A higher income elasticity results in more sensitive consumer

[11] The budget share equation is the log price derivative of the consumer's budget function based on Shephard's Lemma: $w_i = \frac{p_i q_i}{C(u,p)} = \frac{\Delta \text{ In } C(u,p)}{\Delta \text{ In } p_i}$ 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.

demand for a commodity. For most commodities, the elasticity is positive and ranges between zero and one. Thus, the quantity of food demanded increases when the income of household increases, but less than proportionally. Some food commodities are luxury goods with $\boldsymbol{\varepsilon_i > 1}$. Others are inferior commodities with a negative income elasticity, $\boldsymbol{\varepsilon_i < 0}$.

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

$$\varepsilon_{ij}^{u} = \frac{\mu_{ij}}{\omega_j} - \delta_{ij} \quad (Marshallian\ uncompensated\ elasticities) \qquad \textbf{(9)}$$

where $\boldsymbol{\delta_{ij}}$ is the Kronecker delta, equal to **1** if $\boldsymbol{i = j}$, and 0 otherwise. Uncompensated price elasticities give the proportional changes in quantity demanded in response to a 1% 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:

$$\varepsilon_{ij}^{c} = \varepsilon_{ij}^{u} + \varepsilon_i \omega_i \quad or \quad \varepsilon_{ij}^{*} = \varepsilon_{ij}^{c} = \varepsilon_{ij}^{u} + \omega_i \eta_i \ (Hicksian\ compensated\ elasticities) \ \textbf{(10)}$$

## 1.3 Data

The data used in our empirical analysis are drawn from the Living Standard Measurement Survey (LSMS) of Tajikistan, which covered the years 2003, 2007 (in two rounds), and 2009. The surveys have been implemented by the Agency of Statistics under the President of the Republic of Tajikistan (Taj STAT) based on the initiative of the World Bank and since 2007 with the collaboration of the United Nations Children's Fund (UNICEF). The LSMS estimates 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, Republican Subordination (RRS), and Gorno-Badakhshan Autonomous Province (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 LSMS survey of 2009 is a panel survey of 1,503 households, which were interviewed in the LSMS survey of 2007, so both surveys can be matched to each other. However, the questionnaires for the 2007 and 2009 surveys were based on the LSMS survey of 2003 with modifications and addition of new modules, e.g. Migration, Financial Services, Subjective Poverty, and Food Security. The LSMS 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.[12] Of the 4,860 households in the first round, 4,490 households were re-interviewed in the second round. Due to adverse conditions, 54 households could not be revisited and 100 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 inform us about the income resource and expenditure patterns of households with a wide range of demographic characteristics related to internal-external migration, education, health utilities, labor market participation, housing and dwelling, utilities

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

and durable goods, transfer and social assistance, subjective perception of poverty and food security, household expenditure on food and nonfood items, as well as data for household income sources. The income patterns include cash and in-kind forms of wages and bonuses, remittances, scholarships, individual transfers, pensions, social assistance, and income from selling harvest, farm animals, and poultry (or their product). Expenditures include payments for education, transportation, medicine and hospitalization charges, food and nonfood items, bank loans, house utilities and rent, assistance to other relatives or individuals, land use, cultivation, and harvesting, and for purchases of farm animal and poultry breeding along with their food.

The list of food and nonfood products in the 2007 and 2009 surveys is larger from the one used in the earlier survey of 2003. A total of 32 food items were considered in the 2003 survey, extended to 66 in 2007 and 2009. Data on food expenditure were collected in the reference period of the "last seven days" in all surveys. The food module contained questions on purchased and non-purchased portions of consumption. The non-purchased portion was further divided into four subsections: Own produced, received as a gift or humanitarian donation, received as part of wages, and taken from stock. Additionally, the food module of the survey of 2007 and 2009 included the meals and alcoholic and nonalcoholic drinks, which were consumed outside the home. Following the adjustment methodology of the TLSS survey,[13] 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 groups: Bread and cereal; meat and fish; dairy products; vegetables and fruits; oils and animal fats; the rest of the food items; and other products and services.

## 1.4 Descriptive Statistics

Our data provide information on the expenditures and quantities for food and nonfood items but do not report market prices. We computed unit values (Deaton, 1988) as proxy variables for market prices, following several empirical studies (Deaton, 1997; Kedir, 2005; Gibson & Rozelle, 2006; and 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, unit value is calculated as the ratio of expenditures and quantities: $\boldsymbol{uv_j^h = \frac{w_i^h}{q_i^h}}$ where $\boldsymbol{w_i^h}$ is the expenditure and $\boldsymbol{q_i^h}$ is the physical amount of commodity $\boldsymbol{i}$**=1, 2, 3…..**$\boldsymbol{n}$ purchased by household $\boldsymbol{h}$**.** 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).[14]

Often data on expenditure or quantity or both are missing across some households during the survey period. We partially observed this 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. 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,

[13] http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/

[14] However, due to the differences in consumer 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.

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 Table 1 below.

Table 1

*Descriptive Statistics of Unit Values for Food-Grouped Items (2003-2009)*

| | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| Bread and cereal products | 3.001 | 0.853 | 1.40 | 5.47 |
| Meat and 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 and 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 the LSMS, Taj STAT (2003, r1-r2 2007, 2009)*

Unluckily, our data do not provide the physical quantities consumed by households for all individual nonfood 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 nonfood grouped products. Consequently, we used the weights of the Consumer Price Index (CPI) as a proxy for the price of unit values for nonfood products and services, where the monthly CPI was obtained from the IMF and Taj Stat. Table 2 provides the summary of statistics on household demographic characteristics in Tajikistan based on the data of the 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 and status, and his other livelihood 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 (WPF, 2008).

Most individuals with an age of 20 to 65 are urban residents (Taj STAT, 2014). Moreover, many 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 with general secondary and technical education, and 7% are without education. Typically, urban households are headed by young males with high education. The level of education seems unbalanced between urban and rural areas.[15]

[15] Moreover, dissimilarity was noticeable between rural and urban households in terms of household size. On average, the household size in rural areas is 7-8 members, but the national average is 5-6 persons.

Table 2

*Description of Household Demographics Used in QUAIDS Estimation (2003-2009)*

| | 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:1 if male, 0 otherwise | 0.725 | 0.446 | 0.854 | 0.352 |
| -Marital status of HH: 1 if married, 0 otherwise | 0.723 | 0.447 | 0.832 | 0.373 |
| -Education HH head: 1 if basic-secondary education, 0 otherwise | 0.523 | 0.449 | 0.599 | 0.490 |
| -Education HH head: 1 if technic-high education, 0 otherwise | 0.285 | 0.451 | 0.138 | 0.345 |
| -Employment status of HH head: 1 if employed, 0 otherwise | 0.621 | 0.485 | 0.634 | 0.481 |
| -Agro-Employment: 1 if employed in agriculture, 0 otherwise | 0.035 | 0.184 | 0.264 | 0.442 |
| -Poverty status of households: 1 if HH is poor, 0 otherwise | 0.272 | 0.445 | 0.306 | 0.461 |
| -Migration: 1 if household has migrants yes, 0 otherwise | 0.172 | 0.378 | 0.273 | 0.445 |

*Source: Own calculation based on LSMS, 2003-2009*

Rural households work mainly on agriculture, while urban households work in public services, trade, and other sectors. Moreover, rural Tajikistan has a high unemployment rate and huge out-migration. Overall Table 3 reports summary statistics for the other variables, which used in the QUAIDS estimations based on the data of LSMS 2003, rounds 1-2 of 2007, and 2009.

Table 3
*Description of Variables and Summary Statistics 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 Nonfood Expenditure | 4.432 | 1.329 |
| | ***Expenditure shares of food-grouped products*** | | |
| $W_{\text{bread and cereals}}$ | Budget share of bread and cereals | 0.272 | 0 .143 |
| $W_{\text{meat and fish}}$ | Budget share of meat and fish | 0.076 | 0.075 |
| $W_{\text{dairy products}}$ | Budget share of dairy products | 0.046 | 0.048 |
| $W_{\text{vegetables and friuts}}$ | Budget share of vegetables | 0.139 | 0.079 |
| $W_{\text{oils and animal's fats}}$ | Budget share of oils and animal fats | 0.077 | 0.054 |
| $W_{\text{other food items}}$ | Budget share of other food items | 0.078 | 0.061 |
| $W_{\text{other products \& service}}$ | Budget share of other products and services | 0.311 | 0.161 |
| | ***Prices of food-grouped products*** | | |
| Log $P_{\text{bread and cereals}}$ | Price of bread and cereals | 1.071 | 0.368 |
| Log $P_{\text{meat and fish}}$ | Price of meat and fish | 2.367 | 0.378 |
| Log $P_{\text{dairy products}}$ | Price of dairy products | 0.713 | 0.418 |
| Log $P_{\text{vegetables and fruits}}$ | Price of vegetables | 0.842 | 0.347 |
| Log $P_{\text{oils and animal's fats}}$ | Price of oils and animal fats | 1.872 | 0.417 |
| Log $P_{\text{other food items}}$ | Price of other food items | 1.605 | 0.437 |
| Log $P_{\text{other products \& service}}$ | Price of other products and services | 4.299 | 0.211 |
| | ***Spatial dummy variables*** | | |
| 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 |
| | ***Rounds dummy variables*** | | |
| ***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** |

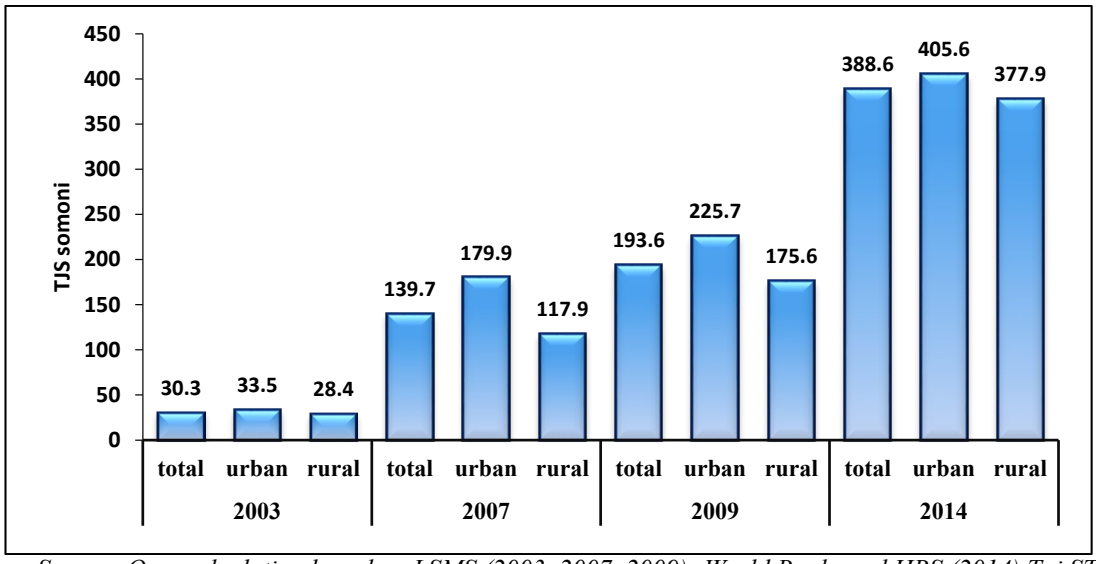
*Source: Own calculation based on data LSMS, 2003-2009*
*Note:* RRS -*Regional Republic Subordination and* GBAO -*Gorno-Badagakashan Oblast*

## 1.5 Household Consumption Patterns and Income Sources

Household consumption has changed considerably in recent years. The average household purchases consumer goods based on its budget and the stability of its income. The substantial upsurge of household consumption relates first to the stabilization of the socioeconomic 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 1).

Figure 1

Monthly Household Net-Income Per Capita in Tajikistan (2003-2014)
*(in national currency TJS-somoni)*



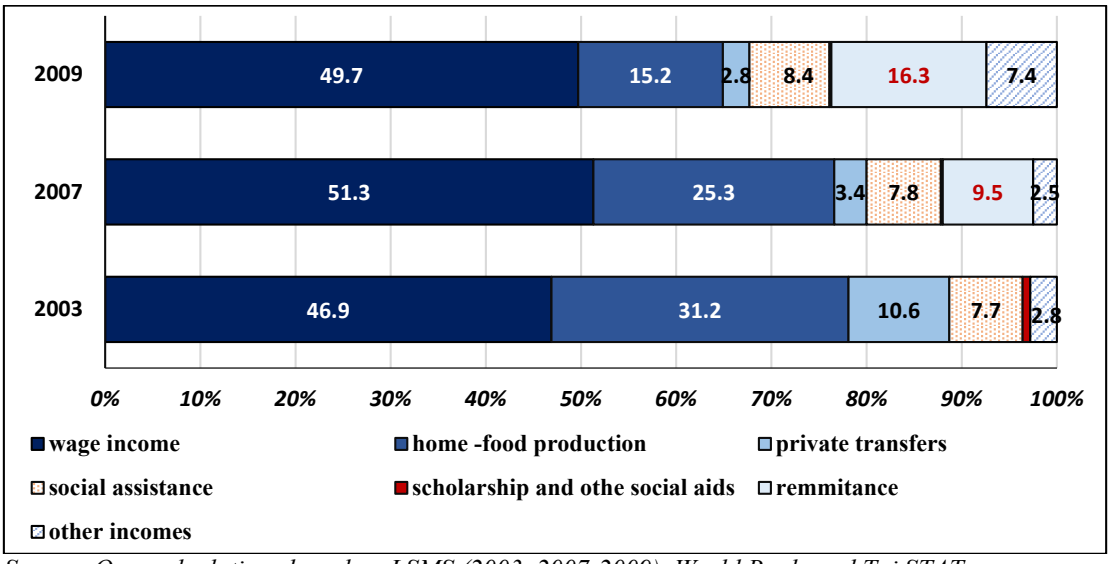

*Source: Own calculation based on LSMS (2003, 2007, 2009); World Bank; and HBS (2014) Taj STAT*

Most Tajik households have temporary income that fluctuates considerably over time. An enormous migration outflow makes the consumption of many households deeply reliant on remittances. Empirical research has been conducted regarding the impact of remittances on household expenditure in Tajikistan (e.g., Olimova & 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 do other households.

According to our data from the LSMS (2003-2009), wage-employment, the pensions-social benefits scheme, and home-food production jointly with food gifts were the major sources of income. Figure 2 illustrates household income by economic activity.

Figure 2

*Monthly Household Net-Income Per Capita by Main Source (2003-2009)*

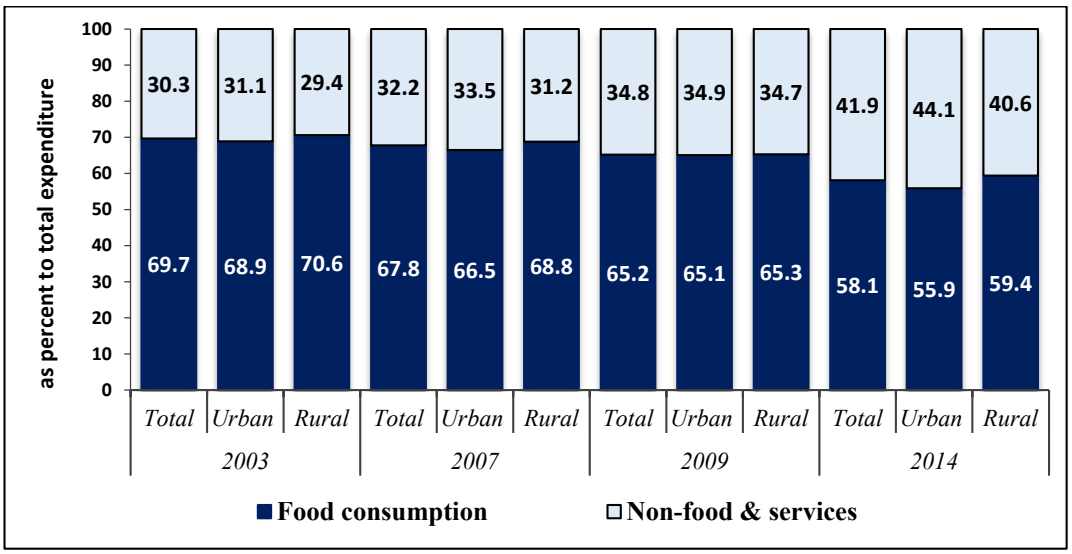



*Source: Own calculations based on LSMS (2003, 2007-2009), World Bank, and Taj STAT*

We observe that Tajik households allocate annually around two thirds of their total expenditure to food consumption. Figure 3 displays the slight rise of the nonfood expenditure share in household budgets over recent years.

Figure 3

*Household Budget Patterns Across Locations (2003-2014)*

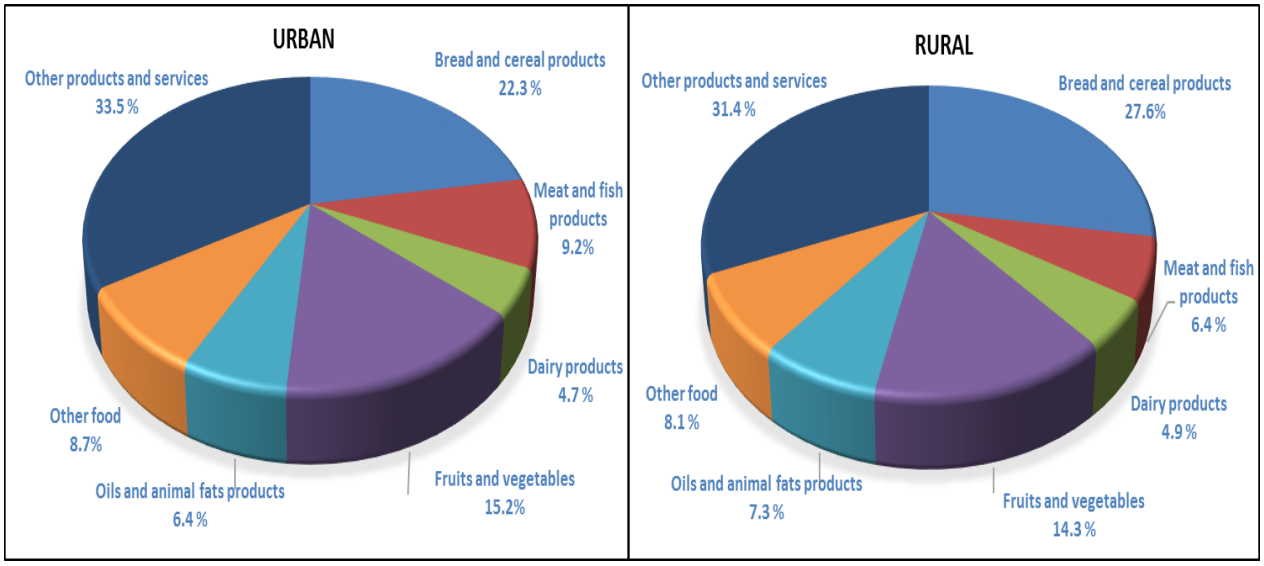



*Source: Own calculations based on LSMS (2003, 2007, 2009); the World Bank; and HBS (2014) Taj STAT*

Figure 4 illustrates the composition of household food consumption by urban and rural samples in Tajikistan. Traditional Tajik households consume a lot of bread products independently of their income and budget allocation. The budget share of rural households devoted to bread and cereal products tends to be greater than for urban households. Commonly, the rural households allocate a larger budget share to cheaper food products. In fact, low-income households with severe insecurity in food consume a poor daily diet of bread and cereals, pasta and potatoes, rarely complemented with vegetables and fruits. And expenditure on dairy products is small in both urban and rural areas.

