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Welfare Effects of Food Tariff Changes on Urban and Rural Households

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ABSTRACT

This study aims to analyze the effects of food tariff changes on the welfare of urban and rural households in Iran. The study considers the role of households as consumers, producers, and workers, as well as the market structure over the past fifteen years. Firstly, the study estimated the consumption behavior for the main food groups using the QUAIDS and pseudo-panel data. Then, the extent of tariff pass-through to domestic food prices was determined, and after that, price-wage elasticity and wage changes as a result of tariff changes were estimated. Finally, it calculated the effect of tariff changes on household purchasing power and income through an indirect utility function to get welfare effects. The results indicate that tariff pass-through to food prices is incomplete and varies between urban and rural areas. The study has found that skilled labor is more sensitive to food tariff reductions than unskilled labor, particularly in rural areas. The results reveal that tariff changes positively affect urban households' welfare, while rural households experience a loss due to these changes. Urban areas benefit from reduced household expenditure, while food prices are increasing in rural areas due to weak or absent tariff pass-through. Although these increases favor producers, they do not compensate for the loss consumers suffer, resulting in reduced welfare in rural areas. The findings show that the effects of tariff changes vary across regions, not only between urban and rural areas but also among different provinces. Furthermore, the tariff reductions have been a boon for consumers, but a bane for producers, ultimately harming production in the long term. The findings suggest that regional markets may be either sufficient or insufficient to convert pass-through-the-border prices into domestic prices. Therefore, policymakers can use this study as a useful guide to reform the regional market structure to raise household welfare, food security, and income inequality.

Keywords: Food Demand, Pseudo-Panel Data, Welfare effect, Wage, Tariff

1. Introduction

As the world's population grows, feeding everyone is becoming a significant concern for many governments. To address this challenge, countries increasingly seek to expand their trade relations internationally. This trend has been ongoing for the past two decades. The history of international trade theories and integration into the global economy dates back to Adam Smith's absolute advantage theory. In his book Wealth of Nations, Smith argued that a market's invisible hand, rather than government policy, determines what a country imports and exports. In 1817, David Ricardo criticized an idea Heckscher and Ohlin later challenged in 1919 and 1933. They introduced the theory of comparative advantage in international trade. According to classical theory, trade liberalization benefits everyone. Workers can quickly move from the competitive import sector to the expanding export sector, so there is no need to adjust wages for full employment. Samuelson & Stolper (1941) developed this theory based on Heckscher and Ohlin's theory. According to Samuelson and Stolper's theory, trade liberalization benefits the abundant factors and harms the scarce factors (Husted & Melvin 2012). Therefore, unskilled labor should benefit from trade liberalization in developing countries with a large amount of unskilled labor. It is worth noting that various economic theories are based on unrealistic assumptions, so their theoretical predictions only sometimes come true in real-world scenarios. For instance, Chao et al. (2019) discovered that tariff reductions can temporarily narrow the wage gap between skilled and unskilled labor. However, the long-term effect on wage inequality could be more favorable. Murakami (2021) also found that while effective tariff reductions may increase industry wages, they only benefit skilled workers, exacerbating wage inequality. Additionally, Dhamija (2023) demonstrated that trade openness does not necessarily decrease wage inequality in Indian rural areas and states. On the other hand, urban wage inequality is increasing due to trade openness. Hyun-Jung et al. (2024) revealed that at a low level of trade openness, an increase exacerbates income inequality, whereas at a high level, trade openness can contribute to decreased income inequality.

Trade liberalization has been a popular strategy for many developing countries in the last two decades. Economic theory suggests that it leads to an overall increase in the country's welfare. However, the effects of trade liberalization on the economy are still a topic of debate. Several studies (e.g., Cho & Diaz 2010; Taylor et al. 2010; Hossain 2011; Marchand 2019; Muñoz et al. 2020; Topuz & Dağdemir 2020; Sethi et al. (2021); Rosenfeld et al. (2024); Tabash et al. 2024) have investigated the effects of trade liberalization on developing countries and produced varying results, although the results were inconclusive. Rojas-Vallejos & Turnovsky (2017) examined 37 countries and found that reducing is likely to lead to greater income inequality in the long run. Shinyekwa et al. (2021), which focused on the East African Community (EAC) countries, found that the African Continental Free Trade Agreement had mixed effects. While all EAC countries experienced tariff revenue losses, the welfare effects varied among these countries, so Uganda and Burundi saw positive effects, while Kenya, Tanzania, and Rwanda saw negative effects. Naanwaab (2022) indicated that while trade liberalization leads to a decrease in income inequality, its effects depend on the direction of trade. Rosenfeld et al. (2024) demonstrated that with trade openness, economic simplification reduced income inequality in Latin American countries. Similarly, Tabash et al. (2024) observed this trend in 18 developing countries.

The distribution of social benefits is an important political issue that arises when it comes to improving general welfare. One of the main goals of economic policy is to enhance the welfare of low-income households. Nicita (2004; 2009) demonstrated that trade liberalization had benefited Mexico. Still, it has also contributed to inequality among regions, such as urban and rural areas, south and north, and skilled and unskilled workers. Recent debates on the impact of trade liberalization on welfare have highlighted the need to identify this policy's actual beneficiaries and losers. Marchand (2012) found that all households, regardless of their per capita expenditure, benefit from trade liberalization, and the effect of trade liberalization is generally pro-poor. Similarly, Silva & Krivonos (2021) in Peru found that while wages for poorly educated and well-educated workers declined due to openness to trade, self-employed workers were strongly affected. This resulted in unskilled workers benefiting the most from the trade liberalization.

It is essential to determine how tariff changes affect household welfare, considering that families play both the roles of consumers and producers. Therefore, it is necessary to investigate the potential channels through which policy changes may affect households. If the market can transmit price changes from the global markets to the consumer, tariff reductions will decrease domestic prices, increasing consumer welfare. However, market failure may lead to an incomplete pass-through. Whether households will benefit from trade liberalization depends on the structure and efficiency of the market where goods are produce13d and sold. In other words, the effect of tariff reduction on the economy depends on the amount of tariff reduction and the extent to which it is passed down to domestic prices. These shocks affect the entire economy by changing relative prices. Price changes are essential in reallocating resources, income distribution, and poverty. In Ghana, Mensah (2019) found that trade liberalization negatively affects rural farm households' income and consumption spending while it benefits urban non-farm households. Vo & Nguyen (2021) indicated that trade liberalization enhances Vietnamese household income and expenditure through either the export channel or increased labor demand. Tariff reduction for exported goods is less favorable to household welfare. Vellinga & Tanaka (2024) demonstrated that trade liberalization results in household welfare converging at a higher level in the long run rather than the short run. The impact of trade liberalization on household welfare has been extensively discussed in the literature by various scholars (e.g., Seshan 2014; Okodua 2014; Le 2014; Han et al. 2016; Bansah & Mohsin 2021; Vo & Nguyen 2021; Wang et al. 2024). Empirical studies have shown that the welfare effects of trade liberalization are influenced not only by tariff reductions but also by other factors such as household characteristics (e.g., size and expenditure patterns) and individual and market characteristics (e.g., price stability and labor market infrastructure) (Nicita 2004, 2009). Therefore, it is evident that the distribution effects of trade liberalization vary across countries and need to be analyzed on a case-by-case basis. Khan et al. (2021) suggested that trade liberalization can improve household income equality and benefit agriculture but may lead to a decline in urban and non-farm household income. Whereas, Murakami (2021) suggests that higher import competition resulting from decreases in output tariffs leads to skill enhancement within industries, consequently increasing the demand for skilled workers.

