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Impact of agricultural supports on competitiveness of agricultural products

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Abstract: The agricultural sector is being supported in Turkey, as well as in the world. The issue of competitiveness is observed in agriculture, despite supports. This study aims at investigating the impact of agricultural supports in Turkey on competitiveness of agricultural products. Vector autoregression (VAR) model has been adopted in the study. The internal terms of trade (*TOT*), percentage producer support estimate (*PSE*), and the producer nominal protection coefficient (*NPC*) variables have been included in the model. The internal terms of trade in Turkey have developed over time against the benefit of agricultural sector. *PSE* has had a significant impact on *TOT*. Therefore, the use of *PSE* as a political variable has been concluded as a significant. Means of support must be discussed in Turkey more than the amount of supports. In particular, supports that will provide farmers with competitive advantage and boost up product farmyard prices will be more efficient and beneficial for farmers.

Keywords: agricultural protectionism; internal terms of trade; trade advantage; Turkey; vector autoregression analysis

Agriculture sector is recognized as being significantly strategic in social and economic terms by virtue of contributions to national income, employment, foreign trade, agriculture-dependent and agriculture-related industries as well as mainly providing food for the population. Therefore; agriculture has been supported in every society since ancient times (Klomp and Haan 2013). Support means all the precautions to protect, promote, and maintain agricultural activities (Dunmore 1986). Hence every society protects their agriculture sector through various supports implemented. Protectionism indeed means to protect one of the economy-composing sectors against foreign competition using various means such as customs tariffs and quotas, subsidies, embargos, prohibitions, voluntary limitations, and food safety criteria (Moon and Pino 2018). In our times, however, it is acknowledged that domestic supports have protection effect as well (Jensen and Shin 2014). Especially supports implemented which have a direct effect on prices in markets are accepted as protection. Therefore; concepts of agricultural protectionism and support are integrated.

Agriculture sector has been affected by liberalization movement that have been vocal in world foreign trade since 1980s. Protective policies in agriculture have been open to debate in those years, and pro-liberalist agriculture trade opinions have emerged (Russo et al. 2011). Agricultural protectionism has undergone a decrease worldwide after the World Trade Organization was founded in 1995. Today, few developments have been observed regarding export subsidies, customs tariffs, and domestic support with the effect of these actions, however, support continues to shift to implementation of different sorts of support (Moon and Pino 2018; Pawlak 2018).

Sustainable income for producers will enable guaranteeing food supply for the increasing world population (Rockström et al. 2017). Therefore, the importance

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of agricultural support is growing, even though support tools implemented vary and change in the world and in Turkey.

Liberal economy policies have been adopted in Turkey after the 1980s, as it occurred in the rest of the world. It is possible to state that agriculture supports advanced as of this period, however, producer income did not rise as expected. Per capita income in Turkey in 2018 was recorded at USD 9 632 (TSI 2018). People engaged in agriculture sector currently take approximately one third of this amount.

The concept of internal terms of trade (TOT) is being used in order to track changes in purchasing power and wealth of a specific social class, especially rural class. TOT is the best way to specify source transfer between sectors and how sectors are influenced by inflationist development (Hossain 2009). TOT is expected to occur in favour of agriculture, to balance the distribution of income between agriculture and other sectors. This is one of the main targets of public supports in agriculture. In Turkey, however, this has been to the contrary of expected. TOT has developed against agriculture, despite fluctuations in time. Therefore, there is capital transfer from agriculture toward other sectors through TOT.

There are some researches that evaluated the effect of agricultural supports. These studies in general associate agricultural support to trade in production and agricultural sustainability. Spicka et al. (2019) highlighted the concept of economic sustainability in agricultural enterprises and the importance of public supports. Arisoy et al. (2017) examined economic sustainability in terms of enterprise sizes and determined that public supports are insufficient for small enterprises. Benavides-Perales et al. (2018) analysed agricultural production dynamics using vector autoregression (VAR) model as of periods. They highlighted the importance of public supports and agricultural foreign trade. Erokhin et al. (2014), Smutka et al. (2016), and Yang (2017) emphasized the necessity of supporting the agricultural sector. In these studies, they debated the effects of the restrictions for agricultural supports imposed on developing countries by the World Trade Organization and aiming at liberalization of trade.