Figure 4

*Composition of Diet based on Food-Grouped Products Across Locations (2003-2009)*




*Source: Own calculations based on the LSMS and the 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 (Appendix A). Several factors account for the low food consumption of Tajik households. The two main ones are food accessibility and availability, which in turn may be influenced by geography, demography, disposable income, price volatility, and climate variability. For example, poor urban households are more vulnerable to variations in food prices, production, and availability in food stocks than rural ones.

## 1.6 Estimation Approach

To estimate the food demand system, we use the QUAIDS model, an extended form of the original AIDS model, which permits nonlinear Engel curves.[16] Following the theoretical restrictions of QUAIDS, we impose the parametric constraints of adding-up, homogeneity, and symmetry conditions across the equations. To avoid singularity in the variance-covariance matrix, we remove the equation for the aggregated group of nonfood products and services, from direct estimation. To estimate the full demand system, we recover the skipped parameters through the adding-up restrictions by re-parameterizing in the equations the constant term $\boldsymbol{\alpha_i}$, expenditure $\boldsymbol{\beta_i}$, prices $\boldsymbol{\gamma_{ij}}$, expenditure squared $\lambda_i$ and socioeconomic variables.

Because Tajik households are poor and have certain socioeconomic preferences, a significant number of zero-value observations occur in our microdata, mainly in such luxury food products as meat, fish, and dairy products (see Appendix B). Zero consumption values may lead to inconsistent estimates of demand parameters (e.g., Blundell & Robin, 1999), which will bias the estimates (Barslund, 2011). Moreover, deleting the zero-consumption values only permits the estimation of conditional effects (Deaton, 1990). When the proportion of zero consumption values in the data causes censored dependent variables, we must apply an econometric technique that avoids the potential problem of sample selection. One technique that has been widely applied is the "two-step estimation" procedure proposed by Heien and Wessells

[16] We estimate the parameters of the QUAIDS model using a modified version of the Nonlinear Seemingly Unrelated Regression method and the Feasible Generalized Least Squares estimator, using the STATA software package.

(1990) and afterwards modified by Shonkwiler and Yen (1999). This procedure consists in running a univariate probit estimation.

This estimation determines the probability that the household will consume any positive quantity of the food in the first step and the correlation among these commodities at the second step.[17] One estimates several probit models independently:

$$w_{ih}^{*} = f(x_{ih}, \mu_i) + u_{ih} \qquad d_{ih}^{*} = z_{ih}'\theta_i + \varepsilon_{ih}$$

$$d_{ih} = \begin{cases} 1 \; if \; d_i^{*} > 0 \\ 0 \; if \; d_i^{*} \leq 0 \end{cases}$$

$$w_{ih} = d_i w_{ih}^{*} \qquad \textbf{(11)}$$

where $\varepsilon_{ih}$ 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-group commodities, and $h$ is the index of households; $\mu_i$ and $\theta_i$ are vectors of parameters associated with vectors of exogenous variables; $x_{ih}$ are household expenditures or incomes and prices, and $z_{ih}'$ are household sociodemographic variables as well as related ones.

Then we can rewrite the system in equation (9) as follows: [18]

$$w_{ih}^{*} = \Phi(z_{ih}'\theta_i) + f(x_{ih}, \mu_i) + \delta_i \phi(z_{ih}'\theta_i) + \xi_{ih} \qquad \textbf{(12)}$$

where $\xi_{ih}$ 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.[19]

In the second step, the results of the probit regression should be incorporated into the QUAIDS model with household demographic variables as follows:[20]

$$\omega_i = \Phi(z_{ih}'\theta_i)\left\{\alpha_i + \sum_j \gamma_{ij} \ln p_j + (\beta_i + \eta_i' z_h)\ln\left[\frac{m}{\bar{m} z_h a(p)}\right] + \frac{\lambda_i}{b(p)c(p,z_h)}\ln\left[\frac{m}{\bar{m} z_h a(p)}\right]^2\right\} + \delta_i \phi(z_{ih}'\theta_i) + \xi_{ih} \qquad \textbf{(13)}$$

Consequently, to derive conditional expenditure and food price elasticities, equation (13) is differentiated in respect to $\ln m$ and $\ln p_j$, and the elasticity equations can be rewritten as:

$$\mu_i \equiv \frac{\partial w_i^{*}}{\partial \ln m} = \Phi(z_{ih}'\theta_i)\left\{1 + \frac{1}{w_i}\left(\beta_i + \eta_i' z_h \frac{2\lambda_i}{b(p)c(p,z_h)}\left[\ln\left(\frac{m}{\bar{m} z_h a(p)}\right)\right]\right)\right\} \qquad \textbf{(14)}$$

The Marshallian (uncompensated) elasticity with respect to price is:

---

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

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

[19] However, there are important implications for the uncensored demand system, where the adding-up condition via parametric restrictions is not possible (Drichoutis, Klonaris, Lazaridis, & Nayga, 2008) and the disturbance terms are heteroscedastic in Equation 2. To overcome this issue, Yen, Lin, & Smallwood (2003) proposed to treat the n$^{th}$-goods equation as a residual category 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 $w_n$ ; they might even be negative.

[20] Hence the equation system (14) requires the estimation based on the full $n$-vector (Yen, Kan, & Su, 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. Equation (m) is household expenditure.

$$\mu_i \equiv \frac{\partial w_i^*}{\partial \ln p_i} = \Phi(z_{ih}'\theta_i)\left\{-\delta_{ij} + \frac{1}{w_i}\left(\gamma_{ij} - \left[\beta_i + \eta_i' z + \frac{2\lambda_i}{b(p)c(p,z_h)} \ln\left[\frac{m}{\bar{m}z_h a(p)}\right]\right] \text{x} \left(\alpha_j + \frac{1}{2}\sum_k \gamma_{jk} \ln p_i\right) - \frac{\lambda_i(\beta_j + \eta_i' z_h)}{b(p)c(p,z_h)} \ln\left[\frac{m}{\bar{m}z_h a(p)}\right]^2\right)\right\} \quad \textbf{(15)}$$

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. The Hicksian (compensated) price elasticities would be obtained by $\varepsilon_{ij}^c = \varepsilon_{ij}^u + \epsilon_i w_i$.

## 1.7 Empirical Results

We estimate the probit equations using these explanatory variables: The log of household income, the log of price food-grouped products, household size, number of children (age 0-15 years), the number of adults (age > 15 years), and the age of the household head, plus dummy variables for household location (rural), poverty status, migration, gender, literacy, and employment status of the household head. However, the pooled estimation extended the number of variables, including the spatial impacts by adding regional dummy variables. Most economic and socio-demographic variables have statistically significant impacts in determining the probability of obtaining zero-value observations for expenditure in grouped food consumption. The parameter estimates and the correlation matrix of the univariate probit regression with pooled data are in Appendix D.

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 cereal products. Food prices also present significant effects independently of the net position of households as producers or consumers of food products. Regarding the rest of the variables, most of the statistically significant coefficients are observed in the food-grouped products of meat and fish products, dairy food items, vegetables and fruits, and oils and animal fats.

We estimate demand for food using the QUAIDS model as the pooled cross-sectional estimation at country level.[21] 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 the probability density function (pdf) and the cumulative distribution function (cdf) are properly incorporated into the QUAIDS model.

The estimated parameters of the QUAIDS model are presented in Appendix E. 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 statistically significant at 1%, 5% or 10% levels for all aggregated food products.

The estimated expenditure parameters suggest that meat and fish, dairy products, and fruits and vegetables are luxuries for Tajik households. The socio-demographic and regional control variables are significant, and their coefficients show the expected signs. For instance, the dummy variable of the poverty status of the households shows a significant effect at the 1% level during all rounds. This suggests that poverty, hunger, and food insecurity are still major policy issues for Tajikistan. The estimated parameters of the dummy variable of migration (households with migrants) show marginally positive effects in the demand for those products which are luxuries for Tajik households. These results accord with the significance of remittances in food

[21] The parameter estimates for each survey separately as well as for rural and urban households are available upon request from the authors. Moreover, 12 socioeconomic and demographic variables were included in the round estimations and additionally another five regional variables were incorporated in the pooled demand estimation.

consumption patterns and the well-being of Tajik households. However, in the round for the year 2009, the decline in 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 and fish, dairy, vegetables and fruits, and other food items, and a significant negative effect for the nonfood group. This suggests that as household size increases for a given level of expenditure and prices, households try to adjust their consumption demand from nonfood products towards food items.

The marginal effects of some of the other socio-demographic variables, such as the number of children, the number of adults, and gender, are not so consistent or significant. Location (rural versus urban) and regional dummies, however, show significant effects throughout.[22]

Table 4 presents the expenditure elasticities from the pooled estimation. The results show that expenditure elasticities vary across location. The expenditure elasticity of food consumption is higher for rural households for all groups of food products.

Table 4

*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 4 shows that all expenditure elasticities have positive coefficients in all rounds across samples. The values corresponding to bread and cereals products, vegetables and fruits, and other food groups have values below unity, while the elasticities for meat and 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 the 1% statistically 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 5 presents uncompensated and compensated price elasticities from pooled estimation.[23] Compensated elasticities suggest that net substitution dominates among food products. Bread and cereal products are net substitutes for all food items, and they show in general the highest (in absolute value) cross-price compensated elasticities.

[22] 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 in Appendix C.

[23] Uncompensated and compensated price elasticities for both urban and rural areas are in Appendices F and G.

This suggests that Tajik households, when they face relatively higher prices for any other food items, react by consuming more bread and cereal products and less of other food commodities.[24]

[24]Net complementarity relationships are rarely observed, and they mostly involve the groups of oils and animal fats and other food items.

*Table 5*

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

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

## 1.8 Conclusions

This paper presented the estimation of a food demand system for Tajikistan using a QUAIDS specification that includes a set of variables representing socioeconomic and demographic characteristics of households. As far as we know, there are no other estimations of this type in the literature for Tajikistan, one of the poorest and most food-insecure countries 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.

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 that we use, this problem is acute even when we aggregate all food items in just seven groups. Many households do not report any consumption of various groups of food products to which they have limited access or that 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 of the 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 respond to changes in expenditure and prices, 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 and fish products, dairy products, and vegetables and fruits can be categorized as luxuries for Tajik households, while bread and cereals, oils and animal fats, and 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 and cereals towards higher-value products such as meat and fish, dairy products, and fruits and vegetables, allowing consumption diversification, thanks to easier access and availability of food.

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## 2. Summaries

*English: 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.*

*Russian: Таджикистан остается страной Центральной Азии, где уровень продовольственной безопасности выше. Соответственно, рост цен на продукты питания оказывает существенное влияние на благосостояние таджикских домохозяйств, поскольку значительная часть их бюджета уходит на потребление продуктов питания. С другой стороны, из-за ограниченности пахотных земель для сельского хозяйства, трудностей с доступностью продовольствия и сезонной доступности продовольствия последствия любых потрясений уровня и изменчивости цен на продовольствие напрямую передаются на модели потребления домохозяйств. Таким образом, рост цен на продовольствие может изменить структуру спроса на продовольствие как в городских, так и в сельских районах Таджикистана*.

## 2. References

Abdulai, A. (2002). Household demand for food in Switzerland: A Quadratic Almost Ideal Demand System. *Swiss Journal of Economics and Statistics*, *138(1)*, 1-18.

Abdulai, A., & Aubert, D. (2004). A cross-section analysis of household demand for food and nutrients in Tanzania. *Agricultural Economics, 31(4)*, 67-79.

Akramov, K. T., & Shreedhar. G. (2012). Economic development, external shocks, and food security in Tajikistan. IFPRI Discussion Paper 01163, March.

Aksoy, M.A., & Isik-Dikmelik, A. (2008). Are low food prices pro-poor? Net food buyers and sellers in low-income countries. World Bank Policy Research Working Paper, No. WPS 4642, June.

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

Asadov, S. (2013). Food security and the agricultural cooperation agenda in Central Asia with a focus on Tajikistan. University of Central Asia, Institute of Public Policy and Administration, Working Paper 16.

Attanasio, O., Di Maro, V., Lechene, V., & Phillips, D. (2013). Welfare consequences of food prices increases: Evidence from rural Mexico. *Journal of Development Economics*, *104*, 136–151.

Banks, J., Blundell, R., & Lewbel, A. (1997). Quadratic Engel Curves and consumer demand. *The Review of Economics and Statistics*, *79(4),* 527-539.

Barslund, M., (2011). Censored demand system estimation with endogenous expenditures in clustered samples: An application to food demand in urban Mozambique. LICOS, Discussion Paper 280/2011.

Blow, L. (2003). Demographics in demand systems. IFS Working Papers W03/18, Institute for Fiscal Studies.

Blundell R., (1988). Consumer behaviour: Theory and empirical evidence—a survey. *The Economic Journal, 98(389)*, 16-65.

Blundell, R., Pashardes P., & Weber, G. (1993). What do we learn about consumer demand patterns from micro data? *The American Economic Review*, *83(3),* 570–597.

Blundell R., Duncan, A., & Pendakur, K, (1998). Semiparametric estimation and consumer demand. *Journal of Applied Econometrics*, *13(5),* 435–461.

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

Bopape, L. E. (2006). The influence of demand model selection on household welfare estimate: An application to South African food expenditure. Michigan State University, Department of Agricultural Economics. Dissertation.

Bouis, H., & Lawrence, H. J. (1992). Are the estimates of calorie income elasticities too high: A recalibration of the plausible range. *Journal of Development Economics*, 39(2), 333-364.

Bouis, H., Haddad, L., & Kennedy, E. (1992). Does it matter how we survey demand for food? Evidence from Kenya and the Philippines. *Food Policy, 17(5),* 349-360.

Brown, R., Olimova, S., & Boboev, M. (2008). A study on international migrants' remittances in Central Asia and South Caucasus: Country report on remittances of international migrants in Tajikistan. Manila: Asian Development Bank.

Chai, A. & Monet, A. (2010). Retrospectives: Engel Curves. *Journal of Economic Perspectives*, *24(1)*, 225–24.

Charles, K. K., Hurst, E., & Roussanov, N. (2009). Conspicuous consumption and race. *Quarterly Journal of Economics, 124(2)*, 425–468.

Christensen, L.R., Jorgenson, D. W., & Lau, L. J. (1975). Transcendental logarithmic utility functions. *American Economic Review, 65(3)*, 367-383.

Clément, M. (2011). Remittances and household expenditure patterns in Tajikistan: A propensity score matching analysis. *Asian Development Review*, *28(2)*. Retrieved from http://ssrn.com/abstract=2001145

Cox, T. L., & Wohlgenant, M. K. (1986). Prices and quality effects in cross-sectional demand analysis. *American Journal of Agricultural Economics*, *68(4)*, 908-919.

Cranfield, J. A. L., Eales, J. S., Hertel, T. W., & Preckel, P. V. (2003). Model selection when estimating and predicting consumer demands using international, cross section data. *Empirical Economics*, *28(2),* 353-364.

Danzer, A. M., Dietz, B., & Gatskova, K. (2013a). Migration and remittances in Tajikistan: Survey technical report. Institute for East and Southeast European Studies, IOS Working Papers No. 327, February.

De Agostini, P. (2014). The effect of food prices and household income on the British diet. University of Essex, ISER Working Paper No. 2014-10, February.

Deaton, A. (1988). Quality, quantity, and spatial variation of price. *The American Economic Review, 78(3)*, 418-430.

Deaton A. (1989). Rice prices and income distribution in Thailand: A non-parametric analysis. *The Economic Journal*, *99*, 1-37.

Deaton, A., (1990). Price elasticities from survey data: Extensions and Indonesian results. *Journal of Econometrics, 44(3),* pp.281–309.

Deaton, A., (1997). The analysis of household surveys: A microeconometric approach to development policy. Washington, D.C.: The World Bank, July.

Deaton, A., & Muellbauer, J. (1980). An Almost Ideal Demand System. *The American Economic Review*, *70(3),* 312-326.

Drichoutis, A. C., Klonaris, S., Lazaridis, P., & Nayga, Jr., R. M. (2008). Household food consumption in Turkey: A comment. *European Review of Agricultural Economics*, *35(1),* 93-98.

Dybczak, K., Tóth, P., & Voňka, D. (2010). Effects of price shocks to consumer demand: Estimating the QUAIDS demand system on Czech Household Budget Survey data. Working Paper Series 8, CNB-Czech National Bank.

Ecker, O., & Qaim, M. (2008). Income and price elasticities of food demand and nutrient consumption in Malawi. Department of Agricultural Economics and Social Sciences, University of Hohenheim, Manuscript.

Engel, E. (1857). Die Produktions- und Consumtionsverhältnisse des Königreichs Sachsen. *Zeitschrift des Statistischen Büreaus des Königlich Sächischen Ministeriums des Innern, 8 and 9.*

Food and Agriculture Organization. (2001). Human nutrient requirements. Food and Nutrition Technical Report Series 1. Report of Joint FAO, WHO, UNU Expert Consultation. Rome. Retrieved from http://www.fao.org/3/a-y5686e.pdf

Food and Agriculture Organization. (2003). Trade reforms and food security: Conceptualizing the linkages. Retrieved from ftp://ftp.fao.org/docrep/fao/005/y4671e/y4671e00.pdf

Food and Agriculture Organization. (2013). Food security dimensions at the national level: The state of food insecurity in the world. FAO. Retrieved from http://www.fao.org/docrep/018/i3434e/i3434e03.pdf

FAOSTAT. (2014). Data. Retrieved from http://faostat3.fao.org/home/E.