This study concentrates on the major commodities that comprise a household food basket, covering chapters 2-4, 7-8, 10-11, 15-17, and 19-21, categorized by the Tariff Harmonized System (HS) Codes. We classified these items into six groups: 1-cereal, 2-meat, 3-dairy, 4-oils and fats, 5-fruit, vegetables, and pulses, and 6- sugar. These categories are considered sub-sectors of the agriculture sector, as they are the main items of a household food basket. Therefore, this study will analyze the effects of tariff changes on these food groups to determine how much trade policy affects household welfare, especially changes in agriculture and food import tariffs. A household's choice of food is contingent on the proportion of income required to buy food. In developing countries, households spend much of their income on food. According to the 2022 Iranian household budget survey, the average annual gross expenditure for urban and rural households was 1.397 and 0.809 billion Rials. Food groups accounted for 26.9% and 40.6% of this expenditure. Food accounts for a significant portion of household expenditure in Iran's urban and rural areas. However, the percentage of food expenditure varies between different provinces. In urban households, food expenses range from 10% in Qom province to 41% in Kohgiluyeh and Boyer Ahmad provinces. In rural areas, it varies from 22% in Tehran to 59% in Sistan and Baluchistan province. This indicates that consumption patterns and food expenses differ across different regions of Iran. Considering that Iran is yet to become a member of the World Trade Organization (WTO) and has not implemented trade liberalization on a large scale, it is an ideal time to study the distribution effects, benefits, and costs of trade liberalization before expanding trade relations globally. Therefore, this study aims to examine the welfare effects of food tariff changes on urban and rural households in Iran. In this context, three hypotheses will be considered. First, reducing food tariffs is expected to lower domestic food prices in urban and rural areas. Second, alterations in food tariffs influence wages and income inequality. The third hypothesis posits that changes in food tariffs substantially affect the welfare of urban and rural households.

2. Material and Methods

2.1. Data collection

The required data for this study included a wide range of statistics that have been collected from various sources, such as Export and Import Regulations Yearbooks, Statistical Center of Iran, Central Bank of the Islamic Republic of Iran, Islamic Republic of Iran Customs Administration (IRICA), FAO and World Bank for the period of 2006-2020. This data has been gathered separately for all urban and rural areas. The household information data includes the raw data of the Statistics Center of Iran as "Household Expenditure and Income" survey data in the period of 2006-2020, which was collected for the urban and rural areas separately for 32 provinces of Iran. In this study, the Deaton (1985) method has been used to build the pseudo-panel data. This method is used because a time series of household survey data does not exist (for a given household over time). Deaton claims that it is possible to construct pseudo-panel data using repeated cross-sectional data (with entirely different instances) and estimators derived from similar panel data. In this way, each cohort is created from individuals who share some characteristics; then, observations are constructed from the mean of each cohort.

In 2022, the value of Iran's imports was equal to $5969 million, of which 24% ($14101 million) is related to the agriculture sector (IRICA 2022). Tariff changes for the six groups including: 1-cereal, 2-meat, 3-dairy, 4-oils and fats, 5-fruit, vegetables, and pulses, and 6- sugar are shown in Figure 1 during 2006-2020. As shown in Figure 1, tariffs for almost all groups decreased during these years, especially after 2016.

Figure 1- Tariff changes of selected food groups in Iran from 2006 to 2020. Source: Import and export regulations and annexed tables books (2006-2020), and the Islamic Republic of Iran Customs Administration (IRICA) (2020)

2.2. Methods

According to economic theory, changes in tariffs impact prices and wages. In this study, we analyze how households respond to changes in prices and income resulting from modifications in tariffs while also considering their heterogeneity. First, it is necessary to separate the effect of tariff changes on domestic prices from the impact of other policies, such as exchange rates. Then, we can calculate the changes in prices resulting from tariff changes. Next, we need to estimate an income equation to determine how changes in prices affect wages. Finally, we gather the effects of tariff changes on purchasing power and income in an indirect utility function to obtain the welfare effects. A household's indirect utility function can be expressed as follows:

$$u_h = V_h[y_h . P] \tag{1}$$

Household utility (u_h) is expressed as a function of the vector of prices (P), paid by households for goods and services, and household income (y_h). Change in a household's welfare can be obtained through approximation of a second-order Taylor series expansion as Equation 2.

$$\frac{du_h}{y_h} = \sum_s \theta_h^s dw_r^s + \sum_u \theta_h^u dw_r^u + \sum_g \theta_{hg}^x dp_{gr} - \sum_g \theta_{hg}^c dp_{gr} - \sum_g \eta_{hg}\theta_{hg}^c dp_h - \frac{1}{2}\left(\sum_g \varepsilon_g \theta_{hg}^c dp_{gr}^2 + \sum_g \sum_{k\neq g} 2\varepsilon_{hgk}\theta_{hg}^c dp_{gr} dp_{kr}\right) \tag{2}$$

Where; η_{hg} is expenditure elasticity, ε_g, own-price elasticity, ε_{hgk}, the cross-price elasticity of good *g* to good *k*, θ_h^s and θ_h^u, skilled and unskilled labor income share, θ_{hg}^x, the share of income from the sale of goods *g* by household *h*, θ_{hg}^c, expenditure share on good *g* by household *h*, and dw_r^s, dw_r^u, dp_{gr}, changes in skilled and unskilled wages and prices respectively (Nicita 2004; 2009).

Choosing an appropriate and flexible demand system is essential when estimating own-, cross-price, and expenditure elasticities. The Almost Ideal Demand System (AIDS) and the Quadratic Almost Ideal Demand System (QUAIDS) are the most commonly used demand systems in the literature, as they are consistent in modeling consumer behavior and flexible in representing consumer expenditure patterns. The QUAIDS is an extension of the AIDS model that includes a higher-order expenditure term to estimate the nonlinear Engel curve, but this does not necessarily make it superior to the AIDS model. Therefore, the Wald test is used to determine the most suitable functional form.

Following Poi (2012), Lopez et al. (2022), and Echeverría & Molina (2022) which investigated the effects of household characteristics on food demand, this study also utilizes the QUAIDS model to describe expenditure share and prices of the different food groups while taking into account social and regional characteristics of households as Equation 3:

$$w_{iht} = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_{jht} + (\beta_i + \acute{\eta}_i z) \ln\left[\frac{y_{ht}}{\bar{y}_0(z) f(p)}\right] + \frac{\lambda_i}{g(p)c(p.z)}\left\{\ln\left[\frac{y_{ht}}{\bar{y}_0(z) f(p)}\right]\right\}^2 \tag{3}$$

Where; w_{iht} and p_{jht} are expenditure share and price of good *i* in the household *h* in time *t*, y_{ht} is the expenditure of the goods in each household at time *t*, and $f(p)$, $g(p)$are price functions as $\log f(p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log p_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j\neq i}\gamma_{ij} \log p_i \log p_j$ and $\log g(p) = \beta_0 + \sum_{i=1}^{n} \beta_i \log p_i$. *z* is a vector of household characteristics variables, including household size, education of head of household, and age-gender ratio series. This ratio is made by dividing the number of people in each age category by the total number of households. For this purpose, individuals are divided by gender and three age groups: youth (0-14 years old), adults (15-64 years old), and elderly (over 65 years old); therefore, up to six variables determine the age-gender ratio series. Also, since the demand style differs across different regions, a region of residence's dummy variable is added to the model. $\bar{y}_0(z)$ represents an increase in household expenditure as a function of *z*, $c(p.z) = \prod_{j=1}^{n} p_j^{\acute{\eta}_j z}$, and α, β, γ, η, λ are parameters that should be estimated.

Uncompensated price elasticity of good *i* concerning changes in the price of good *j* (ε_{ij}) and expenditure elasticity for good *i* (μ_i) in the QUAIDS model with household characteristics variables are as Equations of 4 and 5.

$$\varepsilon_{ij} = -\delta_{ij} + \frac{1}{w_i}\left(\gamma_{ij} - \left[\beta_i + \acute{\eta}_i z + \frac{2\lambda_i}{g(p)c(p.z)} \ln\left\{\frac{y}{\bar{y}_0(z) f(p)}\right\}\right] \times (\alpha_j + \sum_i \gamma_{ji} \ln p_i) - \frac{(\beta_j + \acute{\eta}_j z)\lambda_i}{g(p)c(p.z)}\left(\left[\ln\left\{\frac{y}{\bar{y}_0(z) f(p)}\right\}\right]^2\right)\right) \tag{4}$$

$$\mu_i = 1 + \frac{1}{w_i}\left[\beta_i + \acute{\eta}_i z + \frac{2\lambda_i}{g(p)c(p.z)}\ln\left\{\frac{y}{\bar{y}_0(z)f(p)}\right\}\right] \quad (5)$$

Compensation price elasticities are calculated with the *Slutsky* equation as $\varepsilon_{ij}^{C} = \varepsilon_{ij} + \mu_i\omega_j$ (Poi 2012; Echeverría & Molina 2022).