Studies measuring the effect of support on competitiveness are very limited. In these studies, generally the foreign competition has been emphasized. Tomsik and Rosochatecka (2007) investigated the effect of the change in the agricultural support system in Finland on the producer competition following its accession to the EU. Although the producers in Finland are disadvantaged in terms of competition, there has not been a dramatic decline in agricultural production. Cechura (2008) revealed that financial supports for agriculture increase the competitiveness of producers. The development of an economy can be achieved through a balanced distribution between sectors. Price is the most important determinant of competitiveness. Competitiveness analyses are the most significant when conducted using price effect-measuring criteria, especially TOT.

The agriculture sector is being protected more than others, because of its idiosyncratic structure. There is a competitiveness issue in the agriculture sector nevertheless. This study aims to investigate the influence of agricultural supports on competitiveness of agricultural products.

MATERIAL AND METHODS

Material. The main material of this study consists of secondary data of 24 years between 1994 and 2017. Data was gathered from databases such as those of The Organization for Economic Co-operation and Development (OECD 2018), The Food and Agriculture Organization of the United Nations (FAO 2018), Turkish Statistical Institute (TSI 2018).

Defining variables. This study aims at revealing the effect of agricultural supports on the competitiveness level of producers. We may break down competition into three components of price, quality, and service, where quality influences price. Service is not a determinant in agricultural products. In a country, it is important to specify changes in goods and service prices over time. The more important point here is to evaluate price changes between goods and services. *TOT* is an index indicating price change between agriculture and other sectors. Therefore, *TOT* was included in the model as the main variable that agricultural support influences competitiveness.

Other variables included in the model are percentage producer support estimate (%*PSE*) and producer nominal protection coefficient (*NPC*). These variables are used widely to specify country agricultural protection and support levels.

Internal terms of trade (*TOT*). The movement of spread between prices earned by farmers and prices paid to industry by farmers specify the course of share/distribution relations between industry capital and farmer. This spread is defined as *TOT*. Prices of products grown and supplied to the market by farmers in a specific year are compared to material prices

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purchased by those farmers for their own needs or reproducing the supplied goods, and if for example, there is a drop in goods sold by the farmer, it is concluded that the farmer faces an income and wealth loss (Fohlin et al. 1989). *TOT*, on the other hand, reflects purchasing power of agricultural products compared to other goods and services.

TOT is formalized as:

$$TOT = P_t / P_s \quad (1)$$

where: *TOT* – internal terms of trade; P_t – index of prices gathered by farmer, average annual change of farmer product sales prices on the farm (all primary crops and livestock products and commodity groups e.g. cereals, fruits and vegetables); P_s – index of prices paid by farmer, average annual change in farmer agricultural needs such as seeds, fertilizers, pesticide, diesel oil, tractors, and other consumption needs such as communications, clothing, and household goods.

As there are many goods and services sold and purchased by farmers, index numbers are used to define prices. Agriculture and product group indices of FAO are used in prices earned by farmer. *CPI* (consumer price index) industry index rates obtained by TSI are used in prices paid by farmer. Change in domestic terms of trade is measured according to a base year. The year 2003 was the base year in the measurements.

Percentage producer support estimate (%*PSE*). *PSE* is a support criterion used widely by OECD. It defines the annual monetary value of transfers from consumers and taxpayers to producers. All transfers from consumers and taxpayers to producers are measured along with direct market price support to producers (OECD 2018).