Falkingham, J. (2000). A profile of poverty in Tajikistan. Centre for Analysis of Social Exclusion. London: London School of Economics. Paper 39, April.

Farrell, L., & Shields, M. A. (2007). Children as consumers: Investigating child diary expenditure data. *Canadian Journal of Economics*, *40(2)*, 445–467.

Fisher, D., Fleissig, A. R., & Serletis, A. (2000). An empirical comparison of flexible demand system functional forms. Department of Economics, University of Calgary. Working Papers 2000-04.

Forster, C., Knutson, B. & Potter, S. (2009). Finding the community voice: Food security, community capacity, and the United Nations World Food Programme: Tajikistan. The George Washington University, Elliott School of International Affairs, International Development Studies Capstone Report, June.

Gibson, J., & Rozelle, S. (2006). Evaluating the use of unit values and community prices in demand and food policy analysis. University of Waikato, Stanford University, & University of California, Davis. December.

Heien, D., & Wessells, C. R. (1990). Demand systems estimation with microdata: A censored regression approach. *Journal of Business and Economic Statistics, 8(3)*, 365-371.

International Monetary Fund. (2009). Republic of Tajikistan: Poverty reduction strategy paper. IMF Country Report No. 09/82, March. Retrieved from https://www.imf.org/external/pubs/ft/scr/2009/cr0982.pdf

Ivanic, M., & Martin, W. (2008). Implications of higher global food prices for poverty in low income countries. The World Bank, Development Research Group, Policy Research Working Paper 4594, April.

Ivanic, M., Martin, W., & Zaman, H. (2011). Estimating the short-run poverty impacts of the 2010-11 surge in food prices. The World Bank, Development Research Group, Policy Research Working Paper No. 5633, April.

Jorgenson, D.W., Lawrence, J. L., & Stoker, T. M. (1982). The transcendental logarithmic model of aggregate consumer behavior. In *Advances in Econometrics*, Greenwich: JAI Press, 203-356.

Kedir. A. M. (2005). Estimation of own- and cross-price elasticities using unit values: Econometric issues and evidence from urban Ethiopia. *Journal of African Economies*, *14(1),* 1–20.

Leser, C. E. V. (1963). Forms of Engel Functions. *Econometrica*, *31(4)*, 694-703.

Lewbel, A., & College, B. (2006). Engel curves. In *The New Palgrave Dictionary of Economics*. Retrieved from https://www2.bc.edu/~lewbel/palengel.pdf

Mitchell, D. (2008). A note on rising food prices. The World Bank, Policy Research Working Paper; No. 4682, July.

Moro D., & Sckokai, P. (2000). Heterogeneous preferences in household food consumption in Italy. *European Review of Agricultural Economics*, *27(3)*, 305-323.

Mukasa, A. N., & Berloffa, G. (2013). Welfare dynamics and exposure to food price shocks in Uganda under non-separability: How relevant is the net market position?" Retrieved from http://web.unitn.it/files/download/20429/adamonndungumukasa-paper_0.pdf

Musyoka, M. P., & Bauer, S. (2012). Impacts of rising food price on household welfare and incidence of food insecurity in Kenya. Göttingen Kassel/ Witzenhausen, Tropentag, September. Retrieved from http://www.tropentag.de/2012/abstracts/links/Musyoka_mptSrIYD.pdf

Olimova, S., & Bosc, I. (2003). Labour migration from Tajikistan. International Organization for Migration in Cooperation with the Sharq Scientific Research Center. Dushanbe, July.

Pangaribowo, E. H., & Tsegai, D. (2011). Food demand analysis of Indonesian households with particular attention to the poorest. ZEF-Discussion Papers on Development Policy No. 151. Bonn, August.

Pasinetti, L. (1981). Structural change and economic growth. Cambridge: Cambridge University Press.

Poi, B.P. (2002). From the help desk: Demand system estimation, *Stata Journal*, *2(4)*, 403-410.

Poi, B. P. (2008). Demand system estimation: Update. *Stata Journal*, 8(4), 554-556.

Poi, B.P. (2012). Easy demand-system estimation with quaids. *Stata Journal*, 12(3), 433-446.

Pollak, R., & Wales, T. J. (1981). Demographic variables in demand analysis. *Econometrica*, *49(6)*, 1533-1551.

Raghbendra J., Dang, T., & Tashrifov, Y. (2013). Economic Vulnerability and Poverty in Tajikistan. The Australian National University. Working Paper No. 2008/09, August.

Ray, R. (1983). Measuring the costs of children: An alternative approach. *Journal of Public Economics*, *22(1)*, 89-102.

Sekhampu, T. J., & Dubihlela, D. (2012). The impact of rising food prices on the households in a low-income township in South Africa. *Mediterranean Journal of Social Sciences, 3(3)*.

Singh, I., Squire, L., & Strauss, J. (eds). (1986). *Agricultural household models*. Baltimore: The Johns Hopkins University Press.

Shittu, A. M., Oluwakemi, A. O., & Kabir, K. S. (2015). Welfare effects of policy-induced rising food prices on farm households in Nigeria. AGRODEP Working Paper 0010, April.

Shonkwiler, J.S., & Yen, S.T. (1999). Two-step estimation of a censored system of equations. *American Journal of Agricultural Economics, 81(4)*, 972-982.

Sola, O. (2012). Demand for food in Ondo state, Nigeria: Using quadratic almost ideal demand system. *Journal of Business Management and Economics,* 4(1), 1-19.

Stone, R. (1954). Linear expenditure system and demand analysis: An application to the pattern of British demand. *Economic Journal*, 64(255), 511-527.

Subramanian, S., & Deaton, A. (1996). The demand for food and calories. *Journal of Political Economy*, 104(1), 133-162.

Tafere, K., Taffesse, A. S., Tamiru, S., Tefera, N., & Paulos, Z. (2010). Food demand elasticities in Ethiopia: Estimates using household income consumption expenditure (HICE) survey data. Ethiopia Strategy Support Program II, Working paper (011).

Taj STAT. (2014). Socioeconomic development indicators, 2000-2014. Retrieved from http://www.stat.tj/en/

Taj STAT. (2015). Macroeconomic indicators 1991-2015. Retrieved from http://www.stat.tj/en/

Tefera, N., Demeke M. & Shahidur, R. (2012). Welfare impacts of rising food prices in rural Ethiopia: A Quadratic Almost Ideal Demand System approach. Manuscript.

Tefera, N., Demeke, M., Rashid, S., & Kayitakire, F. (2015). Dynamic food demand and habit-forming behavior: Panel evidence from rural households in Ethiopia. European Commission Joint Research Centre, Monitoring Agricultural Resources (MARS), December.

Theil, H. (1965). The information approach to demand analysis. *Econometrica*, 33(1), 67-87.

World Health Organization, Food and Agriculture Organization, & International Atomic Energy Agency. (1996). Trace elements in human nutrition and health? Retrieved from https://extranet.who.int/iris/restricted/handle/10665/37931

Witt, U. (2001). Learning to consume—a theory of wants and the growth of demand. *Journal of Evolutionary Economics, 11*, 23–36.

Wood, B., & Nelson, C. (2009). Food price crisis: Welfare impact on Mexican households. Paper presented at the International Agricultural Trade Research Consortium Research Symposium Seattle, Washington, June 22-23.

Working, H. (1943). Statistical laws of family expenditures. *Journal of the American Statistical Association*, *38*, 43-56.

World Bank. (2013). World Development Indicators. Retrieved from http://data.worldbank.org/indicator

Yen, S.T., Kan, K., & Su, S.-J. (2002). Household demand for fats and oils: Two-step estimation of a censored demand system. *Applied Economics*, *34(14),* 1799-1806.

Yen, S. T., Lin, B. & Smallwood, D. M. (2003). Quasi- and simulated-likelihood approaches to censored demand systems: Food consumption by food stamp recipients in the United States. *American Journal of Agricultural Economics*, *85(2)*, 458-478.

Zhenga, Z., & Henneberrya, S. R. (2010). An analysis of food grain consumption in urban Jiangsu Province of China. *Journal of Agricultural and Applied Economics*, *42(2),* 337-355.

# Appendix A

## 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)*

# Appendix B

## Percentages of Zero-Consumption Values in the Aggregated Food Groups (2003-2009)

| | 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)*

# Appendix C

## 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* |
|---|---|---|---|---|
| $\eta_{Household\ size\_}$ | *and* | $\rho_{Household\ size\_1} = 0$ | 50.08 | 0.0000 |
| $\eta_{Household\ age\ (Head)}$ | *and* | $\rho_{Household\ age\ (Head)} = 0$ | 2908.95 | 0.0000 |
| $\eta_{Children\ 0-4\ age}$ | *and* | $\rho_{Children\ 0-4\ age} = 0$ | 897.82 | 0.0000 |
| $\eta_{Children\ 5-15\ age}$ | *and* | $\rho_{Children\ 5-15\ age} = 0$ | 353.98 | 0.0000 |
| $\eta_{Adults\ up\ 16>\ age}$ | *and* | $\rho_{Adults\ up\ 16>\ age} = 0$ | 1157.49 | 0.0000 |
| $\eta_{Rural}$ | *and* | $\rho_{Rural} = 0$ | 311.08 | 0.0000 |
| $\eta_{Gender\ (Head):\ Male}$ | *and* | $\rho_{Gender\ (Head):\ Male} = 0$ | 76.40 | 0.0000 |
| $\eta_{Marital\ status:Married}$ | *and* | $\rho_{Marital\ status:Married} = 0$ | 202.87 | 0.0000 |
| $\eta_{Literacy\ (Head):Secondary}$ | *and* | $\rho_{Literacy\ (Head):Secondary} = 0$ | 48.89 | 0.0001 |
| $\eta_{Literacy\ (Head):High}$ | *and* | $\rho_{Literacy\ (Head):High} = 0$ | 151.14 | 0.0000 |
| $\eta_{Employed\ (Head)}$ | *and* | $\rho_{Employed\ (Head)} = 0$ | 71.23 | 0.0000 |
| $\eta_{Agro-mployed\ (Head)}$ | *and* | $\rho_{Agro-mployed\ (Head)} = 0$ | 215.96 | 0.0000 |
| $\eta_{poor}$ | *and* | $\rho_{poor} = 0$ | 403.59 | 0.0000 |
| $\eta_{migrants}$ | *and* | $\rho_{migrants} = 0$ | 30.70 | 0.0001 |
| $\eta_{Dushanbe}$ | *and* | $\rho_{Dushanbe} = 0$ | 371.61 | 0.0000 |
| $\eta_{Sughd}$ | *and* | $\rho_{Sughd} = 0$ | 548.61 | 0.0000 |
| $\eta_{Khatlon}$ | *and* | $\rho_{Khatlon} = 0$ | 560.86 | 0.0000 |
| $\eta_{RRS}$ | *and* | $\rho_{RRS} = 0$ | 483.24 | 0.0000 |
| $\eta_{GBAO}$ | *and* | $\rho_{GBAO} = 0$ | 456.56 | 0.0000 |

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

# Appendix D

## Estimated Parameters of the Univariate Probit Model: Pooled Estimation LSMS (2003-2009)

| | 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*** |
| 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). *, **,*** defined significance at 10, 5, and 1 percent, respectively*

[1] Poverty was estimated based on national poverty line (Purchasing Power Parity (PPP) of 2.15 US dollars per day), LSMS, 2009 (World Bank)

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

# Appendix E

## Parameter Estimates of 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 |
|---|---|---|---|---|---|---|---|
| $\alpha_i$ | 0.4609*** | 0.3221*** | 0.2310*** | 0.3307*** | 0.1286*** | 0.0542*** | -0.5274*** |
| | (0.0087) | (0.0096) | (0.0055) | (0.0063) | (0.0065) | (0.0052) | (0.0156) |
| $\beta_i$ | -0.0727*** | -0.1740*** | -0.0879*** | -0.0531*** | -0.1092*** | -0.0525*** | -0.5493*** |
| | (0.0044) | (0.0052) | (0.0029) | (0.0025) | (0.0029) | (0.0023) | (0.0071) |
| $\gamma_1$ | 0.1001*** | -0.0123*** | -0.0077*** | -0.0276*** | -0.0071*** | -0.0212*** | -0.0242*** |
| | (0.0036) | (0.0027) | (0.0016) | (0.0018) | (0.0017) | (0.0014) | (0.0035) |
| $\gamma_2$ | -0.0123*** | 0.0445*** | -0.0082*** | -0.0236*** | -0.0335*** | -0.0315*** | 0.0645*** |
| | (0.0027) | (0.0039) | (0.0016) | (0.0017) | (0.0019) | (0.0014) | (0.0067) |
| $\gamma_3$ | -0.0077*** | -0.0082*** | 0.0322*** | -0.0172*** | -0.0074*** | -0.0105*** | 0.0187*** |
| | (0.0016) | (0.0016) | (0.0013) | (0.0011) | (0.0011) | (0.0009) | (0.0031) |
| $\gamma_4$ | -0.0276*** | -0.0236*** | -0.0172*** | 0.1033*** | -0.0147*** | -0.0116*** | -0.0086*** |
| | (0.0018) | (0.0017) | (0.0011) | (0.0017) | (0.0012) | (0.0010) | (0.0026) |
| $\gamma_5$ | -0.0071*** | -0.0335*** | -0.0074*** | -0.0147*** | 0.0231*** | -0.0251*** | 0.0646*** |
| | (0.0017) | (0.0019) | (0.0011) | (0.0012) | (0.0018) | (0.0010) | (0.0039) |
| $\gamma_6$ | -0.0212*** | -0.0315*** | -0.0105*** | -0.0116*** | -0.0251*** | 0.0550*** | 0.0448*** |
| | (0.0014) | (0.0014) | (0.0009) | (0.0010) | (0.0010) | (0.0010) | (0.0024) |
| $\gamma_7$ | -0.0242*** | 0.0645*** | 0.0187*** | -0.0086*** | 0.0646*** | 0.0448*** | -0.1597*** |
| | (0.0035) | (0.0067) | (0.0031) | (0.0026) | (0.0039) | (0.0024) | (0.0132) |
| $\lambda_i$ | 0.0203*** | 0.0434*** | 0.0191*** | 0.0126*** | 0.0278*** | 0.0112*** | -0.1344*** |
| | (0.0016) | (0.0021) | (0.0011) | (0.0009) | (0.0011) | (0.0008) | (0.0043) |
| $d_i$ | 0.0898*** | 0.0116 | -0.1942*** | 0.1626*** | 0.1479*** | 0.1368*** | |
| | (0.0230) | (0.0216) | (0.0205) | (0.0118) | (0.0112) | (0.0163) | |
| $\eta_{Household\ size}$ | 0.0034** | 0.0041 | -0.0007*** | 0.0020 | 0.0022 | -0.0005 | -0.0104*** |
| | (0.0039) | (0.0047) | (0.0021) | (0.0020) | (0.0019) | (0.0017) | (0.0029) |
| $\eta_{Children\ 0-4\ age}$ | -0.0037** | -0.0029 | 0.0006 | -0.0012 | -0.0015 | 0.0009 | 0.0079*** |
| | (0.0039) | (0.0047) | (0.0021) | (0.0021) | (0.0019) | (0.0017) | (0.0029) |
| $\eta_{Children\ 5-15\ age}$ | -0.0001 | -0.0041 | 0.0004 | -0.0022*** | -0.0011 | 0.0007 | 0.0063** |
| | (0.0039) | (0.0047) | (0.0021) | (0.0020) | (0.0019) | (0.0017) | (0.0029) |
| $\eta_{Adults\ up\ 16>\ age}$ | -0.0017 | -0.0048** | 0.0011 | -0.0024 | -0.0023 | 0.0001 | 0.0100*** |
| | (0.0038) | (0.0046) | (0.0021) | (0.0020) | (0.0019) | (0.0017) | (0.0028) |
| $\eta_{Household\ age\ (Head)}$ | 0.0000 | 0.0001*** | 0.0000 | 0.0001*** | 0.0001*** | 0.0001*** | -0.0004*** |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| $\eta_{Rural}$ | 0.0095*** | 0.0016* | -0.0027*** | -0.0024*** | -0.0024*** | -0.0037*** | 0.0001 |
| | (0.0012) | (0.0009) | (0.0006) | (0.0006) | (0.0005) | (0.0005) | (0.0013) |
| $\eta_{Gender\ (Head):\ Male}$ | 0.0018 | 0.0077*** | 0.0011 | 0.0018** | 0.0058*** | -0.0002 | -0.0180*** |
| | (0.0017) | (0.0013) | (0.0008) | (0.0009) | (0.0008) | (0.0007) | (0.0017) |
| $\eta_{Marital\ status:Married}$ | 0.0001 | -0.0071*** | -0.0032*** | -0.0028*** | -0.0034*** | -0.0006 | 0.0171*** |
| | (0.0017) | (0.0013) | (0.0007) | (0.0009) | (0.0007) | (0.0007) | (0.0016) |
| $\eta_{Literacy\ (Head):Seconda}$ | -0.0053*** | 0.0039*** | 0.0021*** | 0.0013** | 0.0026*** | 0.0018*** | -0.0064*** |
| | (0.0013) | (0.0010) | (0.0006) | (0.0007) | (0.0006) | (0.0005) | (0.0013) |
| $\eta_{Literacy\ (Head):High}$ | -0.0124*** | 0.0075*** | 0.0030*** | 0.0000 | 0.0015** | 0.0025*** | -0.0022 |
| | (0.0015) | (0.0012) | (0.0007) | (0.0008) | (0.0007) | (0.0006) | (0.0015) |
| $\eta_{Employed\ (Head)}$ | -0.0041*** | 0.0015* | 0.0009* | 0.0025*** | 0.0024*** | 0.0019*** | -0.0050*** |
| | (0.0011) | (0.0009) | (0.0005) | (0.0006) | (0.0005) | (0.0005) | (0.0012) |
| $\eta_{Agro-mployed\ (Head)}$ | 0.0096*** | 0.0007 | -0.0029*** | 0.0002 | -0.0016*** | 0.0002 | -0.0062*** |
| | (0.0013) | (0.0010) | (0.0006) | (0.0007) | (0.0006) | (0.0005) | (0.0015) |
| $\eta_{poor}$ | 0.0301*** | 0.0096*** | 0.0012 | -0.0011 | -0.0083*** | -0.0081*** | -0.0234*** |
| | (0.0018) | (0.0015) | (0.0008) | (0.0009) | (0.0008) | (0.0007) | (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*** | 0.0007 | -0.0009** | 0.0006 | 0.0005 | 0.0013*** | -0.0050*** |
| | (0.0010) | (0.0008) | (0.0005) | (0.0005) | (0.0005) | (0.0004) | (0.0012) |
| $\eta_{Dushanbe}$ | 0.0118*** | 0.0017 | 0.0067*** | 0.0018 | 0.0066*** | 0.0078*** | -0.0365*** |
| | (0.0022) | (0.0017) | (0.0010) | (0.0012) | (0.0010) | (0.0009) | (0.0027) |
| $\eta_{Sughd}$ | 0.0112*** | -0.0153*** | 0.0175*** | -0.0023** | 0.0152*** | 0.0060*** | -0.0322*** |
| | (0.0020) | (0.0016) | (0.0010) | (0.0011) | (0.0009) | (0.0009) | (0.0026) |
| $\eta_{Khatlon}$ | 0.0363*** | -0.0085*** | 0.0113*** | -0.0023** | -0.0010 | 0.0042*** | -0.0400*** |
| | (0.0022) | (0.0016) | (0.0010) | (0.0011) | (0.0010) | (0.0009) | (0.0027) |
| $\eta_{RRS}$ | 0.0175*** | -0.0006 | 0.0113*** | 0.0004 | 0.0031*** | 0.0038*** | -0.0354*** |
| | (0.0021) | (0.0016) | (0.0010) | (0.0011) | (0.0010) | (0.0009) | (0.0027) |
| $\eta_{GBAO}$ | 0.0189*** | 0.0124*** | -0.0005 | -0.0117*** | 0.0065*** | 0.0092*** | -0.0347*** |
| | (0.0023) | (0.0017) | (0.0010) | (0.0013) | (0.0010) | (0.0010) | (0.0030) |
| $\eta_{Survey\ 2003}$ | -0.0317*** | 0.0118*** | 0.0063*** | -0.0156*** | -0.0092*** | -0.0006 | 0.0390*** |
| | (0.0017) | (0.0013) | (0.0007) | (0.0010) | (0.0008) | (0.0007) | (0.0020) |
| $\eta_{Survey\ 2007}$ | -0.0214*** | 0.0014 | 0.0009*** | 0.0076*** | -0.0071*** | -0.0043*** | 0.0230*** |
| | (0.0012) | (0.0009) | (0.0005) | (0.0006) | (0.0006) | (0.0005) | (0.0015) |
| $\eta_{Survey\ 2009}$ | -0.0186*** | 0.0027** | 0.0026*** | 0.0026*** | -0.0046*** | -0.0011* | 0.0164*** |
| | (0.0015) | (0.0011) | (0.0006) | (0.0008) | (0.0007) | (0.0006) | (0.0018) |
| | $rho_{HH\ size}$ | $rho_{child\ 0\text{-}4}$ | $rho_{child\ 5\text{-}15}$ | $rho_{adults\ up16}$ | $rho_{HH\ age}$ | $rho_{rural}$ | $rho_{HH\ gender}$ |
| $\rho_i$ | 0.0164 | -0.3002*** | -0.1853*** | -0.1606*** | -0.4748*** | -0.3325*** | 0.0906*** |
| | (0.0953) | (0.0052) | (0.0050) | (0.0101) | (0.0119) | (0.0176) | (0.0196) |
| | $rho_{Marital\ St}$ | $rho_{Literacy\ 1}$ | $rho_{Literacy\ 2}$ | $rho_{employed}$ | $rho_{agro\text{-}emp.}$ | $rho_{poor}$ | $rho_{migrants}$ |
| $\rho_i$ | -0.0030*** | -0.0715*** | -0.0991*** | -0.0719*** | 0.2105*** | -0.1870*** | 0.2001*** |
| | (0.0002) | (0.0201) | (0.0197) | (0.0192) | (0.0108) | (0.0113) | (0.0116) |
| | $rho_{Dushanbe}$ | $rho_{Sughd}$ | $rho_{Khatlon}$ | $rho_{RRS}$ | $rho_{GBAO}$ | $rho_{Surv\text{-}2003}$ | $rho_{Surv\text{-}2007}$ |
| $\rho_i$ | -0.1190*** | -0.0797*** | -0.1549*** | 0.0529*** | 0.1105*** | -0.0641*** | -0.2424*** |
| | (0.0088) | (0.0111) | (0.0087) | (0.0123) | (0.0133) | (0.0096) | (0.0172) |
| | $rho_{Surv\text{-}2009}$ | | | | | | |
| $\rho_i$ | -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

