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CROP PRODUCTION

Determination of the factors affecting the domestic terms of trade in greenhouse tomato production

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ABSTRACT: Agriculture plays a leading role in the economic growth and development process. Ensuring the continuity of production depends on the purchasing power of the producers. The sustainability of production and the development of the rural welfare index in favor of the producers will increase the driving role of the agricultural sector, which is also a resource for other sectors. This study determined the variables affecting the Domestic Terms of Trade of the greenhouse tomato producers in Antalya, Türkiye. The product price has been determined as the major factor affecting the Domestic Terms of Trade. In addition, it was concluded that a one-unit increase in the product price increases the Domestic Terms of Trade by 34.99 units. Interviews revealed that the continuity of consumption needs is more important than the continuity of production. It has been determined that the high and variable input costs cause erosion in the incomes of the producers. Agricultural policies will be more effective both in the short and long term when the aim is to improve the welfare and purchasing power of producers, rather than intervening in agricultural prices or reducing prices.
Key words: agriculture, price scissors, laspeyres indices, relative prices, rural income.

Determinação dos fatores que afetam os termos de comércio domésticos na produção de tomate estufa

RESUMO: A agricultura tem um papel preponderante no processo de crescimento e desenvolvimento econômico. Garantir a continuidade da produção depende do poder de compra dos produtores. A sustentabilidade da produção e o desenvolvimento do índice de bem-estar rural em favor dos produtores aumentarão o protagonismo do setor agropecuário, que também é um recurso para outros setores. O objetivo principal deste estudo é determinar as variáveis que afetam os Termos de Comércio Domésticos dos produtores de tomate de estufa em Antalya, Turquia. O preço do produto foi determinado como o principal fator que afeta os Termos de Comércio Domésticos. Além disso, concluiu-se que um aumento de uma unidade no preço do produto aumenta os Termos de Troca Domésticos em 34,99 unidades. As entrevistas revelaram que a continuidade das necessidades de consumo é mais importante do que a continuidade da produção. Constatou-se que os altos e variáveis custos dos insumos causam erosão na renda dos produtores. As políticas agrícolas serão mais eficazes, tanto no curto quanto no longo prazo, quando o objetivo for melhorar o bem-estar e o poder de compra dos produtores, em vez de intervir nos preços agrícolas ou reduzir os preços.
Palavras-chave: agricultura, tesoura de preços, índices de laspeyres, preços relativos, renda rural.

INTRODUCTION

Throughout history, poverty has always been the primary problem of societies. Although, the policies designed to eliminate and reduce poverty have changed cyclically, they aimed for people to live in better conditions. According to the 2030 Agenda, poverty is not limited to just a lack of income, but also means being deprived of many layers of life (BURCHI et al., 2022). Moreover, the degree of poverty is not at the same level all over the world. It differs not only between developing and developed countries but also within rural and urban areas within the same country (COULIBALY et al., 2020).

The question of how a country will grow and how societies welfare can be increased is considered one of the main issues of macroeconomics. Welfare and poverty are relative concepts and these are also affected by consumption and production patterns, habits, behaviors and other cultural elements. GANSONRÉ et al. (2022) stated that welfare is related to consumption rather than production. Additionally, besides examining the quality and quantity of consumption items, it is necessary to focus on the extent to which an individual benefits from different services.

Growth in the economy is defined as an increase in Gross National Product (GNP) compared

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to the previous period, and it may not always be reflected in the welfare of individuals at the same rate. In this case, to follow the signals in the economy, price indicators are most frequently looked at. TYAGI (1987) specified that prices, being allocators of resources, inform the producers and the consumers about the levels of production and consumption. The occurrence of high increases in the general level of prices is also considered a market failure. Some studies calculate purchasing power on a national scale and cover all sectors. These are considered to be supplementary to a country's GNP and national accounts such as Per Capita Income (PCI), and in some cases, these accounts are used as correction factors.