2.3. Tariff Pass-through to prices

In general, the theory of tariff pass-through draws heavily from the extensive literature on exchange rate pass-through, which examines how changes in exchange rates affect the prices of imported goods. An incomplete exchange rate transfer means that the exporter will absorb some of the exchange rate changes as a markup for the final cost (Campa & Goldberg 2002). A tariff pass-through model identifies the extent to which observed price changes can be directly related to a change in tariff policy. Factors such as market imperfections and trade costs prevent the complete transmission of tariff changes to domestic prices.

Nicita (2009) extended the approach of Porto (2006) by adding a link from trade policy to domestic prices. To analyze the effect of tariff changes on prices, Nicita (2004; 2009) suggests that changes in the domestic price of imported goods are specified by multiplying tariff change by the imported reasonable price and adjusted by exporter markup changes. Based on this, the cost of trade is used to calculate the reception of border price changes by local markets as Equation 6:

$$\mathrm{P_{gtr}} = \mathrm{e_t PX^*_{gt}}(1+\tau_{\mathrm{gt}})\mathrm{TC_{gtr}} = \mathrm{e_t}(\phi_{\mathrm{gtr}}\mathrm{CP^*_{gt}})(1+\tau_{\mathrm{gt}})\mathrm{TC_{gtr}} \quad (6)$$

Where; P_{gtr} is the domestic price of imported good g in time t in region r, e_t, exchange rate, τ_{gt}, tariff, TC_{gtr}, trade costs, PX^*_{gt} , the global price that is equal to the cost of producing goods (CP^*_{gt}) multiplied by the markup $\phi_{\mathrm{gtr}} = \left(\frac{\mathrm{PD_{gtr}}}{\mathrm{CP^*_{gt}e_t(1+\tau_{gt})TC_{gtr}}}\right)^{\alpha}$, where PD_{gtr} is the price of imported competitive products in region r. Thus, we can rewrite the P_{gtr} as Equation 7:

$$\mathrm{P_{gtr}} = \left(\frac{\mathrm{PD_{gtr}}}{\mathrm{CP_{gt}}(1+\tau_{\mathrm{gt}})\mathrm{TC_{gtr}}}\right)^{\alpha}\mathrm{CP_{gt}}(1+\tau_{\mathrm{gt}})\mathrm{TC_r}\ , \quad 0 \le \alpha \le 1 \quad (7)$$

Where; α is a parameter that can be considered as the level of competition in the domestic market. By taking logarithms from Equation (7), Equation (8) is obtained.

$$\ln \mathrm{P_{gtr}} = \alpha \ln \mathrm{PD_{gtr}} + (1-\alpha)\ln \mathrm{CP_{gt}} + (1-\alpha)\ln(1+\tau_{\mathrm{gt}}) + (1-\alpha)\ln \mathrm{TC_{gtr}} \quad (8)$$

Where; $1-\alpha$ expresses the coefficient of pass-through; according to pass-through literature, Equation (8) can be written as Equation (9). This equation uses distance d as a measure of the cost of trade since it represents the shortest distance from the center of each region (e.g. province) and the border at which goods enter the nation.

$$\begin{aligned} Ln\,P_{gtr} &= \beta_0 + \beta_1 Ln\,X_{gt} + \beta_2 Ln\,Z_{gtr} + \beta_4 d_r + \gamma Ln(1+\tau_{tg}) + \gamma_1 Ln[(1+\tau_{tg})d_r] \\ &\quad + \gamma_2[Ln(1+\tau_{tg})d_r]^2 + \mu_r + \eta_t + \varepsilon_{gtr} \end{aligned} \quad (9)$$

Where; X_{gt}, as a proxy for CP_{gt}, is the control variable that involves the global commodity prices of good g in domestic currency, and Z_{gtr} as the proxy for competitive imported products price (PD_{gtr}). Z_{gtr} is the vector of control variables, including *i)* the local supply ($S_{gtr} = \frac{\sum_h P_{hrgt}}{\sum_h P_{hrt}}$), where is the production of good g at time t in region r in household h, *ii)* regional income ($RI_{tr} = \frac{\sum_h Y_{hrt}}{H_{rt}}$), where is household expenditures h in region r, at time t, H_{rt} is the number of households in region r at time t, and *iii)* the Producer Price Index (PPI) of agricultural production as the proxy for the producer inflation rate. μ_r and η_t represent region and time fixed effects respectively, $\varepsilon_{\mathrm{gtr}}$ is i.i.d error term. To control time-varying factors, the year fixed effects are included in the model for all regions, and regional fixed effects are included for regional price differences. Parameter $\gamma = 1-\alpha$ is pass-through elasticity, and γ_1 is adjusted for each region. If $\gamma = 1$, pass-through is complete, and pass-through is imperfect if $\gamma < 1$. $\gamma_1 = 0$ indicates that pass-through is the same in all regions and $\gamma_1 \neq 0$ when regional prices vary with tariff change.

Deaton's (1985) method and the pseudo-panel data were used to estimate Equation 9. Time series and repeated cross-sectional data (surveys given to different interviewees at different time points) were combined to create pseudo-panel data. Each cohort was made using individuals who share common characteristics, and then the average of each cohort was recorded. This method was used because time series household survey data do not exist. After estimating Equation (9), the percentage of price changes is calculated as follows:

$$dp = \frac{\hat{P}_{gt_1r} - \hat{P}_{gt_0r}}{\hat{P}_{gt_0r}} \tag{10}$$

Where; $\hat{P}_{gt_1r}$ is the predicted price for the last year, and $\hat{P}_{gt_0r}$ is the predicted price for the first year, which is captured from Equation (9).

2.4. Price-Wage elasticities

To calculate Equation (2), estimating the percentage of wage changes is necessary (dw_h). According to Nicita (2009), the income of each household can be illustrated by Equation (11).

$$\ln w_{ijt} = \sum_{grs} \theta^r \theta^s \ln p_{ij}^{gr} \beta_{ij}^{grs} + Z_{it}\gamma + H_{jt}\delta + \varepsilon_{ijt} \tag{11}$$

Where; w_{ijt} is observed wages for a person *i* in household *j* at time *t*, p_{ij}^{gr}, price of good *g* that person *i* must pay in household *j* in region *r*, Z_i, a vector of individual characteristics, H_j, a vector of household characteristics, $\theta^r$and θ^s are dummy variables for workers residence and skills, respectively, ε_{ijt}, the error term, and β_{ij}^{grs}. γ and δ are coefficients that must be estimated. The model also includes several control variables, like as age, years of education, labor gender, occupation status of household head, type of employment, and a regional dummy variable. The region variable controls for the influence of geographic regions (the dummy variable takes the value one if an individual is a resident of province *r* and zero otherwise). The model is estimated for all 18- to 65-year-olds who have declared their salary.

In Equation (11), the dependent variables are individual wages (and not average wages), and the prices may be endogenous to wages. So, after running an exogenous test, the instrumental variables are applied if the prices are endogenous. Additionally, all food groups are aggregated into a single group using their expenditure shares to reduce multi-collinearity. Finally, the percentage changes in wages (dw_h) are calculated by Equation (12):

$$dw_{hrt}^{s,u} = \sum_g \beta_{grt}^{s,u}\, dp_{ghrt} \tag{12}$$

Where; β_g is price-wage elasticity for good g, and dp_{gh} is the percentage change in prices that households must pay.

3. Results and Dissection

3.1. Estimation of price and expenditure elasticities

To choose a proper demand system from among the AIDS and QUAIDS, the Wald test was conducted. The chi-square statistics were calculated for urban and rural household demands, resulting in 608.84 and 63.79, respectively, which were significant at 1% probability. Therefore, the QUAIDS model was chosen as the appropriate model, and Equation (3) was estimated for six food groups by resolving heteroskedasticity separately for both urban and rural areas. The results of estimating the QUAIDS model are presented in Appendix Table A. Table 1 shows urban and rural areas' price and expenditure demand elasticities.