# Appendix F

## Urban- Uncompensated /Compensated Prices and Expenditure Elasticities from Pooled Estimation, LSMS (2003-2009)

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

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

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

# Appendix G

## Rural-Uncompensated /Compensated Prices and Expenditure Elasticities from Pooled Estimation, LSMS (2003-2009)

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

# Integration of the Stock Market into the Economic Environment of Kazakhstan

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***Abstract**: This article analyzes the effect of key macroeconomic variables on the KASE index, a benchmark for the value of large production and financial companies in Kazakhstan. The article applies the Granger causality test to a VAR model for time series during the period of 2011-2021. The model includes an inflation rate, the natural log of gross domestic product, the exchange rate of tenge per dollar, and Brent oil future prices as variables that may affect the price of the KASE index.*

***JEL classifications:** C11, C32, E3, M20*

***Keywords:** KASE Index, Macroeconomic Variables, Inflation Rate, GDP, Oil Prices, Exchange Rate*

## 1. Introduction

Over the last decade, the Kazakhstani stock market has developed rapidly. Established in 1993, the Kazakhstan Stock Exchange (KASE) is the primary source for companies raising capital. Today 50 participants list on KASE, and seven of them are in the KASE index (KASE, 2021). The shares of these seven companies are considered as the most liquid and are traded daily. All companies reside in Kazakhstan. The share prices and financial performance of these entities reflect Kazakhstan's economy. The KASE index is a benchmark for the financial and real sectors and therefore is sensitive to macroeconomic conditions. The goal of this article is to see whether the KASE index correlates with key macroeconomic variables.

Nurmakhanova and Katenova (2019) found a correlation between the KASE index and a foreign exchange rate, and Castro and Jiménez-Rodríguez (2020) showed that oil prices influence exchange rates generally. As oil is a major trading commodity in Kazakhstan and the KASE index includes an oil production company, we will also test for a correlation between the KASE index and oil prices.

Another main macroeconomic variable is inflation, the average rate of increase in product prices. Inflation can destabilize international trade by reducing the foreign purchasing power of the tenge. It also induces the central bank to raise the base interest rate to weaken the demand for products that feeds higher prices. Thus, inflation makes companies cut their reinvestment in operations (Dorrance, 1963). In other words, inflation leads producers to spend more to maintain

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production at the given level. Inflation in Kazakhstan is rather high—6.75% in 2020, 5.25% in 2019, and 6.02% in 2018 (Macrotrends, n.d.). This article will consider the impact of inflation on the KASE index.

The last but not least variable that can affect the KASE index is real gross domestic product (GDP), the amount of output produced in Kazakhstan in a quarter or a year.

A statistical model will check for any reverse relationship. For example, perhaps the KASE index causes inflation to rise, not the other way around, because a high stock index raises the morale of buyers, who respond by trying to buy more.

Finally, the article will reflect on short-term shocks and long-term changes. This deviation into analysis of time horizons will better show whether some variables fundamentally influence on the KASE index or a momentum reflect takes place.

## 2. Literature Review

Usually, investors analyze the correlation of parameters of financial instruments with an economic situation inside or outside of the country. This section summarizes the evidence that macroeconomic trends affect capital markets. Authors survey economic regions and test the correlation between common macroeconomic variables and the indicators of securities.

Investments from capital markets can be attracted in the form of equity capital by issuing stocks and debt capital such as bonds and notes. These instruments are meant to help companies maintain their leverage and manage their investment portfolios (Metel'skaya, 2021).

## 3. Impact of Macroeconomic Variables on the Stock Market

Shah (2018) examined the effect of macroeconomic variables on stock market returns, yields from treasury bills in particular. In emerging markets of India and Pakistan, stock market volatility depended on the T-bill rate: The higher the rate, the lower the stock market returns. Earlier, Gay (2008) studied emerging markets in Brazil, India, China, and Russia where the latter had an economic structure like Kazakhstan's. That makes this study comparable with the Kazakhstan market. Gay focused on how exchange rates affect stock market returns. There was a direct relationship between the exchange rate for the US dollar and share prices. For example, dollar depreciation in Brazil, China, and Russia had negative effects on local stock markets.

In a study of the Kazakhstan market, Oskenbayev, Yilmaz, and Chagirov (2011) argued that oil prices mitigated the impact of foreign currency exchange rates on the stock market, because Kazakhstan ranked high among oil producers. In addition, the authors studied the stock market using a KASE index as the benchmark. This index was based on seven large Kazakhstani companies from the production and financial sectors. The authors concluded that the index was vulnerable, mostly due to political instability. The dependence of stock market on exchange rates was also shown by Nurmakhanova and Katenova (2019). The Kazakhstani tenge and the KASE index had a negative correlation. Otherwise, "when tenge appreciates, KASE index will fall" (p. 7). Moreover, the main effect on exchange rates came from oil price changes. The tenge positively correlated with oil prices. As the tenge strengthened, imports could become cheaper for Kazakhstanis and exports more expensive for foreigners, thus reducing Kazakhstan's net exports, a major component of its GDP. In short, an increase in oil prices could cause the Kazakhstani economy to decline.

GDP had also a direct relation with stock market returns. Abedallat and Shabib (2012) found that the correlation coefficient was 94% in the Turkish economy, which was similar to the Kazakhstani economy. Since GDP was calculated from different sources and various types of cash flows usage (expenditures, investments, consumption, and net exports), Eldomiaty, Saeed, Hammam, and AboulSoud (2019) tested a production and manufacturing index (PMI) and its effect on Amman stock markets. Harris (1991) reported that financial markets were sensitive to the monthly PMI. However, this index had an inverse relationship with stock market returns. In other words, there was no effect of PMI on stock markets, but stock markets directly influenced PMI (Eldomiaty, Saeed, Hammam, & AboulSoud, 2019).

## 4. Methodology

To test the effect of macroeconomic variables on the production sector, this paper will use the Vector Autoregressive Model (VAR). This paper will consider the dynamics of each variable, both in time series and in cross-sectional analysis. And it will see how fast and at what moment the economy reflects fundamental changes in key determinants.

The KASE index is selected as a determinant of Kazakhstan industrial sectors. The price of the KASE index reflects the performance characteristics of the seven largest financial and production companies in Kazakhstan: Bank CenterCredit, Halyk Bank, Kcell, KEGOC, Kazatomprom, Kazakhtelecom, and KazTransOil. The KASE index represents the change in market value of overall share prices corresponding to outstanding shares of the most liquid securities traded on the KASE stock exchange (KASE, 2022). The price of the index is recalculated after each trading session, based on the results of deals. The method of calculating the index measure is presented below:

$$\text{KASEindex} = \frac{MC_n}{D_n}, \quad \textbf{(1)}$$

where

$MC_n$ – the total market value of shares in the index;

$D_n$ – the total value of shares in the index for the first day that the index was computed, given its composition. Each time that the index composition changes, $D_n$ is recalculated (KASE, 2022).

Since this sector is representative, it would be affected by major macroeconomic variables in the time series as well. Table 1 shows the set of observed variables. Values of the KASE index are from the official web site for the KASE and serve as the basis for calculating the return on the KASE index. Other data are from the National Bureau of Statistics and the National Bank of Kazakhstan. GDP is calculated as the natural logarithm of nominal GDP to identify the rate of growth. This is done to control for time trends. Growth rates of other variables are calculated from the given month of the previous year, to control for seasonal effects. For instance, monthly inflation is the percentage change from the same month of a year ago. Exchange rate and Brent oil future price numbers are taken as the closing prices of a trading session on the last day of each month. All values are for the period 2011-2021.

Table 1

*Dependent and Independent Variables*

*Dependent Variable*

| | |
|---|---|
| **KASEreturn** | Return on KASE index price |

*Independent Variables*

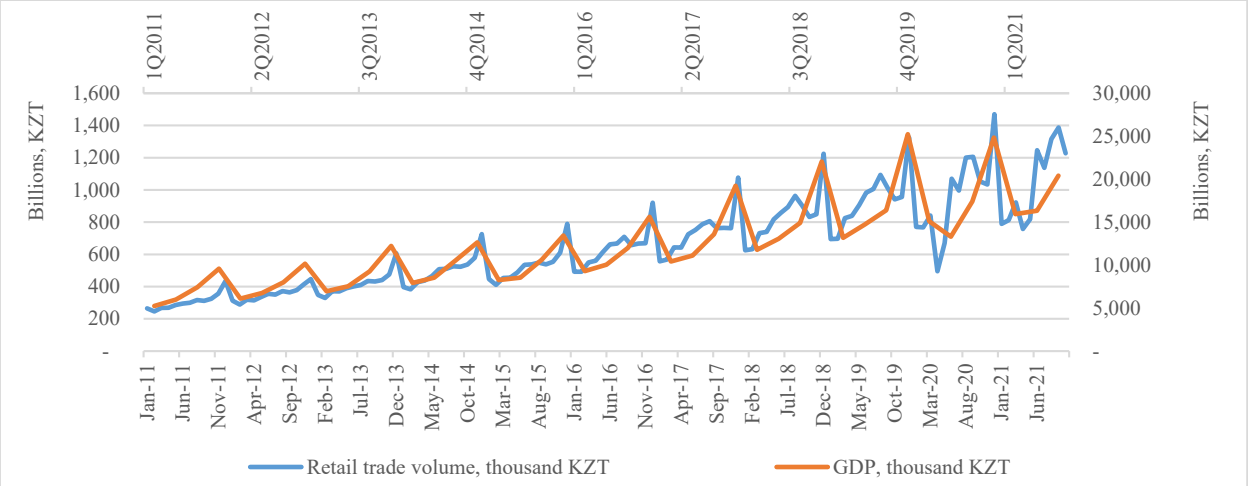
| | |
|---|---|
| **lnGDP** | Change in logarithm of nominal Gross Domestic Product (monthly) |
| **Inf** | Inflation rate (monthly) |
| **FX** | USD/KZT exchange rate (monthly average) |
| **Oil** | Brent oil future price (monthly average) |

One obstacle in the data set is that GDP is reported on a quarterly basis as the highest frequency available. That limits the number of observations for the test. To overcome this issue, GDP is artificially divided into monthly measures. The *ipolation* function in Stata is applied to split the quarterly data into monthly ones. This function requires setting a benchmark that perfectly correlates with the target and has the same nature. Thus, the appropriate benchmark measure is the

volume of retail trade because it resembles GDP and indeed accounts for a fifth of GDP. Graph 1 demonstrates how these two measures correlate.

Figure 1

*Correlation of Quarterly-Based Nominal GDP and Monthly-Based Retail Trade*




Having determined the key variables, we use the following equation for the Vector Autoregressive Model (VAR) with *p* order (VAR (p)), where "order" determines the lags of the time series. For example, a one-year lag corresponds to an order of one; a two-year lag, an order of two:

$$\mathbf{y_t = c + \sum_{i=1}^{p} \varphi_i y_{t-i} + \varepsilon_t,} \qquad \mathbf{(2)}$$

where $y_i$ is a variable of linear function with $p$ number of lags, $c$ is an intercept of the VAR function, $\varphi_i$ is the matrix of coefficients (4x4) and $\varepsilon_t$ is a (4x1) standard error (white noise) of the process. $p_{max}$ is equal to 2 (L1 and L2) following the Akaike Information Criterion (AIC) and the Hannan-Quinn Information Criterion. However, Ivanov and Kilian (2001, as cited in Nurmakhanova & Katenova, 2019) suggested using AIC commonly for monthly time series. Taking into account all variables, the VAR model consists of 5 equations. These equations represent the dependence of each variable on lag of its own time series and of other variables:

$$\begin{aligned}
KASEind_t &= \alpha + \sum_{i=1}^{p} \varphi_i KASEind_{t-i} + \sum_{i=1}^{p} \delta_i lnGDP_{t-i} + \sum_{i=1}^{p} \gamma_i Inf_{t-i} + \sum_{i=1}^{p} \lambda_i FX_{t-i} + \sum_{i=1}^{p} \omega_i Oil_{t-i} + \varepsilon_t \\
lnGDP_t &= \alpha + \sum_{i=1}^{p} \varphi_i lnGDPt_{-i} + \sum_{i=1}^{p} \delta_i KASEind_{t-i} + \sum_{i=1}^{p} \gamma_i Inf_{t-i} + \sum_{i=1}^{p} \lambda_i FX_{t-i} + \sum_{i=1}^{p} \omega_i Oil_{t-i} + \varepsilon_t \\
Inf_t &= \alpha + \sum_{i=1}^{p} \varphi_i Inf_{t-i} + \sum_{i=1}^{p} \delta_i KASEind_{t-i} + \sum_{i=1}^{p} \gamma_i lnGDP_{t-i} + \sum_{i=1}^{p} \lambda_i FX_{t-i} + \sum_{i=1}^{p} \omega_i Oil_{t-i} + \varepsilon_t \\
FX_t &= \alpha + \sum_{i=1}^{p} \varphi_i FX_{t-i} + \sum_{i=1}^{p} \delta_i KASEind_{t-i} + \sum_{i=1}^{p} \gamma_i lnGDP_{t-i} + \sum_{i=1}^{p} \lambda_i Inf_{t-i} + \sum_{i=1}^{p} \omega_i Oil_{t-i} + \varepsilon_t \\
Oil_t &= \alpha + \sum_{i=1}^{p} \varphi_i Oil_{t-i} + \sum_{i=1}^{p} \delta_i KASEind_{t-i} + \sum_{i=1}^{p} \gamma_i lnGDP_{t-i} + \sum_{i=1}^{p} \lambda_i Inf_{t-i} + \sum_{i=1}^{p} \omega_i FX_{t-i} + \varepsilon_t
\end{aligned} \qquad \mathbf{(3)}$$

The assumption is that the Brent Oil price is an endogenous variable since its value is determined by the linear relationship with other macroeconomic variables as well as demand and supply factors.

In the first step, we test each variable for dependence on its own lags and on other macroeconomic time series. The second step is the Granger causality test.

## 5. Granger Causality Test

The Granger causality test identifies whether historical results of the independent variable predict current values of the dependent variable (Papana, Kyrtsou, Kugiumtzis, & Diks, 2014) and

whether they help forecast other variables. The Granger-causality test uses a Chi-square probability distribution to determine whether past values of variable $y_t$ influence future values. Since the data are observed at a particular time, they must comply with a stationary condition; that is, the basic characteristics of the time series, like its mean, do not change over time.