%*PSE* indicates the share of *PSE* in agricultural Gross Production Value (GPV). It defines the rate of support within the production value gained by producers (Spoerer 2015; OECD 2018).

$$\%PSE = \frac{PSE}{GPV} \times 100 = \frac{PSE}{PV + BOT} \times 100 \quad (2)$$

where: *PSE* – producer support estimate; *GVP* – gross production value; *PV* – production value; *BOT* – budget and other transfers (coupled payments, input supports, decoupled direct payments).

Producer nominal protection coefficient (*NPC*). *NPC* is obtained by dividing prices gained as a result of average farmyard prices producers gain plus coupled payments by border reference prices; which means the ratio of farm price including coupled payment to the border reference price (OECD 2018). For example, if *NPC* is calculated as 1.10, it indicates farmers generally get 10% more than what is defined by the international market level. Therefore, this rate larger than 1 indicates that agriculture is supported, while the rate smaller than 1 indicates that agriculture is taxed.

$$NPC = \frac{PP + CDP}{BRP} \quad (3)$$

where: *NPC* – producer nominal protection coefficient; *PP* – product price; *CDP* – coupled direct payments; *BRP* – border reference price.

Unit root test. In a time series, the issue of whether or not include the unit root is considerably important. Unit root test is a way widely used to examine stability. The most important assumption in regression analysis including time series data is that the time series under consideration is stable.

$$Y_t = \rho Y_{t-1} + et \quad (4)$$

where: Y_t – investigating variable for unit root; Y_{t-1} – lag variable of Y_t; *et* – error term.

Hypotheses to investigate the stability of Y_t are as follows:

$\boldsymbol{H_0}$: $|\rho| \geq 1$

$\boldsymbol{H_1}$: $|\rho| < 1$

$|\rho| < 1$ converges to a stable time series when Y_t time series $t \rightarrow \infty$ while $|\rho| \geq 1$ indicates the time series is not stable (Dickey and Fuller 1981).

Finding VAR delay value. The main issue in using expanded Augmented Dickey Fuller (ADF) test is the selection of delay length. The strength and size specifications of ADF test are considerably sensitive to the delay number included in the model. The aim here is to include enough error term to eliminate auto-correlation.

Vector autoregression (VAR) analysis. VAR model permits to include in the analysis multiple variables with their past values, and every equation is solved using Least Squares Method. This model was developed for simultaneous equation systems (Sims 1980). There are no limitations in such models making interior-exterior distinctions between variables. Model operates all variables simultaneously, and examines them in integrity. Variables may be used even if not stable on the same level. Strong estimations regarding the future are enabled by including delayed values of dependent variables. VAR model is formulated with two variables as follows (Gujarati 2009):

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$$y_t = \alpha + \sum_{i=1}^{p} \beta_i y_{t-1} + \sum_{i=1}^{p} \gamma_i x_{t-1} + \varepsilon_{1t} \quad (5)$$

$$x_t = \alpha' + \sum_{i=1}^{p} \theta_i y_{t-1} + \sum_{i=1}^{p} \gamma_i x_{t-1} + \varepsilon_{1t} \quad (6)$$

where: x_t – other variables in the model; α – constant term; p – delay length; ε – error term (Lütkepohl 2011).

Impulse-response analysis. Impulse-response functions are obtained after convenient delay lengths are found in VAR system. Impulse-response functions reveal the effect of shocks on variables, and what kind of effect do they have and when, through tables or graphs. This operation enables us to understand in which variable shocks occur, and how will variables respond to these shocks. In order to specify how shocks will occur, first of all, movements of variables in 10 periods are examined. Responses from other series are revealed with the help of graphs, versus 1-unit change in those shocks occurred in series. Same results may be revealed as tables. Columns display the variables where shocks occur, while rows display responses from the variables against these shocks (Phillips and Tzavalis 2007).

Variance decomposition analysis. Variance decomposition investigates the rate of percentage of change as self-variable-originated and other variable-originated. If the change percentage nearest to a hundred is originated from the variable itself, it is defined as exterior variable. Sorting the variables is considerably important in this analysis. Sorting is done from exterior to interior. Variance research is the second function aimed at in VAR (Callen and Segal 2004).