Table 1- Estimating expenditure, uncompensated and compensated price elasticity for urban and rural areas

	Cereal		*Meat*		*Dairy*		*Oils and Fats*		*Fruit, Veg.& Pulses*		*Sugar*	
	Urban	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*
Expenditure Elasticity	0.8 (0.09)	0.76 (0.11)	1.2 (0.10)	1.17 (0.05)	0.93 (0.03)	0.86 (0.12)	1.04 (0.01)	1.22 (0.25)	1.01 (0.00)	0.98 (0.16)	1.07 (0.04)	1.54 (0.39)
Uncompensated price elasticity												
Cereal	-0.71 (0.02)	-0.87 (0.01)	-0.20 (0.02)	0.05 (0.01)	0.05 (0.00)	-0.003 (0.00)	0.006- (0.00)	0.02 (0.00)	0.02 (0.01)	0.00 (0.01)	-0.006 (0.00)	0.01 (0.00)
Meat	-0.29 (0.02)	-0.05 (0.01)	-0.75 (0.03)	-1.02 (0.04)	0.01 (0.01)	0.11 (0.02)	0.008 (0.01)	-0.07 (0.02)	-0.11 (0.02)	-0.17 (0.03)	-0.02 (0.01)	0.004 (0.02)
Dairy	0.09 (0.02)	-0.004 (0.01)	0.09 (0.03)	0.31 (0.04)	-1.04 (0.04)	-1.04 (0.05)	0.005 (0.01)	0.06 (0.03)	0.01 (0.03)	-0.04 (0.05)	-0.10 (0.02)	-0.10 (0.02)
Oils and Fats	-0.07 (0.03)	-0.05 (0.02)	0.06 (0.47)	-0.30 (0.08)	0.0002 (0.03)	0.07 (0.06)	-0.93 (0.03)	-0.57 (0.09)	-0.10 (0.04)	-0.37 (0.08)	0.01 (0.02)	-0.09 (0.06)
Fruit, Veg. and Pulses	-0.01 (0.01)	-0.03 (0.01)	-0.7 (0.02)	-0.10 (0.03)	-0.001 (0.01)	-0.03 (0.02)	-0.02 (0.00)	-0.07 (0.01)	-0.92 (0.02)	-0.60 (0.04)	0.02 (0.01)	-0.07 (0.01)
Sugar	-0.09 (0.03)	-0.16 (0.02)	-0.09 (0.05)	-0.07 (0.10)	-0.27 (0.06)	-0.32 (0.06)	0.01 (0.02)	-0.12 (0.06)	0.12 (0.06)	-0.5 (0.09)	-0.73 (0.07)	-0.41 (0.10)
Compensated price elasticity												
Cereal	-0.49 (0.02)	-0.66 (0.021)	0.006 (0.02)	0.24 (0.01)	0.16 (0.01)	0.09 (0.00)	0.03 (0.00)	0.07 (0.00)	0.25 (0.01)	0.19 (0.01)	0.03 (0.00)	0.05 (0.00)
Meat	0.006 (0.02)	0.27 (0.01)	-0.46 (0.03)	-0.74 (0.03)	0.16 (0.01)	0.27 (0.02)	0.07 (0.01)	0.00 (0.02)	0.19 (0.02)	0.12 (0.03)	0.03 (0.01)	0.07 (0.02)
Dairy	0.33 (0.02)	0.21 (0.01)	0.32 (0.03)	0.50 (0.03)	-0.92 (0.05)	-0.94 (0.05)	0.05 (0.01)	0.11 (0.03)	0.26 (0.03)	0.15 (0.04)	-0.06 (0.02)	-0.05 (0.02)
Oils and Fats	0.18 (0.02)	0.31 (0.02)	0.32 (0.04)	0.004 (0.07)	0.12 (0.03)	0.24 (0.06)	-0.87 (0.03)	-0.49 (0.09)	0.17 (0.04)	-0.05 (0.08)	0.06 (0.02)	-0.01 (0.06)
Fruit, Veg. and Pulses	0.24 (0.01)	0.22 (0.01)	0.17 (0.02)	0.11 (0.03)	0.12 (0.01)	0.08 (0.02)	0.03 (0.00)	-0.01 (0.02)	-0.65 (0.02)	-0.37 (0.04)	0.07 (0.01)	-0.02 (0.02)
Sugar	0.18 (0.03)	0.27 (0.02)	0.17 (0.05)	0.30 (0.09)	-0.14 (0.06)	-0.12 (0.06)	0.07 (0.02)	-0.02 (0.06)	0.40 (0.06)	-0.10 (0.08)	-0.68 (0.07)	-0.32 (0.10)

*, **, and ***; indicate significant at 10%, 5%, and 1%, respectively. The amount in parentheses is a standard error.

The findings indicate that meat, oils and fats, fruits, vegetables, pulses, and sugar are luxury goods in urban areas. In contrast, meat, oils and fats, and sugar are luxury goods in rural areas. Moreover, based on expenditure elasticity, cereal and dairy are considered luxury goods in urban areas, while cereal, dairy, fruits, vegetables and pulses are considered luxury goods in rural areas. The own-price demand elasticities in urban and rural areas [in Table 1] were negative, which aligns with economic theory. Interestingly, there were differences in consumer behavior between urban and rural areas, as evidenced by the comparison of cross-price demand elasticity. As expected, the signs of compensated own-price demand elasticity were negative for rural and urban areas for all food groups. According to the Slutsky equation, the difference between compensated and uncompensated price elasticity for each group was equal to expenditure elasticity.

3.2. Estimation of tariff pass-through

To estimate Equation (9), we need to first determine the distance *d*. It is worth noting that in Iran, the ports that have imported the highest volume of food items are *Imam Khomeini Port, Amir Abad Port, Martyr Rajai Customs, Lengeh Port, Noshahr Port, Bushehr Port, Mashhad, and Martyr Bahonar* Customs. These ports are shown on Iran's map in Figure 2.

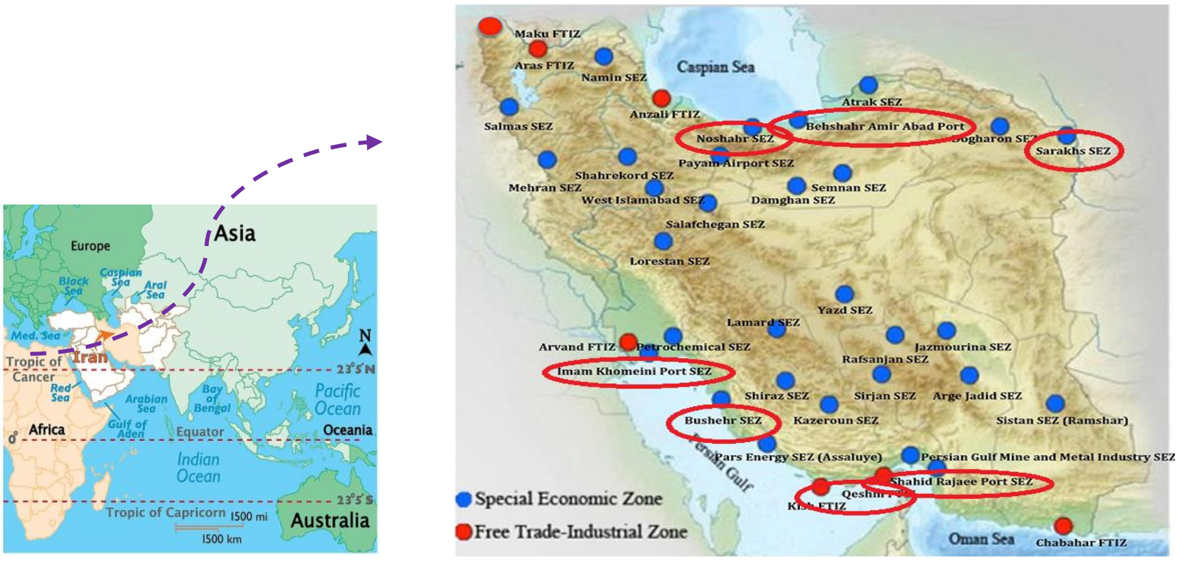

Figure 2- List of Free Trade Zones (FTIZ), Special Economic Zones (SEZ), and Main Port in Iran

The distance between each provincial center and the nearest main port was calculated, considering that the main ports of entry and customs are located across different borders (north, south, southwest, and east regions). Table 2 presents the result of the tariff pass-through model for six food categories in urban and rural areas. The GLS method was used to remove heteroscedasticity. According to economic theory, the tariff coefficient (γ) is expected to be positive, and the tariff-distance coefficient (γ_1) is expected to be negative. In urban areas, the coefficient for cereals at the border was 2.5%. Additionally, the tariff-distance coefficient for cereal was 0.032, which had the expected sign. This coefficient shows that tariff changes do not affect cereal prices at around 781 km from the nearest port ($\frac{0.025}{0.032} \times 1000$). The tariff pass-through coefficients for meat, dairy, oils and fats, fruit, vegetables, and pulses, and sugar were 9.1%, 13.1%, 16.2%, 19.2%, and 12.1%, respectively. As the borders and ports become more remote, the extension of tariff pass-through on prices for cereal, meat, fruit, vegetables, and pulses has been eased. The road tariff pass-through is negligible in urban areas, with coefficients ranging from 9.1% to 19.2%. Low values of these coefficients indicate that consumers do not benefit much from tariff changes.