To verify the stationarity of the variables, we use the Dickey-Fuller (1979) test. The null hypothesis is nonstationarity (also called a "unit root"); the alternative hypothesis, stationarity. A MacKinnon (1994) approximate p-value indicates whether the null hypothesis is rejected, usually at the 1% level of significance. This stringent criterion of significance is chosen due to the fact that some data are absent, which increases the risk of false rejection of the alternative hypothesis.

The final conclusion concerning the relationship between the driving economic sectors of Kazakhstan represented here by the KASE index and major macroeconomic variables is based on the level of significance.

## 6. Results

### 6.1 Dickey-Fuller Test

For the first step, each variable is tested on stationarity in order to predetermine the possibility to apply the VAR model. Table 2 represents the output of the Dickey-Fuller unit-root test.

Table 2.
*The Results of the Dickey-Fuller test*

| Variable | Test statistic | 1% critical value | 5% critical value | 10% critical value | MacKinnon approximate p-value for Z(t) |
|---|---|---|---|---|---|
| KASEreturn | -7.646 | -4.031 | -3.446 | -3.146 | 0.000 |
| lnGDP | -8.510 | -4.031 | -3.446 | -3.146 | 0.000 |
| Inf | -5.923 | -4.031 | -3.446 | -3.146 | 0.000 |
| FX | -5.550 | -4.031 | -3.446 | -3.146 | 0.000 |
| Oil | -5.636 | -4.031 | -3.446 | -3.146 | 0.000 |

The key measure which we are focusing on in this test is a MacKinnon approximate p-value. According to Table 2, the p-value for each variable is equal to 0.000 subsequently being less than $\alpha = 0.05$. Therefore, the null hypothesis is rejected for each case and data provide sufficient evidence that KASEreturn, lnGDP, Inf, FX, and Oil are stationary variables and both the VAR model and the Granger causality test are applicable for this study.

### 6.2 VAR Model

Table 3 shows the result of the model in which KASEreturn is the dependent variable. The key component of Table 3 is the P-value, which is the conditional probability that the null hypothesis is correct. The level of significance is $\alpha = 0.1$; that is, we will reject the null if the P-value is less than .1.

Table 3
*VAR Model: Return on KASE (KASEreturn)*

| | Coef. | Std. Err | z | P-value | 95% Conf. | Interval |
|---|---|---|---|---|---|---|
| **KASEreturn** | | | | | | |
| L1 | .4136198 | . 0867792 | 4.77 | 0.000 | .2435356 | .5837039 |
| L2 | -.0920097 | .0871481 | -1.06 | 0.291 | -.2628168 | .0787973 |
| **lnGDP** | | | | | | |
| L1 | .0211106 | .0254973 | 0.83 | 0.408 | -.0288633 | .0710844 |
| L2 | .0116462 | .0263734 | 0.44 | 0.659 | -.0400447 | .0633372 |
| **Inf** | | | | | | |
| L1 | -.0033295 | .0028083 | -1.19 | 0.236 | -.0088337 | .0021747 |
| L2 | .0041075 | .00261 | 1.57 | 0.116 | -.0010079 | .0092229 |
| **FX** | | | | | | |
| L1 | .0000824 | .0000522 | 1.58 | 0.114 | -.0000199 | .0001846 |
| L2 | -.000097 | .0000523 | -1.85 | 0.064 | -.0001995 | 5.57e-06 |
| **Oil** | | | | | | |
| | .0003106 | .0001745 | 1.78 | 0.075 | -.0000314 | .0006527 |

The first stage verifies if the past measures of macroeconomic variable are helpful in prediction of future returns on KASE index. According to the results, the past performance of index has a significant effect on the results of the first half of the upcoming year since the p-value = 0.000 what is less than $\alpha = 0.1$. Moreover, a positive coefficient (Coef. = .414) indicates the direct relationship between historical results and the forecasted meaning if the previous returns are decreasing, they would continue to decline during the next semiannual period and if the returns are increasing, they would continue to rise. However, the results show that the past performance of index has an insignificant influence on the returns of the second half of a forecasted year since the p-value of L2 is equal to 0.291 being higher than $\alpha = 0.1$.

The next stage of this part of the analysis verifies if past results of economic performance in terms of GDP (lnGDP in the statistical model) influence on the future KASEreturn. The results indicated the insignificant effect of past lnGDP on future returns on index due to the L1 p-value is 0.408 and L2 p-value is 0.659 what are higher than $\alpha = 0.1$.

The outcome of the test which verifies an influence inflation (Inf) on KASEreturn also showed that there was no significant effect of the inflation on index returns both for L1 and L2. The P-value for L1 is equal to 0.236 and for the L2 p-value is 0.116, so the p-value remains above $\alpha = 0.1$ in both cases what means that the null hypothesis is not rejected, and the data do not prove that there is a significant effect of inflation on the returns on KASE index.

The results of the fourth part declared that there was no any significant effect of the exchange rate on the returns on KASE index from the first half of a year (L1) since the p-value = 0.114 was higher than $\alpha$ of 0.1. However, in L2 or in the latest half of the year there was a significant effect on the past returns on KASE index since the p-value for this lag was equal to 0.064 which rejects the null hypothesis. The negative coefficient of -0.000 indicates inverse the relationship between the KASEreturn and FX meaning that the price for USD1 goes down while the returns on the index are increasing. In other words, the higher appreciation of KZT the higher index returns.

Finally, the first part of the VAR model tests the influence of Brent oil future prices on the KASEreturn. According to the Table 3, the p-value is equal to 0.075 being less than $\alpha = 0.1$; therefore, the null hypothesis is rejected, and the data provide sufficient evidence that historical Brent Oil future prices have significant effect on the forecast of the returns on KASE index. The positive coefficient of 0.000 indicates the direct relationship between these two variables causing

the dependent variable (KASEreturn) to grow when the independent (Oil) increases. In the opposite case, returns on KASE index will decline if Brent Oil future prices go down.

Table 4
*VAR Model: Dependent Variable—lnGDP*

| | Coef. | Std. Err | z | P-value | 95% Conf. | Interval |
|---|---|---|---|---|---|---|
| **KASEreturn** | | | | | | |
| L1 | 0.0928861 | 0. 3351976 | 0.28 | 0.782 | -0.5640891 | 0.7498612 |
| L2 | 0.1899613 | 0.3366222 | 0.56 | 0.573 | -0.4698061 | 0.8497288 |
| **lnGDP** | | | | | | |
| L1 | 0.3021892 | 0.0984872 | 3.07 | 0.002 | 0.1091579 | 0.4952205 |
| L2 | 0.588645 | 0.1018713 | 5.78 | 0.000 | 0.3889809 | 0.788309 |
| **Inf** | | | | | | |
| L1 | 0.0420498 | 0.0108475 | 3.88 | 0.000 | 0.0207891 | 0.0633105 |
| L2 | -0.0500845 | 0.0100814 | -4.97 | 0.000 | -0.0698436 | -0.0303255 |
| **FX** | | | | | | |
| L1 | 0.0002088 | 0.0002016 | 1.04 | 0.300 | -0.0001863 | 0.0006038 |
| L2 | -0.0001571 | 0.000202 | -0.78 | 0.437 | -0.0005531 | 0.0002389 |
| **Oil** | | | | | | |
| | 0.0009862 | 0.0006742 | 1.46 | 0.144 | -0.0003351 | 0.0023075 |

The second stage tests whether there is a significant effect of KASEreturn, Inf, FX and Oil on future results of lnGDP. It also tests whether past lnGDP affects its future parameters. It turns out that the KASE index does not affect lnGDP since the p-values for L1 and L2 are high: 0.782 and 0.573, much greater than 0.1.

But past values of lnGDP significantly affect later values. The p-value is 0.002 for L1 and 0.000 for L2.

Inflation (Inf) affects GDP growth. The P-values for L1 and L2 are both 0.000. The positive coefficient L1 (0.042) indicates the direct relationship between lnGDP and Inf.

The past exchange rate does not affect future lnGDP values. P-values of L1 and L2 are 0.300 and 0.437.

Finally, the correlation between lnGDP and oil prices is statistically insignificant. The p-value was 0.144.

Table 5
*VAR Model: Dependent Variable—Inf*

| | Coef. | Std. Err | z | P-value | 95% Conf. | Interval |
|---|---|---|---|---|---|---|
| **KASEreturn** | | | | | | |
| L1 | 2.982493 | 3.216896 | 0.93 | 0.354 | -3.322507 | 9.287493 |
| L2 | -1.953406 | 3.230568 | -0.60 | 0.545 | -8.285204 | 4.378391 |
| **lnGDP** | | | | | | |
| L1 | -4.957061 | .9451827 | -5.24 | 0.000 | -6.809585 | -3.104537 |
| L2 | 4.369468 | .9776601 | 4.47 | 0.000 | 2.453289 | 6.285646 |
| **Inf** | | | | | | |
| L1 | 0.9857497 | 0.1041037 | 9.47 | 0.000 | .7817103 | 1.189789 |
| L2 | -0.3988289 | 0.0967509 | -4.12 | 0.000 | -.5884571 | -0.2092007 |
| **FX** | | | | | | |
| L1 | 0.0004237 | 0.0019345 | 0.22 | 0.827 | -0.0033678 | 0.0042151 |
| L2 | 0.0012152 | 0.001939 | 0.63 | 0.531 | -0.0025851 | 0.0050155 |
| **Oil** | | | | | | |
| | -0.0056409 | 0.0064699 | -0.87 | 0.383 | -0.0183217 | 0.0070399 |

We also found that inflation does not affect the KASE Index (Table 5). The p-values for L1 and L2 are 0.354 and 0.545.

lnGDP from the previous year significantly influences the inflation rate. The P-values both for L1 and L2 are equal to 0.000. Similarly, past rates of inflation influence later ones.

For the exchange rate (FX) and Brent Oil future prices (Oil), the test does not identify any significant effect on the inflation rate. P-values exceed 0.1.

Table 6
*VAR Model: Dependent Variable—FX*

| | Coef. | Std. Err | z | P-value | 95% Conf. | Interval |
|---|---|---|---|---|---|---|
| **KASEreturn** | | | | | | |
| L1 | -117.8312 | 115.3359 | -1.02 | 0.307 | -343.8855 | 108.223 |
| L2 | 96.37953 | 115.8261 | 0.83 | 0.405 | -130.6355 | 323.3946 |
| **lnGDP** | | | | | | |
| L1 | -71.89594 | 33.8878 | -2.12 | 0.034 | -138.3148 | -5.477069 |
| L2 | 56.63361 | 35.05222 | 1.62 | 0.106 | -12.06748 | 125.3347 |
| **Inf** | | | | | | |
| L1 | 2.1173 | 3.732447 | 0.57 | 0.571 | -5.198161 | 9.432761 |
| L2 | -4.168541 | 3.468826 | -1.20 | 0.229 | -10.96731 | 2.630233 |
| **FX** | | | | | | |
| L1 | 0.3793246 | .0693567 | 5.47 | 0.000 | 0.243388 | 0.5152613 |
| L2 | 0.1666291 | .0695181 | 2.40 | 0.017 | 0.0303761 | 0.3028821 |
| **Oil** | | | | | | |
| | -2.572554 | 0.2319673 | -11.09 | 0.000 | -3.027202 | -2.117907 |

Finally, consider the exchange rate. FX is influenced by lnGDP for the past semi-annual period (L1) since the p-value is 0.034, less than 0.1. But p-value for L2 is higher than 0.1, so lnGDP from the first half of the previous year does not affect the exchange rate.

Later values of FX are affected by FX values from the previous two semiannual periods, since the p-value is 0.000 for L1 and 0.017 for L2.

Correlation is significant for FX and Oil, with a P-value of 0.000. The USD/KZT rate depends significantly on Brent Oil future prices.

The returns on the KASE index as well as the inflation rate do not impact significantly on future USD/KZT values. The p-value exceeds 0.1.

### 6.3 Granger Causality Test

In Table 7, the key component is a p-value. Here's the idea behind this test: "If the prediction of one time series is improved by incorporating the knowledge of a second time series, then the latter is said to have a causal influence on the first" (Bose, Hravnak, & Sereika, 2018). The null hypothesis is that the time series x does not influence y.

The only variable that helps predict the return on the KASE index is lnGDP, with a p-value of 0.042, lower than the level of significance, 0.1. For other independent variables, the p-value is higher than 0.1, so Inf, FX, and Oil have no significant effect on the future returns on KASE index.

To forecast lnGDP two measures will be useful: Inflation and Brent Oil future prices. In former case, the p-value is 0.000, so past inflation affects the growth rate of GDP. As for oil prices, the p-value is 0.032, so they affect lnGDP. For KASEreturn and FX, the p-values are 0.553 and 0.130, so these variables do not significantly affect lnGDP.

The only time series that is useful for predicting Inf is lnGDP. This p-value is 0.000. For other variables, the p-value stands above the level of significance, indicating that inflation is not affected by KASEreturn, FX, and Oil.

For the forecast of the USD/KZT exchange rate, the only variable that influences FX is Oil with a p-value of 0.000. For other independent variables, the p-value is higher than the significance level of 0.1. So, the data do not show a significant effect of the KASE return on GDP, or of inflation on the future USD/KZT exchange rate.

Finally, the only variable that affects oil prices is FX. The p-value is 0.059.

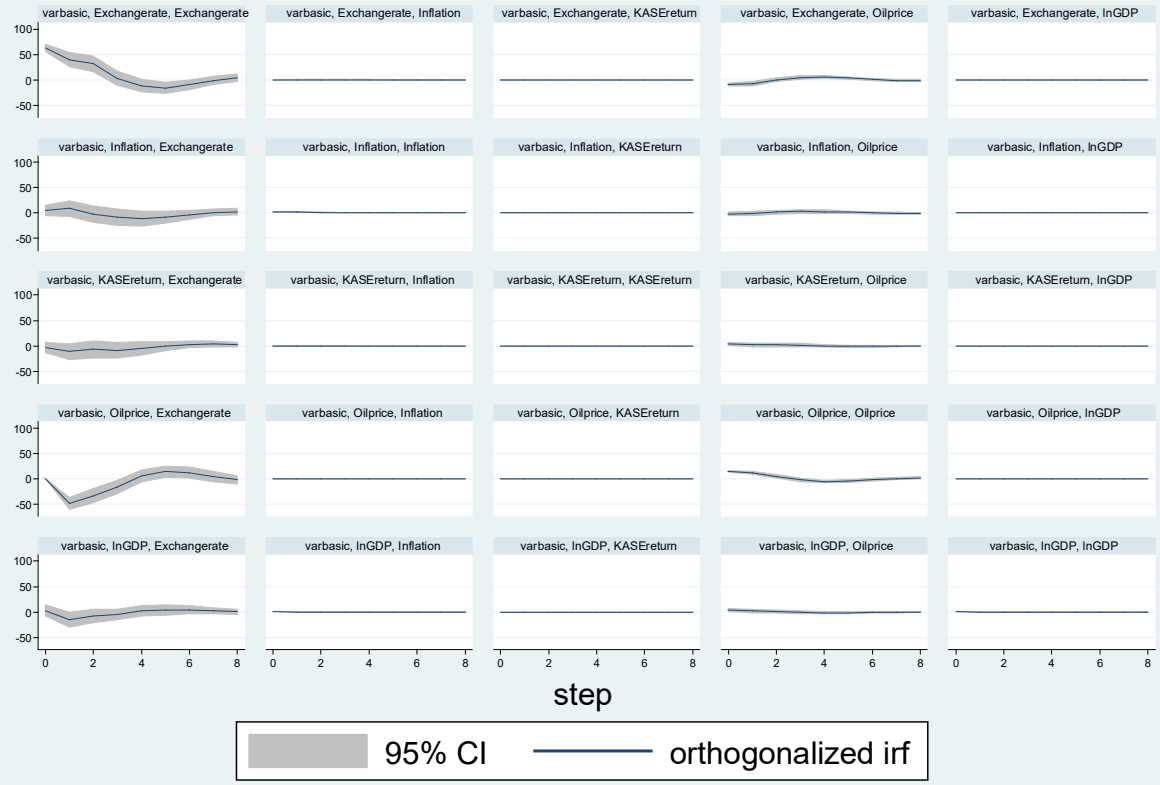
Table 7
*Granger Causality Test*

| Dependent variable | Independent variable | chi2 | P-value |
|---|---|---|---|
| KASEind | lnDGP | 6.344 | 0.042 |
| KASEind | Inf | 3.0184 | 0.221 |
| KASEind | FX | 1.3334 | 0.513 |
| KASEind | Oil | 0.8368 | 0.658 |
| | | | |
| lnGDP | KASEreturn | 1.2519 | 0.535 |
| lnGDP | Inf | 23.516 | 0.000 |
| lnGDP | FX | 4.0769 | 0.130 |
| lnGDP | Oil | 6.8877 | 0.032 |
| | | | |
| Inf | KASEreturn | 1.1858 | 0.553 |
| Inf | lnGDP | 25.051 | 0.000 |
| Inf | FX | 0.61079 | 0.737 |
| Inf | Oil | 2.5974 | 0.273 |
| | | | |
| FX | KASEreturn | 0.21468 | 0.898 |
| FX | lnGDP | 0.69524 | 0.706 |
| FX | Inf | 2.5922 | 0.274 |
| FX | Oil | 97.513 | 0.000 |
| | | | |
| Oil | KASEreturn | 1.6248 | 0.444 |
| Oil | lnGDP | 0.73401 | 0.693 |
| Oil | Inf | 1.5601 | 0.458 |
| Oil | FX | 5.6594 | 0.059 |

**6.4 Impulse Response Functions**

Figure 2 summarizes the impulse response of each function, where the first variable is an impulse variable and the second is a response variable. The grey area on the graph shows how a dependent variable will reflect the shock of an independent one. In Figure 2, the most sensitive variable is the USD/KZT exchange rate (the set of graphs in the first column). In other words, any dramatic change in the Inflation rate, the return to KASE index, the GDP growth rate, and Brent oil future prices will affect significantly dynamics of the exchange rate. In case of positive changes of inflation, KZT will appreciate on the short run but then stabilize on the long run. The KASE return affected FX over the short run, probably via banks included in the index. But that should be tested in further studies. Oil prices have the largest effect on the USD/KZT exchange rate. The tenge appreciates in the short run if oil prices go up, but in the long run the exchange rate returns to its pre-shock level. Finally, the tenge appreciates in the short term when GDP grows abnormally but then depreciates.