RESEARCH FINDINGS

Turkey's agricultural trade. Turkey is an important agricultural country, with approximately three million agricultural enterprises. Average enterprise size is 6 hectares and total agricultural area is 23.2 million hectares. 47% of this area is allocated to cereals. Turkey has a wide range of products due to its ecological advantages. Furthermore, there are more than 80 cultivated plants produced economically. Turkey is the world leader in production of hazelnuts, cherries, apricots, and figs (TSI 2018).

Export value of agricultural products is USD 5.6 billion (USD 17.7 billion with food products), import value is USD 9.3 billion (USD 12.8 billion with food products) in Turkey (TSI 2018). Important agricultural products in Turkey's foreign trade are shown in Table 1. Similarly, Turkish hazelnuts, dried figs, and dried apricots are world leaders in terms of export rankings.

Table 1. Basic export and import agricultural products of Turkey (2017)

Export products	Production amount (t)	Share in world production (%)	Rank in world production	Export value (thousand USD)	Share in world exports (%)	Rank in world exports
Hazelnuts (shelled)	675 000	67.09	1	1 068 958	62	1
Fig	305 689	26.52	1	–	–	–
Dry fig	–	–	–	298 505	59	1
Apricot	985 000	23.14	1	44 188	12	4
Dried apricots	–	–	–	266 879	58	1
Cherries	627 132	25.67	1	159 042	7	4
Eggs	1 205 075	1.50	9	375 790	11	3
Mandarins	1 550 469	4.64	3	334 432	7	3
Lentils	430 000	5.66	3	236 112	10	3
Lemons	1 007 133	5.85	6	292 113	8	5
Import products	**Production amount (t)**	**Share in world production (%)**	**Rank in world production**	**Import value (thousand USD)**	**Share in world imports (%)**	**Rank in world imports**
Cattle	14 080 155	0.94	23	1 159 875	12.34	3
Wheat	21 500 000	2.79	11	1 043 327	2.35	13
Soybean	140 000	0.04	32	947 920	1.51	11
Maize	5 900 000	0.52	21	425 673	1.27	20
Tobacco (unprocessed)	80 000	1.23	15	392 897	3.31	9
Sunflower seeds	1 964 385	4.10	7	356 471	9.16	1

Source: FAO database (2020)

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Turkey accounts for more than half of the world's total export value of these products as well.

The main imported agricultural products in Turkey are cattle, wheat, soybeans, maize, tobacco and sunflower (Table 1).

Findings of model variables. In the scope of this study, *TOT*, %*PSE*, and *NPC* variables were used for VAR model conducted. FAO price indices were used in respect to general agricultural products and various agricultural product groups to specify the prices earned by farmer, calculating *TOT*. *CPI* indexes were used in the prices paid for farmer's own needs or purchased input for reproduction.

Except for several years following the 2001 economic crisis in Turkey (2002–2004), and several years following the 2007 world economic crisis (2008, 2010, 2014), *TOT* have developed at expense of agriculture. *TOT* was calculated in terms of important product groups as well. The picture seems negative in respect of product groups. This negative picture is more obvious especially in animal products and citruses (Table 2).

Agricultural support is defined as the annual monetary value of gross transfers to agriculture from consumers and taxpayers arising from government policies that support agriculture, regardless of their objectives and economic impacts. This indicator includes the total support estimate (*TSE*), measured as a percentage of GDP, the producer support estimate (*PSE*), measured as a percentage of gross farm receipts, the consumer support estimate (*CSE*), measured as a percentage of agricultural consumption, and the general services support estimate (*GSSE*), measured as a percentage of total support. *TSE* transfers represent the total support granted to the agricultural sector, and consist of producer support (*PSE*), consumer support (*CSE*) and general services support (*GSSE*). *PSE* transfers to agricultural producers are measured at the farm gate level and comprise market price support, budgetary payments and the cost of foregone revenue. *CSE* transfers from consumers of agricultural commodities are also measured at the farm gate level. If negative, the *CSE* measures the burden (implicit tax) on consumers through