The accuracy and realism of measuring economic growth can be explained by its relation to purchasing power. It is accepted that one of the most realistic methods of following the daily life traces of price increases in the economy is to measure the purchasing power of people. Purchasing power can measure the economic power of countries with a more realistic and in-depth perspective than standard economic indicators. Because many factors such as how the total product in the economy affects individuals, how the distribution is, the structure of the population and demographic elements affect the purchasing power.

People living in rural areas and making their living through agricultural activities are more affected by the increases in the general price levels. Among the reasons that reduce the purchasing power of the producers are the dependence of agriculture on natural conditions, the constant increase in input prices, and the lack of power to determine the price. According to ELLOUMI & DHEHIBI (2012), a crisis in Tunisia started with an increase in agricultural input prices, reduced the purchasing power of the average farmer and caused a poverty in rural areas which also affected the small farmers generally. While purchasing power can change over the years and varies from region to region, consumption patterns also affect calculations. For this reason, a more realistic picture emerges when the interviews with producers and the data obtained from the fieldwork are completed with the macroeconomic data.

The inflation process which is a continuous increase in the general level of prices also expresses the decrease in the value of money. Besides the fact that inflation reduces the purchasing power of individuals, the distribution of national income also creates very important inequalities. When inflation is analyzed by sectors, it is seen that it affects all sectors of the economy as well as the agriculture sector negatively. This effect creates a dilemma, such as the structural damage to the agricultural sector on the one hand, and the fact that the agricultural sector causes inflation on the other hand. According to ORUÇ (2005), the direction of resource transfer between sectors is important in terms of their being under inflation pressure. A balanced development between sectors can be achieved by directing the input and output relations of the sectors, in other words, the distribution relations of the sectors. As a way of understanding this balance, the concept of Domestic Terms of Trade (DTT) has been developed.

The term "terms of trade" refers to a comparison of prices at which trade occurs. In a two-sector analysis (agriculture and non-agriculture), prices received by the agricultural sector and prices paid by it for purchases made from the non-agricultural sector can be given as an example (TYAGI, 1987). DTT represents the changes in the margin between the gross production value received by the farmer from the marketed unit product and the non-agricultural production expenses and consumption fund. Thus, DTT began to be used as one of the indicators used to determine the direction of resource transfer between sectors (BORATAV, 2014).

In the periods when DTT is in favor of the agricultural sector, it shows that more than one unit of agricultural product produced can be purchased from non-agricultural goods and services sectors. In the periods when DTT is realized against the agricultural sector, there is a transfer of resources from the agricultural sector to the non-agricultural sectors. At the same time, these periods are also expressed as the periods in which the agricultural sector is taxed. Thus, agriculture indirectly prepares resources for the capital accumulation of non-agricultural sectors. It is also important that the income generated by the conversion of DTT against agriculture can be used effectively. To the extent that these incomes come into the hands of investors who invest in productive areas, the contribution of agriculture to economic development will be evaluated to the same extent. Not only the industry but also the commerce sector will benefit from the DTT's turn against agriculture. Especially in underdeveloped countries where the trade sector is stronger than the industrial sector, it can be said that traders and intermediaries will benefit more from the resources that will be created as a result of the development of DTT against agriculture, and therefore, the trade capital will increase. An increase in trading capital can indirectly lead to higher investments by boosting the demand for industrial goods.

The fact that data collection in rural area studies is difficult compared to other regions also

necessitates looking at the daily lives of households. It is essential to assess the purchasing power of the segment generating income from the agricultural sector, rather than solely focusing on their production output. By using DTT, the main purpose of the study is to monitor the changes in purchasing power of the greenhouse tomato producers in Antalya between 2013 and 2020, to determine the variables affecting the DTT and to analyze the effect level of these variables. For this purpose, within the scope of the econometric model application, the dependent variable is the DTT variable created based on the producer. The independent variables are greenhouse width, product price, number of households, education of producers and distance to market.