Figure 2
*Impulse response functions*




## 7. Discussion and Conclusion

In the past decade, capital markets of Kazakhstan became an irreplaceable part of the country's economy. This study considers whether those markets significantly affected major economic indicators. The overall conclusion is that 10 years were not enough to allow a new stock market to integrate with the economy. Nevertheless, the return on KASE index, the most liquid instrument available on the stock market, is influenced by the USD/KZT exchange rate and Brent oil future prices. Despite this fact, the economic situation will not affect investments in the KASE index when inflation is rising. However, in the short run, the index can reflect growth of GDP since it reflects the profitability of firms in the index.

The KZT is sensitive to any economic shocks. The central bank should control such an instable and highly vulnerable domestic currency. Today, the government does not regulate the tenge.

Finally, the study found no significant effect of the exchange rate on economic stability in the form of the growth rate of nominal GDP (reflected in lnGDP) and the inflation rate (Inf). Depreciation of the tenge in terms of dollars does not directly destabilize the Kazakhstani economy. Any rise of inflation during tenge depreciation is simply noise and does not correlate significantly with the increase of prices for services and consumer goods. But other exchange rates can influence inflation in Kazakhstan, for instance, the RUB/KZT exchange rate. Future research should examine this possibility.

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## 8. Summary

*English: This study uses the VAR model to test the correlation between core macroeconomic variables and the KASE index. It finds that the KASE index relates directly to the inflation rate and indirectly to the foreign exchange rate and oil prices.*

*Russian: данное исследование использует регрессионную модель VAR с целью выявления корреляции между главными макроэкономическими показателями и индексом биржи KASE. База данных основана на временной последовательности исторических показателей. Статистический тест выявил прямую зависимость индекса биржи KASE от инфляции и косвенную зависимость от обменного курса и цен на нефть.*

*Қазақ: бұл зерттеу негізгі макроэкономикалық көрсеткіштер мен KASE биржа индексі арасындағы корреляцияны анықтау үшін VAR регрессия моделін пайдаланады. Деректер базасы тарихи өнімділіктің уақыт тізбегіне негізделген. Статистикалық сынақ KASE биржалық индексінің инфляцияға тікелей тәуелділігін және айырбас бағамы мен мұнай бағасына жанама тәуелділігін анықтады.*

## 9. References

Abedallat, A., & Shabib, D. K. (2012). Impact of the investment and gross domestic product on the Amman Stock Exchange index. *Investment Management and Financial Innovations*, *9(3),* 130-136.

Bose, E., Hravnak, M., & Sereika, S. M. (2018). Vector Autoregressive (VAR) Models and Granger Causality in time series analysis in nursing research: Dynamic changes among vital signs prior to cardiorespiratory instability events as an example. *Nurs Res., 66(1),* 12-19, DOI: 10.1097/NNR.0000000000000193

Castro, C., & Jiménez-Rodríguez, R. (2020). Dynamic interactions between oil price and exchange rate. *Plos One.* DOI: https://doi.org/10.1371/journal.pone.0237172

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74 (366*), 427-431.

Dorrance, G. S. (1963). The effect of inflation on economic development. *IMF Staff Papers*, *1963 (1),* DOI: https://doi.org/10.5089/9781451956023.024

Eldomiaty, T., Saeed, Y., Hammam, R., & AboulSoud, S. (2019). The associations between stock prices, inflation rates, and interest rates are still persistent: Empirical evidence from stock duration model. *Journal of Economics, Finance and Administrative Science.* DOI:10.1108/JEFAS-10-2018-0105

Gay, R., D. (2008). Effect of macroeconomic variables on stock market returns for four emerging economies: Brazil, Russia, India, and China. *International Business & Economics Research Journal,* 7*(3).*

Harris, M. (1991). The theory of capital structure*. Journal of Finance*, *46*(*1*), 297-355.

KASE (2021). General presentation. Retrieved on September 14, 2021, from https://kase.kz/files/presentations/ru/21_09_01_KASE_ru.pdf

KASE (2022). Methodology of KASE index calculation. Retrieved on February 15 from https://kase.kz/files/normative_base/indicators_met.pdf

MacKinnon, J. G. (1994). Approximate asymptotic distribution functions for unit-root and cointegration test. *Journal of Business and Economic Statistics*. · DOI: 10.1080/07350015.1994.10510005

Macrotrends (n.d.). Kazakhstan inflation rate 1994-2021. Retrieved on September 14, 2021 from https://www.macrotrends.net/countries/KAZ/kazakhstan/inflation-rate-cpi

Metel'skaya, V., V. (2021). Correlation-and-regression analysis of the influence of macroeconomic factors on capital structure of Russian corporations under crisis conditions. *Journal of Innovation and Entrepreneurship.* https://doi.org/10.1186/s13731-021-00160-w

Nurmakhanova, M., & Katenova, M. (2019). Are stock market and exchange rate affected by oil price in Kazakhstan? *International Journal of Engineering Business Management, 11*, 1-9. DOI: 10.1177/1847979019851926

Oskenbayev, Y., Yilmaz, M., & Chagirov, D. (2011). The impact of macroeconomic indicators on stock exchange performance in Kazakhstan. *African Journal of Business Management, 5(7),* 2985-2991. Available at ISSN 1993-8233.

Papana, A., Kyrtsou, C., Kugiumtzis, D. & Diks, C. (2014). Identifying causal relationships in case of nonstationary time series, *CeNDEF Working Papers*. Retrieved on February 15 from https://ideas.repec.org/p/ams/ndfwpp/14-09.html

Shah, S., A. (2018). Impact of macro level economic factors on capital market returns: Evidence from the emerging market of Asia. *Journal of Hotel & Business Management.* DOI: 10.4172/2169-0286.1000183

# Contemporary Turkmenistan's Foreign Policy: Neutrality and Caution

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*Abstract: The objective of this paper is to analyzse the foreign policy of Turkmenistan in the period from 2007 to nowadays. The paper analyses the main goals of this policy—the status of the Permanent Neutrality of Turkmenistan, its determination of the vectors of foreign policy, and the resolution of regional conflicts; the policy concerning energy security and regional issues; and geo-economic policy. The analysis identifies concepts that led to policy. The paper concludes that neutrality brought security and stability to Turkmenistan, but the internal policy based on human rights violations and corruption needs to be modified to meet the aspirations of citizens and give them more freedom.*
*JEL classifications: K33, K38*

*Keywords: Turkmenistan, Foreign Policy, Central Asia, Eurasia, Natural Resources*

## 1. Introduction

Turkmenistan gained independence from the Soviet Union in 1991. As a result of its geographical position, Turkmenistan heavily influences its neighbors. It has abundant natural resources and ranks fourth in gas reserves. Turkmenistan was a vital part of the historic Silk Road and the Islamic expansion in Central Asia. The Russian Empire annexed Turkmenistan in 1881 after being ruled by Mongolians, Uzbeks, and Persians.

The Turkmen Soviet Socialist Republic was proclaimed on May 13, 1925. On October 27, 1991, Turkmenistan declared independence from the USSR. Unlike many countries that formed political and military alliances, Turkmenistan sought economic and national security through constructive neutrality. The United Nations recognized it as a neutral nation in 1995. But Turkmenistan's foreign policy has varied since independence. President Saparmurat Niyazov created the groundwork for foreign policy in the period 1991-2006. President Gurbanguly Berdymukhamedov, elected in 2017, has continued this policy.

This paper draws especially from the book *Turkmenistan's Foreign Policy*, by Karayev, Gurbanov, and Jorayev (2017); Jumayev's (2012) thesis, "Turkmenistan's Foreign Policy in 1991-2006," about Niyazov's foreign policy; several Central Asian studies and op-ed articles; and the few original sources available, including electronic sources such as the Turkmenistan Constitution. Western studies of Turkmen policy are rare and focus narrowly on natural resources and regional integration. Turkish researchers are interested in Turkmenistan's internal politics and Turkish-Turkmen ties.

This study examines positive neutrality and Turkmenistan's foreign policy objectively and scientifically. It answers these questions: Why was Turkmenistan's foreign policy based on neutrality? How was it achieved? How does neutrality affect Turkmenistan? What is the link between energy security and Turkmenistan's foreign policy? What is Turkmenistan's position on regional issues? Do geoeconomic and cultural-humanitarian factors influence state policy?

This qualitative study examines Turkmenistan's bilateral and multilateral relations, using historical, case study, data, comparative, and theoretical methods. The goal is to understand Turkmenistan's foreign policy and its public and private aspects. Due to its neutrality, Turkmenistan enjoys peaceful relations with its neighbors, which contributes to the security and stability of Central Asia and the Caspian Sea.

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The policy of neutrality excludes the state from armed alliances and interstate hostilities. Neutrality is created by international treaties and regulations. To achieve permanent neutrality, a state must either sign international treaties or enact legislation (Korunova, 2009).

A state that proclaims neutrality has the right to demand that international parties respect its sovereignty, independence, and regional security, as well as the right to refuse any military intervention or alliance. To maintain its neutrality, a country must not participate in wars or military alliances, nor allow external forces to use its territory for armed action or the use of nuclear weapons. It must also not contain terrorists or people who commit acts of aggression, nor participate in boycotts or economic blockades. Positive neutrality promotes peace through pushing for disarmament, eliminating racial prejudice, and advocating a peaceful resolution to international disputes.

Global social unrest is becoming a major concern of global security and international affairs. Thus, normal discretion in compromise is lacking. New concepts and tactics are being developed to reduce resource usage and improve global dispute settlement. Preventive diplomacy is one notion.

Interestingly, former UN Secretary-General Dag Hammarskjold used the phrase preventative discretion. Hammarskjold's thought was to conceal neighboring contentions or keep them from being impeded by superpowers. It was agreed that this would prevent a Cold War from developing while strengthening the role of the UN in resolving conflicts beyond the interests of superpowers.

Former UN Secretary-General Boutros-Ghali reinterpreted Hammarskjold's argument after the Cold War ended. According to his study, "An Agenda for Peace," preventative diplomacy is an "effort to prevent conflicts between parties, to prevent current discussions from turning into confrontations, and to limit the spread of hostilities when they occur" (Acharya, 1994).

“Preventive Diplomacy: Delivering results” was published on August 26, 2011, by UN Secretary-General Ban Ki-moon on behalf of the Security Council. It achieves significant good impacts “with relatively [few] resources,” as stated by the UN head. He highlighted improvements in methodology and data availability concerning upcoming conflicts but lamented failures in predicting and a lack of preventative diplomats.

Regional development theories provide a unique approach to regional socioeconomic development based on history, tradition, planning, and policy. These theories examine the link between empirical objects (like libraries) and their conceptualization (like the library as a creation factor). Topics of interest include undeveloped territories in developed countries, financial strategies, adjusted regional development within the region, territorial approaches, and underlying assets of the European community (Dawkins, 2003, pp. 131-72).

## 2. Turkmenistan's Foreign Policy

### 2.1. Neutrality Strategy

Turkmenistan had two choices in the early 1990s: Join a military alliance to maintain national security or remain neutral. After the fall of the USSR, Turkmenistan adopted a policy of neutrality. Former Turkmen President Saparmurat Niyazov pledged political neutrality and economic openness in July 1992 during a meeting of the Conference on Security and Cooperation in Europe (now OSCE).

In March 1995, President Niyazov proclaimed in Islamabad that his country had constitutionally accepted all neutrality demands. The member states praised Turkmenistan's effort and provided it significant international backing (Gurbanov & Jorayev, 2017, p. 43). Turkmenistan was accorded neutrality by the United Nations on December 12, 1995 (UN Resolution No. 50/80). Turkmenistan renounced weapons of mass destruction, prohibited their transport by land and air, adhered to universal values and principles of democracy, maintained civil peace, and implemented policies in close cooperation with the UN and international humanitarian pacts.

Inter-Afghan discussions and an international conference on Afghanistan were held in 1997 at Ashgabat (Jenča, 2011). Thus, Turkmenistan is a state supporter of peace and an instrument for regional security. After proclaiming its neutrality, Turkmenistan was allowed to implement political and economic reforms and build business alliances with other nations. This affirmed world peace and security, sustainable development, peaceful resolution of issues, and good neighborliness. When elected president in 2007, Gurbanguly Berdymukhamedov declared Turkmenistan's commitment to everlasting neutrality, bringing peace, progress, and stability (Anceschi, 2008:140).

### 2.2. Turkmenistan Promoting Peace, Security and Sustainable Development

Neutrality, peace, good-neighborliness, and cooperation underpin Turkmenistan's foreign policy. It views economic, energy, environmental, and food security as interconnected. Turkmenistan works with regional and international organizations to foster peace and condemns military solutions of international disputes. Turkmenistan values preventative diplomacy in sustaining peace and security and confronting emerging threats. It prepares and deploys a collection of political, legal, diplomatic, social, and economic measures to counter regional threats. It does so in conjunction with the United Nations (UN) and its Charter, the Non-Aligned Movement, the Commonwealth of Independent States (CIS), Information Commissioner's Office (ICO), and the Economic Cooperation Organization (ECO).

Turkmenistan's foreign policy is in line with the UN's pursuit of peace. The UN Regional Center for Preventive Diplomacy for Central Asia is based in Ashgabat. This center was founded on December 10, 2007 and has become a regional communication and cooperation platform to tackle terrorism, armed extremism, organized crime, narcotics, and people trafficking. On these issues, ti also works closely with its neighbors as well as regional and international organizations, including the UN Office of Counter-Terrorism, the Security Council Counter-Terrorism Committee, the UN Office on Drugs and Crime. Turkmenistan is committed to implementing UN disarmament treaties and conventions and maintaining the nonproliferation system.

Turkmenistan helps to implement the Sustainable Development Goals (SDGs) through UN institutions, agencies, and specialized entities (Voluntary National Review of Turkmenistan, 2019). To succeed, the country works with the commercial sector, NGOs, and civil society.

## 3. Turkmenistan, the Pioneer of Preventive Diplomacy

Preventive diplomacy is the use of diplomatic measures to prevent or deescalate current disputes. Actors other than nations engage in preventive diplomacy. Turkmenistan's foreign policy is focused on regional and global peace and security. The country works closely with the UN to avoid conflicts and resolve them peacefully. On December 13, 1991, a joint declaration on the importance of establishing a ceasefire was signed, and on February 18, 1996, the Ashgabat Declaration was signed, which permitted the peaceful conclusion of the inter-Tajik dispute (Efegii, Qicay, Ayse, & Kidik, 1999, pp. 22-24). After the Soviet soldiers left Afghanistan, an internal conflict erupted. The Taliban and the opposition began fighting in 1996. In Ashgabat, in February 1999, the two sides agreed to a truce. On March 14 of the same year, the United Nations convened a second round of Afghan discussions, when all parties agreed to build a new broad-based Afghan government, hold new elections, and maintain the Afghan elections and peace (pp. 24-25).

Turkmenistan has proved its desire to be a regional peacemaker. Turkmenistan has been an important ally and partner of the UN in sustaining regional political stability and encouraging good neighborly ties, friendship, and collaboration. With Kazakhstan's help, Turkmenistan built a regional center for preventative diplomacy in September 2004. Then came a round of meetings including all five Central Asian nations. According to the recommendations of the UN Global Counter Terrorism Strategy and the High Level Panel on Threats, Challenges, and Changes, a regional center for preventive diplomacy will be established in Ashgabat (Malyshev, 2010).

Since its inception, the Center has allowed Central Asian leaders to focus on common risks and concerns. Many local, regional, and other players have established lasting and creative

working connections with the Center (*Turkmenistan Today*, 2017). In 2010, the Center helped Kyrgyzstan when the former president was deposed in April and ethnic unrest erupted in June. The Center has helped facilitate reconstruction, recovery, and elections in the country, while promoting dialogue between political leaders and civil society representatives and helping lay the groundwork for reconciliation. Turkmenistan fully supports the UN and all parties interested in establishing security and stability in Afghanistan, and it provides essential political and organizational circumstances for UN-sponsored dialogue.

### 3.1. International Cooperation in the Field of Disarmament

Turkmenistan has signed significant international accords on nonproliferation of nuclear weapons and other weapons of mass destruction, and it does not host any foreign military personnel on its territory. The country perceives enormous weapon arsenals, especially nuclear weapons, as a source of distrust, fear, and hostility. No new types or technology of weapons of mass destruction will be produced in Turkmenistan since it is neutral.

Turkmenistan joined many international disarmament treaties and conventions, including the Anti-Personnel-Mine Ban Treaty, Biological and Chemical Weapons Conventions, Comprehensive Nuclear Test Ban Treaty, Certain Conventional Weapons Convention, International Convention for the Suppression of Acts of Nuclear Terrorism, Treaty Establishing a Nuclear-Weapon-Free Zone in Central Asia, and the Nuclear Nonproliferation Treaty (NPT) (United Nations Office for Disarmament Affairs, n.d.). On September 8, 2006, Turkmenistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan signed in Semipalatinsk the Treaty on the Establishment of a Nuclear-Weapon-Free Zone in Central Asia (Embassy of Turkmenistan in the Republic of Armenia, 2021). By signing the Treaty, Central Asian countries agreed to prohibit the creation, ownership, and use of nuclear weapons and their components. As part of this pact, the parties agreed to work together on global and regional security, nuclear disarmament, and non-proliferation.

Terrorism, illicit drug trafficking, and organized crime are addressed in Turkmenistan's treaties and agreements, which include the Single Convention on Narcotic Drugs, the Convention on Psychotropic Substances, the United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, the International Convention against the Recruitment of Mercenaries, the International Convention for the Suppression of Terrorism (Karayev, Gurbanov, & Jorayev, 2017, pp. 108-109). Turkmenistan's collaboration with the North Atlantic Treaty Organization (NATO) in disarmament is crucial. Turkmenistan joined the North Atlantic Cooperation Council in 1992 and the Partnership for Peace (PFP) program in 1994 (NATO, 2018).

Turkmenistan does not contribute troops to NATO-led operations. But Turkmen officials do attend NATO and member state training. On September 14, 2015, in Vienna, the International Atomic Energy Agency's member nations approved Turkmenistan's membership during the organization's 59$^{th}$ General Conference. The IAEA member nations welcomed Turkmenistan's commitment to nuclear nonproliferation norms globally, particularly in Central Asia (Embassy of Turkmenistan in the Republic of Kazakhstan, 2015).

## 4. Energy Policy of Turkmenistan

### 4.1. Energy Security as a Priority for Turkmenistan

Energy security is the link between national security and energy resource availability. Energy security means that the customer has dependable access to the needed amount of energy and resource. The contemporary world relies on massive energy supplies to power transportation, communications, security, and health services. Energy is crucial to any country's national security as a source of economic strength. Attacks on the energy supply infrastructure, as well as accidents and natural disasters, are among the numerous hazards to energy security. Energy security includes

supply and transportation dependability, pipeline management, anti-extortion, and price stabilization.