As mentioned in Table 2, the tariff pass-through coefficients for these food groups range from 9.1 to 19.1% in urban areas, indicating that consumers do not benefit much from tariff changes. Moreover, increasing distances to borders and ports reduces the extent of tariff pass-through to prices. The control variables have the expected sign and the domestic prices of cereals, dairy, oils and fats, fruits, vegetables, and pulse, and sugar positively and significantly affected through their world prices in urban areas. Thus, these findings validate our initial hypothesis that reducing food tariffs results in decreased domestic food prices in urban and rural areas, which aligns with Nicita (2004; 2009), Marchand (2019), Mogendi et al. (2023), and Wang et al. (2024) findings. Additionally, the agricultural producer price index (PPI) positively and significantly impacts the prices of cereals, meat, oils and fats, fruits, vegetables, and pulses, and sugar groups. However, only oil and fats prices decreased by raising the local supply. The effects of regional income control variables indicated that in urban areas, the price of cereals, dairy products, oils and fats, and sugar decreased by 18%, 9.4%, 8.7%, and 5.1%, respectively, with a one percent increase in the regional income. Meanwhile, the prices of meat, and fruit, vegetables, and pulses increased by 3.8% and 1.7%, respectively.

The findings of tariff transfer in rural areas are presented in Table 2, with the values of tariff pass-through coefficients having the expected sign in all cases. The coefficients for meat, dairy products, fruits, vegetables, and pulses were negligible. The coefficient of the variable tariff distance in rural areas did not differ across regions, which is consistent with Nicita's (2004; 2009) findings, which noted insignificant regional differences for agricultural products in all Mexican states.

Table 2- Estimating tariff pass-through to food prices in urban and rural areas

Variables \ Product	Cereal	Meat	Dairy	Oils & fats	Fruit, veg., and pulses	Sugar
Urban Areas						
World price	0.212*** (0.038)	0.012 (0.019)	0.190*** (0.023)	1.78*** (0.068)	0.089** (0.038)	0.097*** (0.032)
PPI	0.263*** (0.029)	0.087** (0.038)	0.018 (0.012)	0.475*** (0.058)	0.027 (0.019)	0.042* (0.023)
Local supply	0.023 (0.016)	0.046 (0.031)	-0.0018 (0.005)	-0.087*** (0.019)	0.008 (0.006)	-0.024 (0.015)
Regional income	-0.18*** (.027)	0.038 (.019)	-0.094*** (.013)	0.087** (.041)	0.017 (.015)	-0.051*** (0.021)
Tariff	0.025** (0.012)	0.091*** (0.011)	0.131*** (0.018)	0.162** (0.065)	0.192*** (0.013)	0.121*** (0.032)
Tariff × Distance	-0.032** (0.013)	-0.067*** (0.018)	-0.032 (0.024)	-0.008 (0.025)	-0.039*** (0.013)	-0.032 (0.022)
$(\text{Tariff} \times \text{Distance})^2$	1.15e-06 (0.00)	-8.70e-06*** (0.00)	7.31e-06 (0.00)	-3.91e-05* (0.00)	1.64e-05*** (0.00)	2.32e-07 (0.00)
Constant	6.15*** (0.621)	6.45*** (0.472)	4.86*** (0.321)	-7.51*** (0.922)	3.94*** (0.382)	4.73*** (0.421)
Rural Areas						
World price	0.125 (0.122)	0.011 (0.121)	0.321*** (0.091)	0.322*** (0.113)	-0.128 (0.087)	0.065* (0.031)
PPI	0.287*** (0.052)	0.253*** (0.039)	-0.087 (0.069)	0.102*** (0.029)	0.103*** (0.019)	0.052* (0.028)
Local supply	0.022** (.011)	-0.002 (.004)	-0.008 (.006)	0.061 (.042)	0.007 (.004)	0.019 (0.011)
Regional income	-0.214*** (0.059)	0.087** (0.032)	-0.079** (0.031)	0.061** (0.032)	0.018 (0.028)	-0.017 (0.025)
Tariff	0.069*** (0.026)	-0.048 (-0.034)	0.211 (0.117)	0.350*** (0.065)	0.018 (0.014)	0.186*** (0.073)
Tariff × Distance	-0.022 (0.031)	0.007 (0.023)	-0.041 (0.029)	-0.008 (0.031)	-0.063*** (0.017)	0.021 (0.036)
$(\text{Tariff} \times \text{Distance})^2$	6.15e-06 (0.00)	3.20e-07 (0.00)	-5.41e-06 (0.00)	-3.11e-05 (0.00)	-7.31e-06 (0.00)	-2.52e-05 (0.00)
Constant	6.69*** (1.24)	5.45*** (0.85)	5.22*** (0.71)	5.98*** (0.81)	5.38*** (0.51)	5.16*** (0.55)

*, **, and ***; indicate the significant at 10%, 5%, and 1%, respectively. The amount in parentheses is a standard error. PPI is the Producer Price Index (PPI) of agricultural production

3.3. Estimation of price-wage elasticities

The homogeneity of the explanatory variables was first tested to assess the impact of tariffs on wages and estimate the price-wage elasticity. Hayashi's C-statistic (2000) was used to reject the null hypothesis of price exogeneity at a 1% probability. To control for endogeneity, Equation (11) was estimated using two lags of the price variables as instrumental variables. The estimation results are presented in Table 3 using two methods: OLS and instrumental variable (IV). The provinces were aggregated into five regions based on the general extent and neighborhoods, which reduced the number of regional dummy variables. The coefficients of the control variable were significant in urban and rural areas and were as expected. Wages increased with age and education, and in both rural and urban areas, male heads of households generally earned more than their female counterparts. The employment management variables of the economy sectors (services, agriculture, industry, transportation) differed slightly between urban and rural areas. Agriculture offered the lowest wages for both urban and rural areas, while transportation and industry provided the highest wages in urban regions. This is because there is little or no development of industry and services in rural areas, and transportation costs are high. It is not surprising that the transportation sector pays high wages.

As mentioned in Table 3, estimates of the impact of food prices on wages have shown a significant and positive relationship between food prices and wages in urban and rural areas. Consequently, these findings confirm the study's second hypothesis that changes in food tariffs affect wages. It is important to consider the potential implications of this relationship, such as the impact on income inequality and the ability of individuals to afford necessities. Policymakers may need to take this relationship into account when considering measures to address rising food prices or to ensure fair wages for all workers. Further research could also delve into the specific mechanisms driving this relationship and how it may vary across different regions and sectors of the economy. This is consistent with the findings of Nicita (2004; 2009), Cherkaoui et al. (2011), Kareem (2014), Rasool & Tarique

(2018), Anwar & Guha (2023), Dix-Carneiro & Traiberman (2023), and Vellinga & Tanaka (2024). Furthermore, it was observed that skilled workers had a more significant impact on price trends than unskilled workers. The effect of wages on price trends was significant in all five urban and rural areas and varied across regions. This contradicts Nicita's (2004; 2009) findings but aligns with Kareem's (2014) and Hassan & Kornher's (2022) results. Hassan & Kornher (2022) found that in the long run, the impact of food prices on changes in rural wages has decreased, while the impact of urban wages has increased in some regions.