Table 2. Internal terms of trade (%)

Year	Agriculture	Cereals	Citrus	Pulse	Oil crops	Edible animals	Meat	Milk
1994	**132.65**	104.50	133.72	116.11	92.49	168.22	213.06	131.35
1995	**130.19**	117.54	154.43	159.43	89.08	155.90	175.80	136.46
1996	**123.67**	137.43	158.60	113.66	94.24	136.05	140.30	127.01
1997	**120.00**	123.47	138.15	93.98	83.86	126.82	124.38	127.55
1998	**122.19**	110.45	125.61	99.18	78.02	133.47	132.75	141.05
1999	**102.55**	96.27	111.01	104.68	64.53	116.51	115.20	128.57
2000	**96.73**	87.67	106.43	113.71	61.89	109.79	107.20	118.09
2001	**89.42**	88.24	92.27	104.38	79.93	91.67	83.08	101.71
2002	**93.02**	93.78	91.69	107.12	86.67	97.23	95.13	96.85
2003	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2004	**100.84**	103.03	104.02	100.60	95.27	102.53	100.33	104.87
2005	**99.57**	95.11	107.22	100.83	109.23	98.56	96.20	101.41
2006	**96.90**	84.98	93.56	89.34	107.42	98.74	94.83	103.83
2007	**98.63**	92.17	102.13	91.09	107.02	97.99	98.30	97.57
2008	**99.69**	112.09	103.01	108.61	109.51	95.65	92.83	98.20
2009	**95.45**	94.81	90.39	107.33	100.45	100.18	105.75	93.01
2010	**101.25**	89.20	86.63	97.44	98.96	109.87	123.96	98.42
2011	**98.86**	96.07	82.32	101.74	98.84	105.46	122.90	83.37
2012	91.75	92.10	73.23	107.67	95.85	98.93	109.54	84.28
2013	**84.92**	92.97	60.26	92.32	76.92	89.32	95.28	83.45
2014	**91.07**	94.49	58.74	94.00	107.16	88.16	93.09	84.57
2015	**91.46**	91.56	54.99	92.58	88.17	93.73	100.32	88.12
2016	**89.14**	87.96	57.10	108.46	92.19	93.91	105.24	82.91
2017	**85.96**	88.08	58.48	120.56	106.38	90.34	104.45	80.05

Source: Author's calculation (FAO 2018; TSI 2018)

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Table 3. Agricultural support

Year	*TSE* (million USD)	*PSE* (million USD)	*CSE* (million USD)	*GSSE* (million USD)	*TSE* % of GDP (%)	*PSE* % of gross farm receipts (%)	*CSE* % of agricultural consumption (%)	*GSSE* % of total agricultural support (%)
1994	6 731	7 173	–5 025.6	809.8	4.464	27.30	–24.1	10.10
2000	14 456	9 036	–7 449.4	4 286.2	4.873	32.38	–33.3	32.20
2005	13 775	14 449	–10 732.3	2 671.2	3.408	29.02	–27.0	15.60
2010	20 513	24 383	–17 486.9	2 785.1	3.511	29.67	–28.1	10.30
2015	16 377	15 315	–8 789.7	2 852.3	2.115	23.09	–20.0	15.70
2016	16 868	15 968	–8 299.9	2 685.4	2.161	24.86	–20.0	14.40
2017	13 545	12 874	–6 661.0	2 395.3	1.793	20.79	16.4	15.70

TSE – total support estimate, *PSE* – producer support estimate, *CSE* – consumer support estimate, *GSSE* – general services support estimate

Source: OECD database (2018)