Berdymukhamedov's foreign policy is a major component in enhancing state power and influence in regional and global affairs. Turkmenistan's natural resource wealth explains its need for energy security. Turkmenistan has huge gas and oil reserves, especially of natural gas. The nation boasts the world's fourth biggest deposit and is a major electricity generator in the region. Turkmenistan has hundreds of prospective oil and gas sites, onshore and offshore. Despite enormous reserves, of the more than 150 deposits that have been found, only 50 are exploited (Shevchenko, 2011).

Turkmenistan has been gradually supplying energy to global markets since Berdymukhamedov took office. The country considers dependable and secure energy transit to be critical to sustainable growth and international collaboration. Due to the intricacy and complexities of energy security, President of Turkmenistan addressed the UN General Assembly in 2007 and proposed an international system for dependable protection and security of energy supply to global markets. The UN General Assembly overwhelmingly adopted a resolution in 2008 entitled "Reliable and stable energy transit: Its role in achieving sustainable development and international cooperation," sponsored by Turkmenistan and 58 other nations (Zukang, 2009).

The President's idea satisfies the country's 21st-century foreign policy goals, which include the secure supply of Turkmenistan's raw materials to international markets. To ensure sustainable development and international collaboration, the UN General Assembly overwhelmingly adopted a resolution co-sponsored by 71 UN member states on May 17, 2013. This text provides the framework for an international expert committee to write a comprehensive treaty to ensure global energy cooperation. The resolution also commended the Turkmen government's intention to hold an international expert forum on this issue in early 2014 (Alkalaj, 2013).

**4.2. Turkmenistan's Diversification Policy**

Central Asia and the Caspian Sea Basin are in the limelight, due to their substantial hydrocarbon and raw material deposits. The area, particularly Turkmenistan, is a major energy provider. Turkmenistan aims to expand raw material production and sell to global markets.

Founded in the Soviet period, the natural gas industry grew quickly. Since 1999, Turkmenistan has increased its production and exports of this raw resource. Turkmenistan has 149 gas and gas condensate reserves. These are around 10% of the world's total, with 136 offshore and 10 on the Caspian Sea shelf. Galkenesh, the country's largest gas reservoir, was founded in 2006 and has a production potential of 30 billion cubic meters of gas per year.

Turkmenistan ranks third in liquid and gaseous hydrocarbon reserves among the Caspian nations. There are various routes for Turkmen gas to reach international markets: North to Russia, east to China, south to Iran; south through Afghanistan and Pakistan to India; and west over the Caspian Sea to Europe. During the Soviet era, Turkmenistan was a major provider of gas to other Soviet republics. The Central Asia Pipeline connected Turkmenistan to the Soviet Union's European region through Uzbekistan, Kazakhstan, and Russia. Turkmenistan supplies its natural gas to Russia via the Central Asian pipeline (CAC). Turkmenistan continues to provide Russia with natural gas despite tensions over pricing and legal issues (*EurAsia Daily*, 2019).

Iran was the second route for Turkmen gas to go to international markets. Due to the need for gas in Iran's northeast, the two nations agreed to build two gas pipelines connecting them. With a length of 1024 kilometers and a capacity of 18 billion cubic meters per year, the second pipeline was finished in 2010. Despite price and pament conflicts, both nations have maintained gas contacts since the pipelines were built (Atai & Azizi, 2012).

The third option, the Turkmenistan-China pipeline, benefits both Turkmenistan and the globe. They agreed in 2007 on a pipeline from Turkmenistan to China via Uzbekistan and Kazakhstan. Its length is almost 7,000 kilometers, comprising 188 kilometres in Turkmenistan, 539 km in Uzbekistan, 1,300 km in Kazakhstan, and over 4,500 km in China. Construction began in December 2009. Two further branches were built in 2010 and 2014, resulting in three lines with a total capacity of 55 billion cubic meters per year. The nations agreed in 2012 to build a fourth

pipeline via Uzbekistan, Kyrgyzstan, and Tajikistan, increasing gas exports to 65 billion cubic meters per year. This initiative is considered the start of the modern Silk Road (Azzena, 2015).

Berdymukhamedov's government is formulating methods for increasing export potential for Turkmenistan in the near future, creating an efficient energy export infrastructure, diversifying energy exports, and transferring them to global markets multilaterally. Turkmenistan is developing new ventures with international partners to fulfill strategic aims. One example is the planned Turkmenistan, Afghanistan, Pakistan, and India gas pipeline (TAPI). On March 15, 1995, Turkmenistan and Pakistan signed the first Memorandum of Understanding for the pipeline project. The pipeline's passage through Afghanistan was a problem for the Taliban, therefore the deal fell through. A new agreement was signed in December 2002 by the governments of Turkmenistan, Afghanistan, and Pakistan, and the Asian Development Bank delivered its final feasibility report in 2005. The project was to start in 2006 but halted owing to Afghanistan's unpredictable security situation (Tomofeenko, 2010).

In April 2008, Afghanistan, Pakistan, and India inked a framework deal for Turkmenistan gas purchases. The pipeline agreement was signed in December 2010 in Ashgabat. Construction on the Turkmen side began in December 2015 and ended in 2019, while work on the Afghan side began in February 2018 and work in Pakistan began in the first quarter of 2020. The pipeline spans 214 km in Turkmenistan, 774 km in Afghanistan, and 826 km in Pakistan. The project's full capacity is 33 bcm per year (Rémy, 2018). The TAPI pipeline project is to connect South and Central Asia via gas pipelines, as well as improve energy transmission in South Asia. It is thought that transit through Afghanistan and Pakistan will assist regional peace and security. Turkmenistan also intends to export electricity to Europe.

### 4.3. Energy Issue at the Heart of Turkmenistan's Diplomacy

Energy diplomacy refers to the government's foreign actions to guarantee energy security and encouraging energy-related commercial prospects. Turkmenistan strives to establish a robust global energy security structure that balances the interests of all suppliers, transit nations, and consumers.

Turkmenistan is modernizing the country's fuel and energy complex and diversifying energy exports to global markets. The state regularly invests in the energy industry to boost oil, gas, and electricity production capacity. Turkmenistan, the region's largest discretionary producer of energy, already exports to Afghanistan and Iran and plans to expand export capacity. Also, Turkmen power might be sent to Kazakhstan, Tajikistan, Pakistan, and the Caucasus. Russia, Iran, and China already buy Turkmen gas. As part of its energy policy, the nation is implementing two large projects to diversify energy supply channels. One is the planned Trans-Caspian pipeline. The other is TAPI. Berdymukhamedov said it will foster peace, social and economic success, and commerce among the countries in the area.

Turkmenistan aspires to be a leader in renewable energy as well as in natural resources. It will create a Solar Energy Institute under the Turkmen Academy of Sciences to strengthen scientific and technological study (Khan, 2018). Turkmenistan's 2017 leadership of the Energy Pact Conference demonstrates global support for its policy of international energy cooperation.

## 5. Turkmenistan's Foreign Policy Towards Regional Issues

### 5.1. Cooperation for Peace and Stability in Afghanistan

Afghanistan was one of the first nations to recognize Turkmenistan's independence in 1991. The inter-Afghan discussions launched by Turkmenistan and conducted in Ashgabat in the 1990s are a shining example. In any event, the Afghan civil war, the Taliban administration, and overall instability in Afghanistan damaged bilateral relations. After September 11, 2001, and the collapse of the Taliban administration in Afghanistan, the two nations' ties changed. Their strategic collaboration began when Afghan officials visited Turkmenistan (Fahim, 2012). Turkmenistan

often contributed humanitarian aid to Afghanistan, as well as medical and educational help to Afghans.

Turkmenistan has spearheaded confidence-building initiatives called “regional infrastructures” since 2012. These include counter-terrorism, drug prevention, disaster management, regional cooperation in infrastructure, commerce, and education. TAPI and the Turkmenistan-Afghanistan-Tajikistan railway (TAT), as well as electrical lines, are among the results. The three nations signed the TAT pact in March 2013 to improve the railway corridor in Central Asia by connecting it to global markets and offering convenience and efficiency to the Indian Ocean (Rahim, 2016).

The Taliban worry the Central Asian nations of Central Asia. But since the U.S. withdrawal from Afghanistan in August 2021, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan have relied on the Taliban. Islamic State (IS) has claimed responsibility for rocket attacks on Uzbekistan and has targeted mosques near the Central Asian border in recent months. Security policy in Central Asia is limited and has few choices for dealing with a new border threat, as demonstrated by the worsening situation in the region. In northern Afghanistan, the Islamic State is gaining ground and gaining strength. In the spring of 2022, the group bombed Shia mosques in Kunduz and Mazar-i-Sharif, killing hundreds of worshipers (BBC News, 2022). Islamic State claimed that an Afghan rocket had struck Uzbek military sites, however the Taliban and Uzbekistan refuted this allegation (Gul, 2022).

Turkmenistan began building a railway in 2013 and finished it in November 2016. A 10-kilometer railway is being built to improve the Akina Railway Station in Afghanistan, as per a deal made between the Turkmenistan and Afghan railway authorities. Moreover, in February 2019, the two nations inked an MOU to develop a 30 km railway extension from Akina port to Andkhoi district, Afghanistan's first major location. Turkmen professionals will design and build the project (Akina-Andkhoy railway line construction resumed, 2022). The TAPI gas pipeline is another major project that should boost the Afghan economy by creating jobs and social infrastructure, and by stabilizing the region politically.

### 5.2. The Importance of the Caspian Sea in the Foreign Policy of Turkmenistan

The Caspian Sea is the world's biggest saltwater basin with no natural link to the ocean. The Don River and the Volga Canal in Russia are exceptions. The sea is rich in marine hydrocarbon resources and has a crucial geopolitical location for transit routes. The sea is surrounded by Azerbaijan, Russia, Kazakhstan, Turkmenistan, and Iran. The Caspian Sea's legal status has long been contentious, thanks to its political, economic, and strategic importance. The Russian and Persian empires clashed throughout the 18th and 19th centuries, leading to several pacts: The Treaty of Saint Petersburg (1723); the Peace of Walistan (1813), ending the Russo-Persian War of 1806-1813; and the Peace Treaty of Turkmenchay (1826-1828).

These treaties became void once the Bosheviks deposed Tsar Nicholas II in 1917. The Treaty of Amity and Cooperation between Soviet Russia and Iran was signed in 1921. It grants both sides equal rights to float commercial ships and warships. Each party received a 10-mile fishing license from the other under the Treaty of Establishment, Trade, and Navigation, signed in 1940. *En outre*, the Soviet Union and Iran agreed to establish a land boundary between Astara, Azerbaijan, and Hasankuli, Turkmenistan. This was an unofficial border between the Caspian Sea and the Black Sea (Abilov, 2013).

In 1996, on a proposal of Turkmenistan, a special working group of deputy foreign ministers was formed to draft an agreement on the legal status of the Caspian Sea. The text was negotiated over two decades, with 51 sessions of special working groups, 10 meetings of foreign ministers, and four summits of heads of state, who met at Ashgabat in 2007, Tehran in 2010, and in Baku, Azerbaijan, and Astrakhan, Russia (Amanzholova, 2018). The second summit in Tehran was remarkable for signing the Joint Declaration, which became the first political declaration by the Caspian heads of state (Chebotarey, 2017).

Turkmenistan's attitude on cooperation with Caspian Sea states is based on good faith, equality, and mutual respect. After negotiations, the Caspian states agreed on the country's legal status. The first five-year pact, the Framework Convention for the Protection of the Marine Environment of the Caspian Sea, was signed in Tehran in 2003 and ratified by parliaments.

Turkmenistan and Azerbaijan disagree over the three oil fields of Sardar (Kyapaz), Omar (Azerbaijan), and Osman (Chirag). The parties agreed to handle disputes in line with Article 33 of the UN Charter, signed in 1996. Turkmenistan's stance is that the Caspian Sea's bottom and subsoil between Turkmenistan and Azerbaijan should be established along the middle line, in accordance with international law.

Turkmenistan has been trying to resolve this problem since 1998 (*Sputnik News*, 2021). Its resolution will reinforce the building of the Trans-Caspian pipeline between Turkmenistan and Kazakhstan. Since its independence, Kazakhstan has regarded the Caspian Sea as peaceful and friendly. Berdymukhamedov, speaking at the Caspian presidential summits, stressed the necessity for flexibility in achieving mutual agreements, and for inventing innovating measures that balance the interests of nations.

## 6. Foreign Economic Relations of Turkmenistan

Turkmenistan has implemented an "open doors" strategy in economic ties to stimulate foreign investment and commerce. This strategy specifies the country's peacekeeping and helps build successful models of economic understanding. Turkmenistan was one of the three nations with the greatest and most constant economic growth rates from 2010 to 2018 (World Bank, 2019).

In 2007, the government standardized the double exchange rate. It also oversaw steady development of power engineering, oil and gas complex, building, agriculture, transportation, and communications. And it is forming new industries like textiles, chemicals, construction materials, and communications. One key tool is the National Program for Social and Economic Development of the Country for 2018-2024 (Ministry of Foreign Affairs of Turkmenistan, n.d.) Turkmenistan is aiming to enter the global market (Jumayev, 2012).

Turkmenistan believes that better financial reporting is the major instrument for building international collaboration and attracting foreign investment. The country has commercial links with 119 countries and is keen on enhancing ties with the International Monetary Fund (IMF), the European Bank for Reconstruction and Development (EBRD), the Asian Development Bank (ADB), and the International Development Bank (IDB), among others. Turkmenistan's international trade reached 18.3 billion dollars in 2018, up 11.3% from 2017. In this raw-material economy, exports outnumber imports 2.2 to 1. In 2018, the external debt was $1,870 million, or 4.75% of the gross domestic product (GDP). Experts predict a steady fall in growth in 2020-2025, despite rising export profits for gas and textiles. Turkmenistan's largest commercial partners include China, Italy, Afghanistan, Turkey, the UAE, Germany, and Russia (Sarybayeva, 2019).

The growth of mutually beneficial international commercial, economic, and investment cooperation is an important part of Turkmenistan's foreign policy under President Gurbanguly Berdymukhamedov. This has led to an increase in the percentage of foreign investments in the Turkmen economy and the number of investment projects and joint ventures. Experts say Turkmenistan's economy is efficient and has high investment potential (Asia Regional Integration Center, 2017). The state gives major tax, customs, visa, and insurance incentives to international firms. A key factor in this were the Turkmenistan Laws on Foreign Investments and Hydrocarbon Resources. External variables affecting foreign investment include global economic conditions and the preference of international investors to do business in nations with a stable political climate. Turkmenistan is also developing free economic zones, which allow widespread adoption of new technology. Such zones can also saturate the local consumer market, expand employment, build a modern market infrastructure, and speed up regional growth, national wealth, and Turkmen well-being.

Turkmenistan's substantial natural resources, export and transit prospects, active industrialization, and growing commerce and service sectors are attracting big global investors. The petroleum and energy industry is an example. Many well-known multinational businesses operate in Turkmenistan under production sharing agreements, including those connected to geological research and exploitation of hydrocarbon reserves on land and water. CNPC was one of the first international corporations to enter the Turkmen market. CNPC has been exploring and developing resources for the transnational gas pipeline between Turkmenistan and China since 2007. CNPC and Petrofac Limited, a London-based provider of oilfield services to the international oil and gas business, are also developing the Galkynysh field. It ranks among the world's top five largest gas fields, having a reserve of 4 to 14 trillion cubic meters of natural gas. The Chinese CNPC is building a commercial gas complex, producing 30 billion cubic meters per year, in the Galkynysh field, under a contract with Turkmengaz.

Partnerships with other Asia-Pacific leaders are also growing. The Japanese prime minister visited Ashgabat in October 2015 and signed pacts with Japanese business and financial circles exceeding 18 billion dollars (Latest News of Turkmenistan Today Online, 2017). Aside from heavy industry, foreign money can invest in textiles, agriculture, electronics, construction products made from domestic raw resources, amd tourism. It is also attributable to initiatives in transportation and communications, such as modernizing civil aviation, railroad. and maritime infrastructure, building motorways, and using national space satellites. The continual privatization attracts international investment, broadens support for private enterprise, and fosters foreign joint ventures.

## 7. Neutrality Is Not Enough in a Difficult and Complex Internal Situation

### 7.1. Assertions of Pervasive Corruption

Despite its geostrategic location and policy of neutrality, Turkmenistan suffers from severe corruption and is classified as one of the most corrupt countries. Civil liberties, political variety, and freedom of speech are practically nonexistent. Many Turkmen people have been forced to wait in long lines to get low-quality subsidized necessities like wheat and eggs, since the typical Turkmen person cannot afford commercial prices. A scarcity of hard currency in 2019 led to long lines at ATMs and a ten-fold higher dollar exchange rate on the underground market than the official rate (Pannier, 2021).

Despite Berdymukhamedov's statements, the Foreign Policy Centre declared the country to be "on the edge of catastrophe" in May 2021. The governing elite in Turkmenistan abuses its power to enrich themselves at the expense of the population by exploiting natural resources. This has led to years of poor management, wasteful expenditure, and widespread corruption. People in Turkmenistan are seeing money that should be spent on the public being embezzled, concealed abroad, or used to acquire property in the United States and Europe (Eurasianet, 2022).

Turkmens are mired in a state of delusion. Turkmens have little knowledge of economics, borrowing, or outlays. Usually the public budget is brief and made up of confusing data. Because of the lack of transparency, those in positions of authority can spend public funds any way they see fit. Because of this, Turkmenistan's ruling class, their families, and where their money is stashed remain a mystery, unlike other Central Asian kleptocracies (Stronski, 2017).

Many cases of corruption from Azerbaijan, Kyrgyzstan, and Kazakhstan are available on the Organized Crime and Corruption Reporting Project (OCCRP)'s website, but few from Turkmenistan. Some independent voices allow information to be collected and disseminated, typically anonymously, despite restrictions on freedom of speech in other Central Asian countries, such as Uzbekistan. Dissenting reporters in Turkmenistan are frequently harassed, imprisoned, and even executed. Outside of the country, the few independent voices can be heard (Myatiev & Shikhmuradov, 2021).

Corruption reporting in Turkmenistan has been scarce due to a lack of information on how much money the Turkmen government earns, which is then spent on vanity projects. Management of revenue or expenditures is not under national jurisdiction (Myatiev & Shikhmuradov, 2021).