MATERIALS AND METHODS

In this section, the source of the data and the details of the sampling method are explained. The data source of the research consists of primary data obtained from greenhouse tomato producers in Antalya, and the product scope is limited to standard tomato, which is the most grown product in the region. The survey was conducted in Kumluca, Serik and Aksu districts in 2019-2020. In the study, data obtained from the Turkish Statistical Institute (TUIK) was used as a secondary data source.

Inclusion of all units that make up the main population in the scope of the analysis is called a complete census, and working with a limited number of units representing the main population is called sampling (KARAGÖLGE & PEKER, 2002; ERMAN & KÜÇÜK, 2016). In other words, it is the process of estimating the parameters of the population by sampling fewer units than the total number of units in the population (GÜRIŞ et al., 2017). Examination of the universe as a complete census is very costly. It is less costly to work with the population that is thought to represent the universe (LIAMPUTTONG, 2013; BALTACI, 2018).

In the study, agricultural holding size was taken as the basis for the data collection method. The main mass is the greenhouse tomato production area in Antalya. Stratified sampling was preferred because the data belonging to the main population were not homogeneous. This method was used to determine the appropriate sample size. Thus, before the implementation, the sample size to be drawn should be decided (HUDSON, 2007).

The population is divided into 5 strata according to the holding size. The number of units of sample to be drawn from each stratum was determined using Neyman distribution, and sample volumes were distributed to strata. According to the Neyman allocation, the number of samples to be drawn from the h^{th} layer is obtained with the formula (1). The sample size required to estimate the mean is obtained using formula (2) by stratified random sampling and Neyman apportionment (YAMANE, 2001).

$$n_h = n.\frac{N_h.S_h}{\sum N_h S_h} \quad (1)$$

$$n = \frac{(\sum N_h S_h)^2}{N^2 D^2 + \sum N_h {S_h}^2} \quad (2)$$

n_h = the size of the sample drawn from the h^{th} layer, n=sample size, N_h = size of the h^{th} layer,
S_h = standard deviation of the h^{th} layer, D = sensitivity

The sample size chosen for the estimation of the parameters in the study was determined with an error level of 0.05 and a confidence level of 95%. The operating area widths of the greenhouses surveyed and the number of surveys taken from the layers are given in table 1. Before calculating the sample size, the holdings were stratified according to their sizes. Sensitivity is defined by the product of reliability and standard error (MERT, 2016). The Z value for a 95% confidence level is 1.96, and it is taken as 2 when calculating the sample size.

The total population size is 14503 holdings, and the strata widths and standard deviation values belonging to strata are given in table 1. The sample size is calculated as 158.750 in formula (3) and it has been apportioned to the strata in accordance with the Neyman allocation.

$$n = \frac{(\sum N_h S_h)^2}{N^2 D^2 + \sum N_h {S_h}^2} = 158.75 \quad (3)$$

Domestic Terms of Trade

The price mechanism carried out with agricultural products / industrial products is called DTT of agriculture (VARLI, 2012). DTT shows how many units of an industrial product can be purchased with one unit of agricultural product. It is the ratio of the agricultural products price index, and industrial products price index (4). The result showed the losses and gains of the agricultural sector in trade (ŞIMŞEK, 1991). BORATAV (2001) defined DTT as *"the expression of the ratio between the movements of Price Received by the Farmer (PRF) and the Price Paid by the Farmer (PPF) according to a starting year"*. The prices of the substances in the PRF and Agriculture-PPI are compiled according to the Statistical Classification of Economic Activities

Table 1 - Sample number and Neyman allocation.

Number of strata	Holding size (da)	------N_h------	------S_h------	-----N_hS_h-----	------S_h^2------	----N_h S_h^2----	-----n_h-----
1	below 1 da	1564	0.173	271.088	0.030	46.987	4.125
2	below 5 da	10188	0.371	3781.432	0.137	1403.536	57.543
3	below 10 da	1875	1.305	2448.385	1.705	3197.115	37.258
4	below 20 da	438	2.451	1073.7	6.009	2632.035	16.338
5	below 50 da	438	6.524	2857.533	42.563	18642.68	43.484
Σ		14503	10.826	10432.14	50.445	25922.36	158.750