Table 3- Estimating price-wages elasticity in urban and rural areas

Variables	***Urban***		***Rural***	
	Wage regression (OLS)	*Wage regression (IV)*	*Wage regression (OLS)*	*Wage regression (IV)*
Food price- skilled labor in region 1	0.322*** (0.009)	0.432*** (0.024)	0.354*** (0.008)	0.357*** (0.041)
Food price- skilled labor in region 2	0.324*** (0.008)	0.437*** (0.028)	0.321*** (0.007)	0.391*** (0.036)
Food price- skilled labor in region 3	0.365*** (0.009)	0.439*** (0.027)	0.271*** (0.011)	0.343*** (0.029)
Food price- skilled labor in region 4	0.322*** (0.012)	0.423*** (0.023)	0.248*** (0.011)	0.436*** (0.032)
Food price- skilled labor in region 5	0.347*** (0.012)	0.4332*** (0.029)	0.245*** (0.011)	0.383*** (0.033)
Food price-unskilled labor in region 1	0.321*** (0.009)	0.363*** (0.03)	0.201*** (0.011)	0.341*** (0.029)
Food price-unskilled labor in Region 2	0.289 *** (0.008)	0.375*** (0.028)	0.234*** (0.009)	0.345*** (0.029)
Food price- unskilled labor in Region 3	0.263*** (0.008)	0.354*** (0.028)	0.214*** (0.006)	0.354*** (0.027)
Food price- unskilled labor in Region 4	0.278*** (0.011)	0.375*** (0.029)	0.232*** (0.008)	0.326*** (0.028)
Food price- unskilled labor in Region 5	0.281 *** (0.008)	0.375*** (0.023)	0.199*** (0.006)	0.326*** (0.027)
Age	0.647*** (0.009)	0.631*** (0.014)	0.434*** (0.010)	0.421*** (0.017)
Years of education	0.152*** (0.004)	0.121*** (0.027)	0.123*** (0.004)	0.081*** (0.019)
Gender	0.017* (0.009)	0.027* (0.013)	0.298*** (0.011)	0.332*** (0.014)
Household head	0.205*** (0.005)	0.191*** (0.008)	0.097*** (0.008)	0.098*** (0.008)
Services	0.123*** (0.025)	0.123*** (0.026)	0.131*** (0.015)	0.121*** (0.017)
Manufacturing	0.123 *** (0.024)	0.118*** (0.027)	0.175*** (0.017)	0.161*** (0.019)
Transport	0.103*** (0.019)	0.096*** (0.022)	0.201*** (0.014)	0.211*** (0.012)
Constant	0.923*** (0.071)	0.492*** (0.172)	1.92*** (0.056)	1.42*** (0.013)
R^2	0.681	0. 76	0. 65	0. 51
Statistics C	22.14***		35.32***	
	Shea partial adjusted R^2			
Food price lag- skilled labor in region 1	0.078		0.059	
Food price lag- skilled labor in region 2	0.073		0.063	
Food price lag- skilled labor in region 3	0.071		0.060	
Food price lag- skilled labor in region 4	0.072		0.067	
Food price lag- skilled labor in region 5	0.076		0.062	
Food price lag- unskilled labor in Region 1	0.068		0.081	
Food price lag- unskilled labor in region 2	0.075		0.085	
Food price lag- unskilled labor in region 3	0.071		0.084	
Food price lag- unskilled labor in region 4	0.069		0.083	
Food price lag- unskilled labor in region 5	0.070		0.082	

*, **, and *** indicate the significance at 10%, 5%, and 1% respectively, and the amount in parentheses is a standard error.

3.4. Estimation of welfare effects of tariff changes

Table 4 provides the results of estimating tariff changes on household welfare in urban and rural areas. The second column represents the average percentage of total effect from a second-order Taylor series expansion approximation concerning price and expenditure elasticity, and the third column indicates the average percentage of total effect from a first-order Taylor series expansion approximation. These tables provide details of the welfare effects of tariff changes for each province. Additionally, Figure 3 displays a map of Iran that describes the boundaries of the areas with their respective capitals.

Table 4- Welfare Effects of food tariff changes in urban and rural areas

									Consumption Expenditure							
									Price effects				*Income effects*			
Province	*Welfare effect (second-order Taylor series expansion approximation)*		*Welfare effect (first-order Taylor series expansion)*		*Impact of tariff changes on labor income* $\sum_{s,u} \theta_h^{s,u}\, dw_r^{u,s}$		*Effect of tariff changes on agricultural income* $\sum_g \theta_{hg}^x\, dp_{gr}$		*Effects of tariff changes on consumption expenditures* $-\sum_g \theta_{hg}^c\, dp_{gr}$		*Price effect of consumption expenditures* $-\frac{1}{2}\sum_g \varepsilon_g \theta_{hg}^c dp_{gr}^2$		*Cross price effect on consumption expenditures* $-\frac{1}{2}\sum_g \sum_{k\neq g} 2\varepsilon_{gk}\theta_{hg}^c dp_{gr} dp_{kr}$		*Income effects* $-\sum_g \eta_{hg}\theta_{hg}^c dp_{gr}$	
	Urban	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*
***Region** 1*	**1.9**	**-1.1**	**1.6**	**-0.5**	**-0.1**	**0.2**	**-0.3**	**0.3**	**1.9**	**-0.9**	**0.1**	**0.0**	**0.0**	**0.0**	**1.6**	**-0.7**
Tehran	3.2	0.1	0.2	-0.2	-0.1	-0.4	-0.4	0.0	1.9	0.3	0.1	0.0	0.0	0.0	1.7	0.3
Qazvin	5.9	-1.6	1.5	-0.5	-0.2	0.5	0.0	0.4	3.2	-1.5	0.1	0.0	0.0	0.0	2.8	-1.1
Mazandaran	0.9	-1.3	1.8	-0.3	0.0	0.5	-0.7	0.5	0.9	-1.3	0.0	0.0	0.0	0.0	0.6	-1.0
Semnan	2.4	-1.3	1.2	-0.6	-0.1	0.2	-0.5	0.1	1.7	-0.9	0.1	0.0	0.0	0.0	1.2	-0.7
Golestan	3.6	-1.9	3.0	-0.7	-0.2	0.5	-0.1	0.4	2.1	-1.6	0.1	0.0	0.0	0.0	1.7	-1.2
Qom	3.1	-0.8	1.8	-0.4	0.0	0.0	0.0	0.1	1.8	-0.6	0.1	0.0	0.0	0.0	1.3	-0.4
Region 2	**2.6**	**-2.1**	**1.3**	**-0.8**	**0.0**	**0.5**	**-0.2**	**0.4**	**1.5**	**-1.7**	**0.1**	**0.1**	**0.0**	**0.0**	**1.2**	**-1.3**
Esfahan	1.9	-1.8	1.1	-0.5	0.3	0.7	-0.4	0.8	1.2	-1.9	0.1	0.1	0.0	0.0	0.8	-1.4
Fars	2.6	-2.3	1.3	-0.6	0.0	1.1	-0.4	0.6	1.6	-2.3	0.1	0.1	0.0	0.0	1.3	-1.8
Bushehr	5.0	-1.6	2.6	-0.7	-0.3	0.3	0.0	0.2	2.9	-1.2	0.1	0.0	0.0	0.0	2.3	-0.9
Chaharmahal and Bakhtiari	1.7	-2.0	1.0	-0.8	0.2	0.5	-0.2	0.4	1.1	-1.7	0.1	0.1	0.0	0.0.	0.6	-1.3
Hormozgan	2.1	-3.2	1.1	-1.7	0.1	0.3	-0.1	0.2	1.2	-2.2	0.0	0.1	0.0	0.0	1.0	-1.6
Kohgiloyeh and Boyerahmad	2.2	-1.4	1.0	-0.7	0.1	0.2	-0.3	0.1	1.3	-1.0	0.0	0.0	0.0	0.0	1.1	-0.7
Region 3	**2.6**	**-1.4**	**1.3**	**-0.5**	**0.0**	**0.5**	**-0.5**	**0.4**	**1.4**	**-1.3**	**0.1**	**0.0**	**0.0**	**0.0**	**1.3**	**-1.0**
East Azarbaijan	2.5	-0.9	1.4	-0.4	0.1	0.2	-0.2	0.1	1.4	-0.8	0.1	0.0	0.0	0.0	1.1	-0.5
West Azerbaijan	3.8	-1.5	2.1	-0.4	0.2	0.7	-0.4	0.3	2.4	-1.5	0.2	0.0	-0.1	0.0	1.6	-1.1
Ardabil	1.7	-1.8	0.7	-0.3	0.0	0.9	-0.6	0.7	1.2	-1.9	0.1	0.1	0.0	0.0	1.0	-1.5
Zanjan	2.2	-1.7	1.0	-0.7	0.0	0.2	-0.4	0.4	1.5	-1.3	0.1	0.0	0.0	0.0	1.1	-1.0
Gilan	4.3	-0.5	1.7	0.0	-0.3	0.2	-1.1	0.4	3.1	-0.6	0.2	0.0	-0.1	0.0	2.5	-0.5
Kurdistan	1.4	-2.3	0.7	-1.0	0.1	0.5	-0.4	0.4	1.1	-1.9	0.1	0.1	0.0	0.0	0.6	-1.4
Region 4	**0.9**	**-1.4**	**0.5**	**-0.5**	**0.2**	**0.5**	**-0.4**	**0.4**	**0.7**	**-1.3**	**0.1**	**0.0**	**0.0**	**0.0**	**0.3**	**-1.0**
Kermanshah	1.0	-1.2	0.7	-0.4	0.2	0.4	-0.3	0.3	0.8	-1.2	0.1	0.0	-0.1	0.0	0.2	-0.8
Ilam	0.7	-1.5	0.6	-0.3	0.7	0.8	-0.7	0.4	0.6	-1.5	0.1	0.0	0.0	0.0	0.0	-1.2
Lorestan	0.9	-2.0	0.3	-0.7	0.1	0.6	-0.7	0.5	0.9	-1.8	0.1	0.0	0.0	0.0	0.5	-1.4
Hamedan	1.3	-2.0	0.7	-0.8	0.1	0.4	-0.3	0.5	0.9	-1.7	0.1	0.0	0.0	0.0	0.6	-1.2
Markazi	0.0	-0.5	-0.1	-0.2	0.0	0.1	0.0	0.1	-0.1	-0.5	0.0	0.0	0.0	0.0	0.1	-0.3
Khuzestan	1.3	-1.4	0.8	-0.4	0.1	0.5	-0.2	0.3	0.9	-1.3	0.1	0.0	0.0	0.0	0.4	-1.0
Region 5	**1.4**	**-1.7**	**0.8**	**-0.7**	**0.1**	**0.4**	**-0.5**	**0.3**	**1.1**	**-1.4**	**0.1**	**0.0**	**0.0**	**0.0**	**0.6**	**-1.1**
Razavi Khorasan	2.7	-1.6	1.2	-0.5	-0.2	0.6	-0.3	0.4	1.7	-1.5	0.1	0.0	0.0	0.0	1.4	-1.1
South Khorasan	1.5	-1.3	0.6	-0.6	0.0	0.2	-0.9	0.2	1.4	-1.0	0.1	0.0	0.0	0.0	0.9	-0.7
North Khorasan	2.5	-1.2	1.2	-0.5	0.0	0.2	-0.7	0.2	1.8	-0.9	0.1	0.0	-0.1	0.0	1.2	-0.7
Kerman	0.6	-2.6	0.5	-1.1	0.2	0.4	-0.1	0.7	0.5	-2.2	0.1	0.1	0.0	0.0	0.1	-1.6
Yazd	0.7	-0.9	0.6	-0.1	0.5	0.6	-0.8	0.3	0.9	-1.0	0.1	0.0	-0.1	0.0	0.1	-0.8
Sistan and Baluchestan	0.5	-2.7	0.5	-1.3	0.3	0.5	-0.1	0.3	0.4	-2.1	0.1	0.1	0.0	0.0	0.0	-1.5
All urban and rural areas	**2.1**	**-1.6**	**1.1**	**-0.6**	**0.1**	**0.4**	**-0.4**	**0.3**	**1.4**	**-1.3**	**0.1**	**0.0**	**0.0**	**0.0**	**1.0**	**-1.0**