### 7.2. Lack of Human Rights in Turkmenistan

The Turkmen government's human rights record deteriorated in 2021. Turkmenistan's economy remains precarious. Subsidies for utilities including water, gas, and electricity had ended. The departure from crisis-affected areas continued, but authorities attempted to stop people from finding work abroad. Anyone who makes a religious or political declaration in violation of the law will face serious repercussions for their actions. Access to information is regulated by the state. There will be no independent human rights watchdogs. Turkmen prisons are possibly holding hundreds of the missing (United States Department of State, 2020).

Turkmenistan's media are censored. All media are owned and controlled by the government. Foreign journalists' access is restricted. Foreign stringers face retaliation from the authorities. The government continues to censor the Internet. Foreign-made, private surveillance technology tracks and restricts websites, identifies people who have evaded censorship, intercepts phone calls, and blocks social media (SMS) (Jomartov, 2020).

The authorities blocked all VPN services, according to Radio Free Europe/Radio Liberty (RFE/RL) and the Turkmen Initiative for Human Rights (TIHR). Turkmenistan restricts the activities of international human rights organizations. A nonprofit organization's failure to register can result in a fine, jail time, or even the loss of all of the organization's assets (Jomartov, 2020). Authorities constantly threaten civil society activists. Gaspar Matalaev was imprisoned for three years on phony fraud charges in order to supervise state-sponsored forced labor in the cotton harvest (Cotton Campaign, 2019). An activist for Baloch minority rights, Mansur Mingelov, was sentenced to 22 years in jail in 2012.

The government routinely bars dissidents and the families of detainees from leaving the country. Turkmenistan's travel prohibition, and pressure on Turkmen relatives still in exile to return, remain in place. In March, TIHR revealed that Ashgabat officials planned to seize and demolish 75 homes. According to RFE/RL (2022), hundreds of private homes were also razed near Ashabat International Airport in July. There was no mention of how much compensation residents would receive if they provided the proper papers (United States Department of State, 2020).

Unauthorized religious organizations are illegal in Turkmenistan. The law prohibits religious literature. Illegal religious practice is punished harshly. In Turkmenistan, anyone who refuses to serve in the military faces the death penalty. At least six protesters have been arrested and three are still in custody, according to an independent religious freedom organization, Forum 18 (2021).

Torture and abuse continue in Turkmenistan prisons. Turkmenistan's legal system makes it difficult to determine the exact number of political prisoners. As a precaution against retaliation, the government withholds critical material while also closing important proceedings and prohibiting independent monitoring (Freedom House, 2021).

Forced disappearance or incommunicado imprisonment of hundreds of inmates has lasted for nearly 17 years. Families are in the dark regarding the whereabouts of loved ones. There are 121 people still unaccounted for in Turkmenistan, according to Prove They Are Alive, an international initiative to oppose forced disappearances in that country. Ovadandepe Prison is well-known for its inhumane treatment of political prisoners and long-term isolation cells (Freedom House, 2021).

Men in Turkmenistan might face two years in prison for same-sex activities. The UN Human Rights Committee said on March 29 that the detention of three Jehovah's Witness conscientious objectors violated their rights under the International Covenant on Civil and Political Rights (Forum18, 2021).

### 7.3. Conflicts on the Border with Afghanistan

Despite Turkmenistan's neutrality, it must cope with regional security. Tensions have often plagued the border with Afghanistan, especially after the Taliban took over in 2021. Recently, for the first time, Turkmen border guards and Taliban militants have sustained a firefight (RFE/RL, 2022). Turkmen border guards opened fire days after Turkmen troops killed an Afghan civilian in the same location (Eurasianet, 2022). However, such news is censored in the Turkmen media. Similarly, according to reports, Turkmen forces were in a gunfight in May 2018 that killed 25 Turkmen, but authorities and state-run media remained silent. Turkmen border guards are said to have fired upon the Taliban when they arrived to investigate (Pannier, 2022).

More generally, only two instances of Turkmen forces using weapons have been documented in the country's 30-year history of independence: In 2015 and 2018. With big energy projects in Turkmenistan stalled for years due to Afghan insecurity, the shooting event seems perplexing. However, Turkmen forces fire their weapons, demonstrating a lack of confidence between the two countries (Indeo, 2021).

Censorship in Turkmenistan is wide-ranging: Turkmen officials assert that the country has never had any cases of Covid-19, despite overwhelming evidence to the contrary (Jomartov, 2020).

The escalating turbulence near the Turkmen-Afghanistan border alarms Turkmen officials. After capturing Qaramqol and Ghormach, the Taliban seized control of Andkhoy on June 25 (32km from the border with Turkmenistan). The Taliban took over Torghundi, the second dry port between Afghanistan and Turkmenistan, on July 9 (AKIpress, 2021).

Like Tajikistan, Turkmenistan moved heavy weapons and helicopters from Lebap to Serhetabad, a major border crossing with Afghanistan, to strengthen border security. The government summoned reservists in Ashgabat to military recruiting posts to prepare for possible deployment. The Taliban says it wants only to rebuild the Islamic Emirate in Afghanistan; it does not wish to undermine the borders and sovereignty of Central Asian neighbors. The IS-K could benefit from border volatility by destabilizing regions of Turkmenistan (Indeo, 2021).

As recently as 2017, IS-K militants claimed control of Afghanistan's Jowzjan Region, which borders Turkmenistan's eastern province of Lebap, and the Darzab region inside it. Islamic State (IS) briefly took control of a portion of Afghanistan close to the Turkmen border, but Afghan security forces and the Taliban expelled IS troops (Pannier, 2017).

In 2014, Afghan Taliban ambushed and killed six Turkmen border guards; and in 2016, 27 Turkmen conscripts were killed along the Afghan border. These were the two deadliest incidents. To make matters worse, 1.5 million Turkmen live in Faryab and Jowzjan in northern Afghanistan, close to Turkmenistan's borders (Annayev, 2016). Because of this, ethnic conflicts could destabilize Ashgabat.

To retain neutrality, Berdymukhamedov should explore expanding military and security ties with Russia and China. In the current political climate, despite Western sanctions against the Taliban for denying civil rights for women, Turkmenistan (as well as other Central Asian countries) see the Taliban as a more trustworthy political partner who can help implement energy and infrastructure projects that would attain regional cooperation. The US-Taliban "Agreement for Bringing Peace to Afghanistan" inked in Doha combats transnational terrorist groups like Daesh and Al Qaeda. This pact ensures that terrorists will not use Afghan land to threaten the neighbors.

## 8. Conclusions

An examination of Turkmenistan's foreign policy under President Gurbanguly Berdymukhamedov reveals its bases of neutrality, peace, good neighbourliness, and mutually beneficial collaboration. Turkmenistan’s goals include a peaceful and political solution to the Afghan dilemma and the country's socioeconomic recovery.

Turkmenistan considers energy, ecology, water, and other security issues to be interrelated and indivisible. Raising the quality of life of Turkmens requires a systemic effort. The “Concept

of Course of Turkmenistan's Neutral Foreign Policy for the Period 2017-2023" defines two major avenues for diplomacy. It entails organized bilateral ties and participation with international organizations. Turkmenistan has diplomatic ties with 131 countries and belongs to 43 international organizations.

Despite its policy of neutrality, Turkmenistan suffers from a lack of human rights, administrative and economic corruption, and security threats, especially on the border with Afghanistan. The danger has increased with the Taliban takeover. The policy of neutrality has no real meaning without a just national strategy that grants the people their full rights and distributes wealth fairly, without corruption or waste of public money.

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## 9. Summary

*English: This study deals with the policy of neutrality and with contemporary foreign policy of Turkmenistan. It argues that Turkmenistan has benefited greatly from neutrality and peaceful regional interaction, but its internal policy needs adjustment to meet popular aspirations.*

## 10. References

Abilov, S. (2013). *Legal Status of the Caspian*. Hazar Raporu/Caspian Report

Acharya, A. (1994). *Preventive diplomacy: Issues and institutions in the Asia Pacific Region*. Paper presented to the 8th Asia-Pacific Roundtable.

Akina-Andkhoy railway line construction resumed. (2022). Retrieved from http://www.andrewgrantham.co.uk/afghanistan/tag/turkmenistan

AKIpress. (2021). Taliban captures Torghundi town on border with Turkmenistan. Retrieved from https://akipress.com/news:660393:Taliban_captures_Torghundi_town_on_border_with_Turkmenistan/

Alkalaj, S. (2013). Statement by Mr. Sven Alkalaj Executive Secretary of the United Nations Economic Commission for Europe at High-level International Conference on Energy Security and Sustainability: The OSCE Perspective. Retrieved from https://www.unece.org/fileadmin/DAM/press/execsec/2013/17Oct_OSCE.pdf

Amanzholova, Z. (2018). *Caspian Sea legal status: From disassociation to collaboration*. The

Astana Times. Retrieved from https://astanatimes.com/2018/08/caspian-sea-legal-status-from-disassociation-to-collaboration

Anceschi, L. (2008). *Turkmenistan's foreign policy: Positive neutrality and the consolidation of the Turkmen regime.* Central Asia Research Forum Book 13.

Annayev, D. (2016). *Turkmenistan counts on Turkmen-Afghans to fight extremism*, Retrieved from https://central.asia-news.com/en_GB/articles/cnmi_ca/features/2016/07/20/feature-01

Asia Regional Integration Center. (2017). Real Gross Domestic Product (y-o-y growth, %), Turkmenistan. Retrieved from https://aric.adb.org/turkmenistan#:~:text=The%20economy%20was%20estimated%20to,2021%20from%2039%25%20in%202017.

Atai, F., & Azizi, H. (2012). The energy factor in Iran-Turkmenistan relations. *Iranian Studies, 45(6).*

Azzena, F. (2015). Turkmenistan's energy policies analysis: Conflicting choices in gas exports. Manuscript.

BBC News. (2022). Afghanistan: Kunduz mosque attacked during Friday prayers. Retrieved from https://www.bbc.com/news/world-asia-61191643

Chebotarev, A. (2017). The Caspian issue: A protracted solution. *Novainfo*. Retrieved from http://navoine.info/caspian-dec.html

Cotton Campaign. (2019). Gaspar Matalaev free after three years of unjust imprisonment. *International Labor Rights Forum* Retrieved from https://laborrights.org/releases/gaspar-matalaev-free-after-three-years-unjust-imprisonment

Dawkins, C.J. (2003). Regional development theory: Conceptual foundations, classic works, and recent developments. *Journal of Planning Literature*, *18*, 131-172.

The Diplomat. (2016). The Turkmenistan-Afghanistan-Tajikistan Railway. Retrieved from https://thediplomat.com/2016/12/the-turkmenistan-afghanistan-tajikistan-railway/

Efegii, E., Qicay, A. M., & Kidik, H. (1999). An essay on the cooperation between Turkmenistan and international and regional organizations. *Journal of Azerbaijani Studies.*

Embassy of Turkmenistan in the Republic of Armenia. (2021). The policy of Turkmenistan in the field of disarmament. Retrieved from https://armenia.tmembassy.gov.tm/en/news/5112

Embassy of Turkmenistan in the Republic of Kazakhstan. (2015). Turkmenistan became a state member of IAEA. https://kazakhstan.tmembassy.gov.tm/en/news/240

*EurAsia Daily.* (2019). Gas supplies from Turkmenistan to Russia in a "new way" may begin in 2019. Retrieved from https://eadaily.com/ru/news/2019/05/17/postavki-gaza-iz-turkmenii-v-rossiyu-mogut-nachatsya-v-2019-godu

Eurasianet.org (2022). Turkmenistan: A leopard never changes its spots. Retrieved from https://eurasianet.org/turkmenistan-a-leopard-never-changes-its-spots

Fahim, S. (2012). Turkmenistan and Afghanistan: From neutrality to cooperation. *Eurasia Research*

Forum18. (2021). Turkmenistan: The right to acquire and use religious literature...of their choice? Retrieved from https://www.forum18.org/archive.php?country=32

Freedom House. (2021). Freedom in the world 2021: Turkmenistan https://freedomhouse.org/country/turkmenistan/freedom-world/2021

Gul, A. (2022, April 19). Uzbekistan dismisses Islamic State's claim of cross-border attack. Voice of America. Retrieved from https://www.voanews.com/a/uzbekistan-dismisses-islamic-state-s-claim-of-cross-border-attack-/6535868.html

Gurbanov, N & Jorayev, G. (2017). *Turkmenistan's foreign policy.*

Indeo, F. (2021). *Turkmenistan's ambivalent foreign policy towards Afghanistan*. Central Asian Bureau for Analytical Reporting. Retrieved from https://cabar.asia/en/turkmenistan-s-ambivalent-foreign-policy-towards-afghanistan-taliban-advance-and-rising-instability-along-the-shared-border

Jenča, M. (2011). *Foreign policy of neutral Turkmenistan in light of cooperation with the UN*. United Nations Regional Centre For Preventive Diplomacy for Central Asia. Retrieved from https://unrcca.unmissions.org/statement-srsg-miroslav-jen%C4%8Da-occasion-16th-anniversary-turkmenistans-neutrality-foreign-policy

Jomartov, D. (2020). *How Turkmenistan's media works (or doesn't).* Institute for War and Peace Reporting. Retrieved from https://iwpr.net/global-voices/how-turkmenistans-media-works-or-doesnt

Jumayev, I. (2012). *Foreign trade of Turkmenistan: Trends, problems, and prospects*. University of Central Asia, Institute of Public Policy and Administration. Working Paper No 11.

Karayev, B., Gurbanov, N., & Jorayev, G. (2017). Turkmenistan's foreign policy.

Khan, M. U. H. (2018). *National energy policy of Turkmenistan*. SD Analysis.

Korunova, E.V. (2009). Program of the course: Definition of neutrality. *Theory and practice of neutrality policy in the system of international relations*. Bulletin of Moscow University, Series 25, International relations and world politics. No. 1.

Latest News of Turkmenistan Today Online. (2017). Foreign investment in Turkmenistan: Facts and figures. Retrieved from http://infoabad.com/obschestvo-i-yekonomika/inostranye-investicii-v-turkmenistane-cifry-i-fakty.html

Maintenance of International Security. (1995). UNGA 155; A/RES/50/80[B] (12 December 1995) Retrieved from http://www.worldlii.org/int/other/UNGA/1995/

Malyshev, D.V. (2010). UN preventive diplomacy in Central Asia; Bulletin of Moscow University, Series 25, *International relations and world politics*. No. 2.

Ministry of Foreign Affairs of Turkmenistan. (n.d.). Economy. Retrieved from https://www.mfa.gov.tm/en/articles/4

Myatiev, R., & Shikhmuradov, B. (2021). *As Turkmenistan's people go hungry, President's nephew profits off food imports.* OCCRP Retrieved from https://www.occrp.org/en/investigations/as-turkmenistans-people-go-hungry-presidents-nephew-profits-off-food-imports

North Atlantic Treaty Organization (2018). Relations with Turkmenistan. Retrieved from https://www.nato.int/cps/cz/natohq/topics_50317.htm

Pannier, B. (2017). Is there a terrorist threat for Turkmenistan? Radio Free Europe/Radio Liberty. Retrieved from https://www.rferl.org/a/qishloq-ovozi-turkmenistan-terror-threat-afghanistan-islamic-state/28653368.html

Pannier, B. (2021). Currency collapse mirrors Turkmenistan's extreme economic woes? Radio Free Europe/Radio Liberty. Retrieved from https://www.rferl.org/a/currency-collapse-turkmenistan-economic-woes/31193958.html

Pannier, B. (2022). First firefight: Turkmen, Taliban engage in border shoot-out. Gandhara, https://gandhara.rferl.org/a/turkmen-taliban-border-shoot-out/31640965.html#:~:text=The%20only%20incident%20along%20the,not%20part%20of%20the%20Taliban.

Rémy, G. (2018). TAPI gas pipeline: A strategic project contributing to peace and stability in Central and South Asia. Global Energy. Retrieved from http://cifalgroupe.com/images/Publications/TAPI%20gas%20pipeline%20by%20G.%20R%C3%A9my%2002.2018_GlobalEnergy.pdf

Radio Free Europe/Radio Lilberty. (2022). Turkmen border guards skirmish with Taliban. Retrieved from https://www.rferl.org/a/turkmenistan-border-guards-skirmish-taliban/31638582.html

Sarybayeva, A. (2019). What is the economy of Turkmenistan? *Money Market Factory.*

Shevchenko, M. (2011). Energy security of Turkmenistan as a factor for its international position strengthening; Science-information bulletin of Russian Academy of Science.

*Sputnik News*. (2021). Turkmenistan calls for compliance with international law on the division of the Caspian Sea bottom. Retrieved from https://az.sputniknews.ru/politics/20120705/297559616.html?mobile_return=yes

Stronski, P. (2017). Turkmenistan at twenty-five: The high price of authoritarianism. Carnegie Endowment for International Peace. Retrieved from https://carnegieendowment.org/2017/01/30/turkmenistan-at-twenty-five-high-price-of-authoritarianism-pub-67839

Timofeenko, L. (2010). Turkmenistan: Route diversification of energy resource export. *Russia and States of Eurasia Magazine.*

*Turkmenistan Today*. (2017). Peace-making potential of neutrality and preventive diplomacy: The initiatives of Turkmenistan in action. No.11.

United Nations Office for Disarmament Affairs. (n.d.). Disarmament Treaties Database: Turkmenistan. Retrieved from http://disarmament.un.org/treaties/s/turkmenistan

United Nations Secretary-General's Report. (2011). *Preventive diplomacy: Delivering results.*

United States Department of State. (2020). Country reports on human rights practices for 2020. Bureau of Democracy, Human Rights and Labor. Retrieved from https://www.state.gov/wp-content/uploads/2021/03/TURKMENISTAN-2020-HUMAN-RIGHTS-REPORT.pdf

Voluntary National Review of Turkmenistan. (2019). Empowering people and ensuring inclusiveness and equality. *UN Sustainable Development Goals.*

World Bank. (2019). GDP per capita growth (annual %) – Turkmenistan. Retrieved from https://data.worldbank.org/indicator/NY.GDP.PCAP.KD.ZG?locations=TM

Zukang, S. (2009). Statement by Mr. Sha Zukang, Under-Secretary-General for Economic and Social Affairs to the High-Level Conference on Reliable and Stable Transit of Energy and its Role in Ensuring Sustainable Development and International Cooperation. Ashgabat, Turkmenistan. United Nations Department of Social and Economic Affairs. Retrieved from https://www.un.org/development/desa/statements/uncategorized/2009/04/statement-to-the-high-level-conference-on-reliable-and-stable-transit-of-energy-and-its-role-in-ensuring-sustainable-development-and-international-cooperation.html

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