(NACE Rev.2) and the Statistical Classification of Products by Activity (CPA 2008) (EUROSTAT, 2006; EUROSTAT, 2008).

$$DTT = \frac{\text{Agricultural Price Indices}}{\text{Non} - \text{Agricultural Product and Service Indices}} \quad (4)$$

DTT can be calculated with the help of Laspeyres agricultural products price index and non-agricultural goods and index formulas. The Laspeyres index is one of the composite weighted indices proposed by the German economist Etienne Laspeyres to measure current prices or quantities in proportion to the data of a selected base period (TEKIN, 2015). The calculation formulas are shown in (5,6).

$$Laspeyres\ Price\ Index: \quad \frac{\sum p_t q_0}{\sum p_0 q_0} . 100 \quad (5)$$

$$Laspeyres\ Quantity\ Index: \quad \frac{\sum q_t p_0}{\sum q_0 p_0} . 100 \quad (6)$$

If the price index of non-agricultural goods and services increases faster than the agricultural sector, it means that DTT is against agriculture, and if the price of agricultural goods increases faster, DTT is in favor of agriculture. If all prices increase or decrease at the same rate, it indicates that there is no change in the relative purchasing power between the two sectors. In other words, when (DTT) >1, agricultural sector prices increase relatively and DTT develops in favor of agricultural products; When (DTT) <1, it indicates that agricultural sector prices have decreased relatively and DTT has developed against agricultural products (DAĞDEMIR, 2011).

The reason for the change in DTT is due to the interaction between agricultural product prices and industrial product prices. The fact that DTT is in favor of the agricultural sector means that the same amount of agricultural products can buy more industrial products (DAĞDEMIR, 2011). In the situation of being in favor of agriculture, there is a transfer of resources from other sectors to the agricultural sector. The income disparity between agriculture and industry is shrinking. It means that the farmer can buy more industrial goods with the money he receives from the agricultural product he produces. In the situation of being in the detriment of agriculture, there is a transfer of resources from the agricultural sector to other segments. The income disparity between agriculture and industry is growing. This means that the farmer can buy fewer industrial goods with the money he receives from the agricultural product he produces (GÜRLER, 2016). It is possible to impose an indirect tax on agriculture by turning DTT against agriculture (ŞIMŞEK, 1991).

Identification of factors affecting DTT

The statistical analysis technique used to estimate the relationship between two or more variables that have a cause-effect relationship between them is expressed as regression analysis (ŞAHINLER, 2000) which is also used in the study. According to another definition, it is the function of the independent variables that are thought to be related to the dependent variable (ARI & ONDER, 2013). The multiple linear regression model aim to explain the total change in the dependent variable with the help of independent variables (KAYAALP et al., 2015). The linear regression equation was calculated with the help of the formula specified in (7). In this regression equation, "Y_{ij}" refers to the dependent variable, "α" to the constant coefficient, "β_i" to the independent variable coefficients and "u_{ij}" to the error term of the regression.

$$Y_{ij} = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + u_{ij} \quad (7)$$

Since the study to determined the factors affecting the changes in DTT of tomato producers in 2019, it was tried to determine the factors affecting DTT, and regression analysis was performed with the independent variables in its equation. The dependent variable was determined as the DTT of tomato producers, and the independent variables

as greenhouse area width, product price, number of people living in the household, education and distance to the market. In addition, considering that the ownership of the land and the experiences of the producers may affect DTT, it was added to the correlation and regression equation. It has been concluded that land ownership status, agricultural experience and greenhouse experience do not have a significant effect on DTT. Therefore, these variables were excluded from the model (8).

$$DTT_{2019} = \alpha + \beta_{(\text{Greenhouse area width})} + \beta_{(\text{Product price})} + \beta_{(\text{Number of people living in the household})} + \beta_{(\text{Education})} + \beta_{(\text{Distance to market})} + u_{ij} \quad (8)$$

RESULTS AND DISCUSSION

Most wealthy nations use income measures, while most developing nations use expenditure metrics. The practical ramifications of choosing one or the other prevail despite the theoretical distinctions. When there are few sources of income and the money from those sources is documented for administrative needs like taxation or payroll contributions, it is simpler to quantify income (GARROWAY & LAIGLESIA, 2012).