Figure 3- Iran's Political Map with the international boundaries, provinces boundaries, and their capital

Tariff changes in urban areas led to a rise in household welfare in nearly all provinces, except for *Markazi* province, which did not experience any welfare benefits from these changes. However, the distribution of these benefits varied across different provinces. In urban areas, the food tariff changes benefitted consumers across the country (by 2.5%) and were complemented by minimal wage income benefits (0.1%), which compensated for the losses incurred by producers (-0.4%) and contributed to an overall welfare increase of 1.2%. Furthermore, the provinces of *Qazvin*, *Bushehr*, *Gilan, West Azerbaijan, Golestan, Tehran, and Qom* benefited the most from the recent tariff changes. These changes increased these provinces' real incomes by 5.9%, 5.0%, 4.3%, 3.8%, 3.6%, 3.2%, and 3.1%, respectively. These findings confirm our third hypothesis that increasing food tariffs has a significant impact on the welfare of both urban and rural households. The confirmation of this hypothesis highlights the critical implications of food price increases on the overall welfare of households, both in urban and rural settings. This suggests that changes in food tariffs can directly affect the purchasing power and standard of living of individuals and families in these areas. It underscores the importance of understanding and addressing the impact of food price fluctuations on household welfare through targeted policies and interventions. These findings emphasize the need for strategies to mitigate the potentially negative effects of rising food prices on vulnerable populations and ensure equitable access to affordable and nutritious food for all. However, the provinces of *Lorestan, Mazandaran, Yazd, Ilam, Kerman, Sistan and Baluchestan*, and *Markazi* experienced the lowest benefits. This can be attributed to the fact that agricultural producers in these provinces tend to incur more losses than others. The other areas experienced an average level of profit. This result is in line with the findings of Ghosh et al. (2023), which showed that trade gains depend significantly on regional structural transformation.

Households in rural areas across the country have experienced a decrease in welfare by 1.6% due to changes in tariffs. Despite the benefits of agricultural income and wage gains, which increased by 0.7%, they were not enough to compensate for the losses suffered by consumers, which amounted to 2.3%. This means that rural households in the country have lost out due to changes in food tariffs. All provinces have been affected except for Tehran, which only experienced a 0.1% loss. The highest income reductions, exceeding 3%, were observed in the provinces of *Hormozgan*, and *Sistan and Baluchestan*, while the provinces of *Kerman, Kurdistan*, and *Fars* experienced income reductions of over 2%. Changes in the consumer channel mainly caused these losses. In most provinces of the country, including *Chaharmahal and Bakhtiari, Lorestan, Hamedan, Golestan, Isfahan, Ardabil, Zanjan, Razavi Khorasan, Qazvin, Bushehr, West Azarbaijan, Ilam, Kohgiluyeh and Boyer-Ahmad, Khuzestan, South Khorasan, Mazandaran, Semnan, Kermanshah, and North Khorasan*, losses between -2 and -1 percent were experienced. However, in other provinces, losses were less than one percent. This indicates that the impact of trade policies is not uniform across the regions. The results obtained from the first and second-order approximation of Taylor's expansion indicated that losses and benefits achieved in the first-order expansion were less than in the second-order approximation. The first-order approximation fails to account for the behavioral reactions to product substitutes, leading to biased results. The results align with the Wang et al. (2024) findings that trade liberalization in consumer goods has enhanced the consumption welfare of urban Chinese households across regions.

4. Conclusions

The results of this study shed light on the effects of food tariff changes on urban and rural households' welfare in Iran. The model used in this study is a comprehensive one that examines welfare effects at the microdata level. The finding indicates that tariff pass-through for prices of different food groups in urban and rural range from 9.1 to 19.1% and 4.8 to 35%, respectively. These findings indicate that firstly, in rural areas, prices increase due to weak or lack of tariff pass-through. Secondly, these levels of tariff pass-through are a little smaller than what is found in other countries, which depends on the conditions of Iran's economy and international trade policies. Consequently, the consumers do not benefit much from tariff changes. Meanwhile, increasing distances to borders and ports reduces the extent of tariff pass-through to prices. Provinces located near ports and customs benefit more in urban areas than those located farther away. Regions in the east, southeast, and central provinces, experience a reduction in welfare with increasing distance from major ports. The most significant losses in rural areas have been in the south and southeast regions of the country. This difference in results depends on multiple factors such as household characteristics, trade cost, consumption pattern, the structure of the local market, the way that trade policy transfers to prices, producers or consumers of agricultural products, the way that wages change, households' utilization of labor, and partly the difference between skilled and unskilled labor.