Consumption expenditures were obtained by creating 12 expenditure items and a product basket from the goods and services included in this item, based on TURKSTAT. Within the scope of the basket, 27 products were selected from the food and non-alcoholic beverages expenditure item (Figure 1). We calculated the amount of tomato that the producers need to produce in order to meet the expenditures made on the selected products and to buy a unit of product. Within the scope of the research, olive oil, onions, tea, and rice are consumed in all households. It was found that DTT was against the tomato producer for olive oil and onion in 2019 and in favor of the tomato producer for tea and rice. In order to meet the annual expenses of these products consumed in all producer households, a producer must produce 1959,477 kg of tomatoes. The average tomato production amount of the producers in 2019 was 102318.8 kg. Producers can meet their expenses on these four products with 2% of the tomatoes they produce. Producers can meet the expenditures of all food products (27 products) with approximately 13% of the production amount.

In order to calculate the DDT, it is necessary to analyze several variables, including domestic demand, production, inflation, and currency rates (SUSLU & YANARDAG, 2002). According to the results of the multiple linear regression model given in table 2, the most powerful factor affecting the DTT level of tomato producers is the price of the product. A one-unit increase in the product price increases the DTT by 34.99 units. In other words, it is concluded that a one-unit increase in tomato prices will increase the purchasing power of the producers, calculated with the help of DTT, by 34.99 units. However, it is thought that a one-unit increase in the

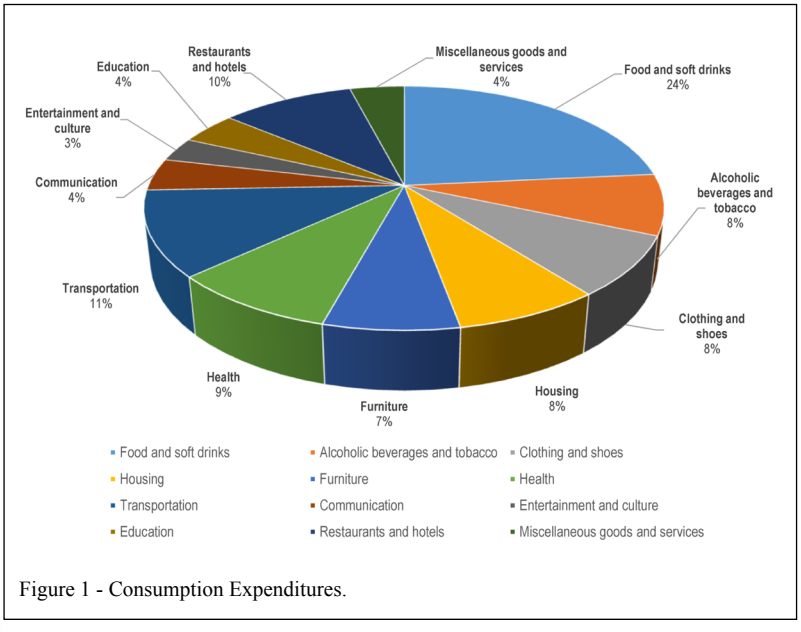

Figure 1 - Consumption Expenditures.

Table 2 - DTT Regression estimation results.

DTT	--Coefficient--	Standard Error	--------t--------	------P > t------	-----[95% Confidence interval]----	
Greenhouse width	1.322	0.3099088	4.27	0.000***	.7097787	1.934221
Product price	34.99003	4.681762	7.47	0.000***	25.74126	44.23879
Number of people living in the household	4.504104	2.4485	1.84	0.068	-0.332877	9.341086
Education	-1.254759	0.6218772	-2.02	0.045*	-2.48327	-0.0262479
Distance to market	-0.36226	0.2058468	-1.76	0.080	-0.768907	0.0443879
- cons	-2.369693	13.65267	-0.17	0.862	-29.34038	24.60099
F (5,154): 15.81	Prob > F: 0.000	R-squared: 0.3392	Adj R-squared: 0.3178			

(* < 0.05, ** < 0.01, *** < 0.001).

tomato product price will have reflections not only on tomato producers but also on consumers.

A correlation matrix was created for all of the independent variables used in the model of the study and it is shown in table 3. According to the correlation matrix, there is an inverse and weak relationship between greenhouse width and product price, distance to the market and product price, and distance to market and education. A similar weak relationship was found between the greenhouse width variable and the number of people living in the household, education and distance to the market. There is a weak and same-sided relationship between the product price, the number of people living in the household and the education variables. The same type of relationship exists between the distance to market and the number of people living in the household. In addition, according to the correlation matrix, the correlation coefficient between greenhouse width and product prices was found to be r = -0.02081. The correlation coefficient between the education variable and the number of people living in the household was calculated as r = -0.1418. Since the r values of the variables are < 0.50, it is possible to say that there is no multicollinearity. In other words, according to the correlation matrix for the independent variables, no finding indicating the existence of the multicollinearity problem was encountered.

VIF is more effective than the correlation matrix in detecting the multicollinearity problem. The VIF values calculated for the independent variables are given in table 4. The fact that the VIF value is greater than 10 and greater than 5 indicates that there is a strong multicollinearity problem. All of the VIF values calculated for the independent variables are below the values of 5 or 10. Since all of the calculated VIF values are less than 10, it is seen that there is no multicollinearity problem in the model.

Various tests are available to detect the presence of varying variance. Before testing this assumption, which states that the variance of the residues is constant, it is desired to see the scattering of the residues. The scatter plot for the varying variance is given in figure 2. To avoid the problem of varying variance in the model, the points should be randomly distributed around the zero line of the residuals. The presence of the dots at the end of the graph that opens to the right indicates that there is a problem of varying variance in the model.

It does not seem possible with graphs to be sure of the existence of varying variance in the model.

Table 3 - Correlation matrix between independent variables.

Correlation matrix	Greenhouse width	Product price	Number of people living in the household	Education	Distance to market
Greenhouse width	1.000				
Product price	-0.2081	1.000			
Number of people living in the household	0.1809	0.0022	1.000		
Education	0.0205	0.2680	-0.1418	1.00	
Distance to market	0.1810	-0.2395	0.1001	-0.1838	1.000

Table 4 - VIF values of arguments.

Variables	---------VIF---------	-------VIF1/2-------	-----Tolerance-----	---------R2---------
Greenhouse width	1.12	1.06	0.8954	0.1046
Product price	1.18	1.08	0.8503	0.1497
Number of people living in the household	1.07	1.03	0.9358	0.0642
Education	1.13	1.07	0.8815	0.1185
Distance to market	1.11	1.05	0.9032	0.0968

Average VIF = 1.12.

For this reason, varying variance tests were performed. The test statistic of White's test, namely the chi2 value, was calculated as 35.09, the degree of freedom was 20, and the P value was 0.0196. Since P = 0.0196 < 0.05, H0 hypothesis expressing homogeneity of variances is rejected at a 0.05 error level (95% confidence level). In other words, there is a problem of varying variance in the model. However, if it is at the 0.01 error level, H0 is accepted. Therefore, the results should also be compared with the Breusch-Pagan/Cook-Weisberg test results. Breusch-Pagan/Cook-Weisberg test statistic calculated chi2 = 21.24 and P value was 0.000. Since P = 0.000 < 0.05/0.01 the null hypothesis is rejected. It is concluded that there is a problem of varying variance in the model (Table 5).

In the models with variable variance problems, it is necessary to eliminate the varying variance. For this, the White estimator was used in the study. Standard errors are recalculated and these are called robust standard errors. The obtained model and robust standard errors are given in table 6.