The findings on the welfare effects demonstrated that the tariff reduction had a net positive impact on the welfare of urban households, while it was detrimental to rural households. At the national level and in urban areas, the households' benefits from the reduced tariffs on food groups exceeded their losses, generally increasing the welfare of urban households. However, in rural areas, the benefits from rising agricultural income and wages could not compensate for the losses incurred by rural consumers, resulting in a decrease in the welfare of rural households. Consequently, the tariff reduction policy benefited urban residents, but negatively impacted rural households due to the limited tariff pass-through. In urban areas, the benefits are predominantly derived from the consumption of goods, while in rural areas, they are primarily generated through the income of labor and farmers. The weak or lack of tariff reductions pass-through to food prices in rural areas has led to a certain increase in prices. Consequently, consumers in these areas have suffered, but these changes have benefited producers and labor. Compared to rural areas, the impact of wages and producers' income in urban areas has been declining in most provinces. In other words, in rural areas, the reduction in tariff rates has been more advantageous for producers and labor, but detrimental to rural consumers. In urban areas, it has been more beneficial for consumers but detrimental to producers and labor. Hence the producers in urban areas have been more affected by the reduction in tariff rates. This is due to the higher pass-through of tariff reductions to prices in urban areas compared to rural areas, leading to a decrease in prices in these regions. Overall, the findings indicate that the tariff reduction has been beneficial for urban households but detrimental to rural households. This is related to higher tariff-pass through for food items which have a greater share in household expenditure. This leads to the transmission of border prices to urban households and the failure of tariff reduction pass-through to the prices of most food items in rural areas. It is important to note that the calculated welfare effects stem from multiple factors, including proximity to the port, local market structure, local supply and household demand behavior, and crucially, the ability of the local market to translate trade policy changes into domestic price changes. In other words, the efficiency of the market is a key determinant. Ultimately, the average household welfare is higher in urban areas of provinces that can more effectively pass on tariff reductions to consumers.

The findings indicate that the ability or lack of regional markets to achieve pass-through or international prices relative to domestic prices. Therefore, restructuring the local market is crucial before policymakers join the World Trade Organization. In other words, since the market cannot transfer the benefits of tariff changes to all households equally, the Iranian government must increase tariff pass-through to prices before joining the World Trade Organization and implementing worldwide trade liberalization. This can be done by improving infrastructure and reducing trade and transport costs, especially in rural areas, to benefit from trade liberalization. Moreover, losses of producers and vulnerable populations should be minimized by increasing productivity, promoting science and technology, subsidizing agricultural inputs, and increasing investment in the agriculture sector.

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Appendix

Table A- The QUAIDS model estimates of food groups in urban and rural areas

	Cereal		*Meat*		*Dairy*		*Oils and Fats*		*Fruit, Veg., & pulses*		*Sugar*	
	Urban	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*	*Urban*	*Rural*
α	-0.34*** (0.02)	-0.52 (0.03)	0.81*** (0.04)	0.23*** (0.03)	0.00 (0.03)	0.17*** (0.02)	0.07*** (0.01)	-0.02 (0.02)	0.34*** (0.04)	0.65*** (0.07)	0.10*** (0.01)	0.01 (0.02)
β	-0.13*** (0.00)	-0.13*** (0.02)	0.13*** (0.01)	-0.02 (0.03)	-0.02*** (0.00)	0.08*** (0.01)	0.007* (0.00)	-0.66*** (0.01)	0.00 (0.00)	0.20*** (0.02)	0.006* (0.00)	-0.05*** (0.01)
γ_1	0.15*** (0.00)	0.04*** (0.00)										
γ_2	-0.15*** (0.01)	0.00 (0.00)	0.15*** (0.01)	0.01 (0.00)								
γ_3	0.02*** (0.00)	-0.01*** (0.00)	0.00 (0.00)	0.02*** (0.00)	0.00 (0.00)	0.00 (0.00)						
γ_4	-0.008** (0.00)	0.01*** (0.00)	0.008*** (0.00)	0.008*- (0.00)	0.00 (0.00)	0.00 (0.00)	0.003** (0.00)	0.03*** (0.00)				
γ_5	-0.01 (0.00)	-0.04*** (0.00)	0.01**- (0.00)	-0.04*** (0.01)	0.00 (0.00)	0.00 (0.00)	-0.004** (0.00)	-0.03*** (0.00)	0.02*** (0.00)	0.14*** (0.02)		
γ_6	-0.01*** (0.00)	0.00 (0.00)	0.00 (0.00)	0.009* (0.00)	-0.01*** (0.00)	-0.02*** (0.00)	0.00 (0.00)	0.00 (0.00)	0.007*** (0.00)	-0.03*** (0.00)	0.01*** (0.00)	0.03*** (0.00)
λ	-0.004*** (0.00)	0.00 (0.00)	0.004*** (0.00)	-0.007*** (0.00)	-0.0007*** (0.00)	0.006*** (0.00)	0.0002** (0.00)	-0.005*** (0.00)	0.00 (0.00)	0.01*** (0.00)	0.0003*** (0.00)	-0.006*** (0.00)

coefficient of household characteristic in urban and rural area

	η_1		η_2		η_3		η_4		η_5		η_6	
	Urban	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**
household head edu.	0.00 (0.00)	0.002*** (0.00)	0.00 (0.00)	-0.002*** (0.00)	0.0002** 0.00)	0.00 (0.00)	0.00 (0.00)	0.0006*** (0.00)	-0.0003** (0.00)	-0.0009** (0.00)	0.00 (0.00)	0.0005** (0.00)
size	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.0003** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.0002*** (0.00)	0.00 (0.00)
0-14 years old - male	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.0002** (0.00)	0.00 (0.00)	-0.0009*** (0.00)	0.00 (0.00)	0.0001* (0.00)	0.00 (0.00)	0.00 (0.00)	-0.0002** (0.00)
15-64 years old - male	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.005* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
older than 65 years old - male	0.01*** (0.00)	0.01**- (0.00)	-0.01*** (0.00)	0.00 (0.00)	0.002** (0.00)	0.006* (0.00)	0.00 (0.00)	0.005** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.01*** (0.00)
0-14 years old - female	-0.004*** (0.00)	-0.03*** (0.00)	0.002*** (0.00)	0.02*** (0.00)	0.001*** (0.00)	0.009** (0.00)	0.00 (0.00)	-0.01*** (0.00)	0.00 (0.00)	0.02*** (0.00)	0.0006*** (0.00)	0.00 (0.00)
15-64 years old - female	-0.003*** (0.00)	0.00 (0.00)	0.004*** (0.00)	0.00 (0.00)	-0.001*** (0.00)	0.00 (0.00)	0.0004* (0.00)	0.00 (0.00)	0.00 (0.00)	0.003* (0.00)	0.00 (0.00)	0.00 (0.00)
Region 1	-0.007*** (0.00)	-0.03*** (0.01)	0.01*** (0.00)	0.02*** (0.00)	-0.003*** (0.00)	-0.01*** (0.00)	0.00 (0.00)	0.008*** (0.00)	-0.003*** (0.00)	0.00 (0.00)	0.001*** (0.00)	0.01*** (0.00)
Region 2	0.005*** (0.00)	-0.03*** (0.01)	-0.003** (0.00)	0.02*** (0.00)	0.0008* (0.00)	-0.01*** (0.00)	0.001*** (0.00)	0.01*** (0.00)	-0.003*** (0.00)	-0.01* (0.00)	0.00 (0.00)	0.01*** (0.00)
Region 3	-0.007*** (0.00)	0.00 (0.00)	0.01*** (0.00)	0.008* (0.00)	-0.001** (0.00)	-0.008*** (0.00)	0.0008** (0.00)	0.005** (0.00)	-0.003*** (0.00)	-0.01*** (0.003)	0.001*** (0.00)	0.006** (0.00)
Region 4	-0.009*** (0.00)	0.00 (0.00)	0.01*** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.002** (0.00)	0.006*- (0.00)	0.0009** (0.00)	0.00 (0.00)

*, **, and *** indicate the significant at 10%, 5%, and 1%, respectively. The amount in parenthesis is a standard error.