Link and Ramsey Reset tests were calculated to test the presence of the model specification problem. Calculated results are given in table 7. The coefficient of the _hatsq variable was obtained as t = -1.28 and P = 0.203. Since the P value was 0.203 > 0.10, the H0 hypothesis was accepted. In other words, there is no specification error in the model. Ramsey Reset test statistic was calculated as 3.73 and P value as 0.0126.

CONCLUSION

In the study, DTT was calculated at the producer level and it determined the factors affecting it. For this purpose, within the scope of the econometric model application, the dependent variable was determined as DTT, which was created

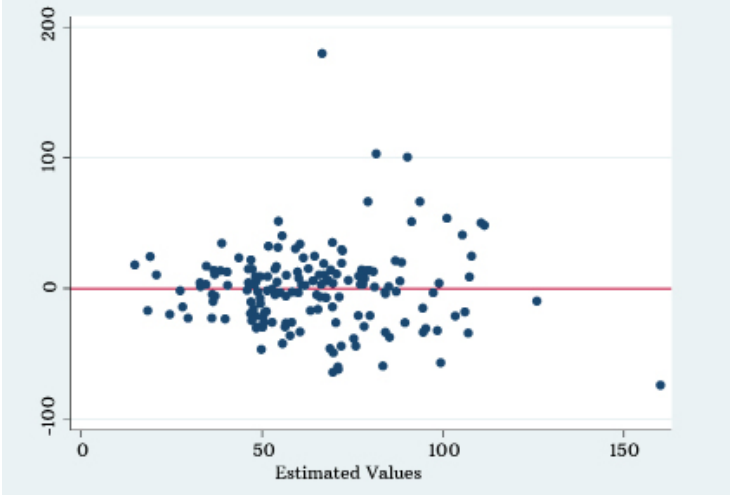

Figure 2 - Scatter plot for varying variance.

Table 5 - White, Breusch-Pagan / Cook-Weisberg test results.

White Test				---------Breush-Pagan / Cook-Weisberg Test---------	
Source	Chi2	Sd	P	Chi2 (1)	21.24
Varying Variance	35.09	20	0.0196		
Skewness	10.85	5	0.0545		
Kurtosis	1.40	1	0.2372	Prob > chi2	0.0000
Total	47.33	26	0.0064		

based on the producer. The independent variables were determined as greenhouse width, product price, the number of people living in the household, the education of the producers and the distance to the market. After the establishment of the model, a series of tests were carried out to determine the reliability of the model and to determine the existence of problems that may occur. To detect the presence of multicollinearity, firstly the correlation matrix and then the VIF values were examined. According to the correlation matrix, there was no finding showing the existence of the multicollinearity problem. VIF values also supported the correlation matrix results and it was concluded that there was no multicollinearity problem in the model. To detect the presence of varying variance, first, the scatter plot was created and then the varying variance tests were performed. Among the varying variance tests, White and Breush-Pagan/Cook-Weisberg tests were used. The variance scatter plot indicated that there was a problem of varying variance in the model, and the test results supported the graphical findings. White estimator is used to eliminate the problem of changing variance. The new model was found with the robust errors obtained by recalculating the standard errors. Thanks to robust errors, the existence of the variable variance problem has been eliminated. Link and Ramsey Reset tests were calculated to test the presence of the model specification problem. Calculated test values showed that there was no model specification error in the established model. The independent variables determined according to the results of the regression estimation have the power to explain 34% of the dependent variable. It was concluded that the coefficients of the independent variables in the established model (except for the distance to market variable and the number of people living in the household) were significant at the 95% confidence level, or in other words, at the 5% error level.

The study revealed that one unit increase in greenhouse area width increases DTT by 1,322 units (P = 0.021). The increase in greenhouse area width causes a further increase in DTT. As the greenhouse area increases, the purchasing power of the producers also increases. Otherwise, it is possible to say that there will be a decrease in the purchasing power of the producers if the greenhouse area width decreases. Although, the "number of people living in the household" variable is significant at the 90% confidence level in the regression results, it is concluded that it does not have a significant effect as a result of the robust regression.

The coefficient value of the education variable was calculated as -1.25 and the P value as 0.032

Table 6 - Robust regression results.

DTT	Coefficient	Robust Standard error	------t------	----P > t----	[95% confidence interval]	
Greenhouse width	1.322	.5687638	2.32	0.021*	.1984136	2.445586
Product price	34.99003	4.490632	7.79	0.000***	26.11884	43.86122
Number of people living in the household	4.504104	2.798572	1.61	0.110	-1.024442	10.03265
Education	-1.254759	.5795982	-2.16	0.032*	-2.399748	-.1097694
Distance to market	-.36226	.220681	-1.64	0.103	-.7982127	.0736927
-cons	-2.369693	12.99977	-0.18	0.856	-28.05058	23.31119
F (5,154): 16.09	Prob > F:0.000	R-squared: 0.3392				

(*< 0.05, **< 0.01, ***< 0.001).

Table 7 - Model specification.

Model specification		Coefficient	Standard error	T	P > t	[95% confidence interval]	
Link Test	_hat	1.536959	0.4340312	3.54	0.001	0.679665	2.394253
	_hatsq	-0.0037475	0.0029288	-1.28	0.203	-0.0095324	0.002037
	-cons	-17.11957	15.38365	-1.11	0.267	-47.50519	13.26604
		F (2,157): 41.54	Prob>F:0.000	R-squared: 0.3460	Adj R-squared=0.3377		
Ramsey Reset			F (3,151) =3.73	Prob>F=0.0126			

in the model. One unit increase in the education level of producers causes a 1.25 unit decrease in DTT. The most important reason for this is the relationship between education level and consumption amount. It has been concluded that a one-unit increase in education level causes an annual increase of 463.38 USD (1705 TRY, 1 USD = 3.68 TRY) in consumption expenditures.

In the research, it is assumed that the independent variable "distance to market" of the producers will affect the DTT. Because of robust regression, it was concluded that distance to market did not have a significant effect on DTT. As a result of the field study, it was found that one of the most important factors affecting the agricultural income of the producers and accordingly the purchasing power, rather than the distance to the market, is the length of the marketing channel. The gap between tomato producer prices and tomato consumer prices increased from 2016 to 2020. In other words, while the difference between producer and consumer prices was 0.32 USD (0.96 TRY, 1 USD = 3.023 TRY) in 2016, this difference reached 0.80 USD (2.96 TRY, 1 USD = 3.68 TRY) in 2020. These scissors, which are formed between the exit price of the product from the producer and the price of reaching the consumer, affect the producers and consumers significantly. It does not seem possible to eliminate these scissors and intervention in the marketing channel will also affect other actors. It is a fact that shortening the marketing channel will significantly affect the purchasing power of producers and consumers. Conversely, the income of some segments will be greatly affected. It does not seem possible in the short term to eliminate this situation, which affects every sector significantly. Studies are needed to make improvements to shorten the marketing channel by integrating regional policies and product-based policies, creating new employment areas. It is also supported by the participants of the research that it would be beneficial for the producers to participate in producer organizations and to be in active communication with local governments so that they can have a role in marketing and setting the prices. Tomato prices in Türkiye have been steadily rising from 2016 to the year 2023 and expected to continue in the long run. According to TUNCEL (2013), despite temporarily closing production gaps, measures that aim to restrain price increases in agricultural products by turning to imports result in the sector leaving. The tomato industry has also been exposed to price suppression policies through imports.

In cases where the internal terms of trade are against agriculture, it becomes difficult for producers to stay in the agricultural sector. The decrease in purchasing power pushes the producers to migrate from the village to the city. This affects food security. Food supply never loses its importance for food safety. The Covid-19 pandemic has reminded people once again that food is always the top priority. For this reason, keeping the income of the producers at a certain level to ensure the sustainability of agricultural production should continue to be the primary objective of agricultural policies.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

AUTHORS' CONTRIBUTIONS

All authors contributed equally for the conception and writing of the manuscript. All authors critically revised the manuscript and approved of the final version.

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