Table 4. Producer nominal protection coefficients

Year	Turkey	OECD total	EU-28	USA
1994	1.279	1.364	1.396	1.078
2000	1.444	1.332	1.293	1.149
2005	1.355	1.227	1.228	1.064
2010	1.377	1.116	1.041	1.023
2015	1.235	1.097	1.051	1.028
2016	1.253	1.105	1.049	1.030
2017	1.189	1.099	1.044	1.032
Average (1994–2017)	**1.316**	**1.210**	**1.193**	**1.059**

Source: OECD database (2018)

market price support (higher prices) that more than offsets consumer subsidies that lower prices to consumers. *GSSE* transfers are linked to measures creating enabling conditions for the primary agricultural sector through development of private or public services, institutions, and infrastructure. *GSSE* include policies where primary agriculture is the main beneficiary, but does not include any payments to individual producers. *GSSE* transfers do not directly alter producer receipts or costs, or consumption expenditure (OECD 2018).

Almost each country in the world supports their farmers within limits of the possible. Agricultural supports awarded in Turkey between 1994–2016 are shown in Table 3. *PSE* data were used, one of the most common and objective support criteria in respect of country comparison. Supports awarded to producers in Turkey in given period increased. %*PSE*, as the ratio of this support in agricultural production value, is more significant. Hence this variable was included

Table 5. Augmented Dickey Fuller (ADF) test results

Variables	ADF statistics	Probability
Internal terms of trade (*TOT*) (–1)	–4.1595	0.0042
Producer nominal protection coefficient (*NPC*)	–2.7064	0.0882
Producer support estimate (*PSE*)	–2.7540	0.0806

Source: Author's calculation (FAO 2018; OECD 2018; TSI 2018)

Table 6. Granger causality test results

Null hypothesis	*F*-statistic	Probability
NPC does not Granger cause *TOT*	3.77497	0.0662
TOT does not Granger cause *NPC*	1.35577	0.2580
PSE does not Granger cause *TOT*	1.44547	0.2433
TOT does not Granger cause *PSE*	2.63428	0.1202
PSE does not Granger cause *NPC*	8.58230	0.0083
NPC does not Granger cause *PSE*	1.38522	0.2530

NPC – producer nominal protection coefficient, *TOT* – internal terms of trade, *PSE* – producer support estimate

Source: Author's calculation (FAO 2018; OECD 2018; TSI 2018)

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Table 7. Specifying convenient delay for vector autoregression (VAR) model

Lag	Log L	LR	FPE	AIC	SC	HQ
0	–224.8208	–	1 573 325	22.78208	22.93144	22.81124
1	–208.1071	26.74197*	739 311*	22.01071*	22.60815*	22.12734*
2	–205.8523	2.931267	1 566 350	22.68523	23.73075	22.88932
3	–198.5028	7.349496	2 263 638	22.85028	24.34388	23.14184
4	–187.4741	7.720111	2 915 541	22.64741	24.58908	23.02644

*Indicates lag order selected by the criterion, LR – sequential modified LR test statistic (each test at 5% level), Log L – log likelihood, FPE – final prediction error, SC – Schwarz information criterion, AIC – Akaike information criterion, HQ – Hannan-Quinn information criterion

Source: Author's calculation (FAO 2018; OECD 2018; TSI 2018)

in the VAR model. Examining %*PSE* data from the same period reveals there is no rise in *PSE* (Table 3).

The concept of protectionism today is not independent from domestic support awarded to agriculture by countries. *NPC* is one of the criteria used to compare agricultural protectionism levels of countries. Therefore, it was included in VAR model. *NPC* is over one both in Turkey and in the USA, in EU and in OECD. This means that there is support for agriculture. According to the numbers examined, we may state that, compared to other countries, agriculture in Turkey is supported more (Table 4).

Vector autoregressive (VAR) model findings. VAR model is defined as delay-distributed model where delay numbers of the variables in the model must be specified, and delayed variables must be included in the model. Intended for this aim, delayed values of variables are specified by ADF test and shown in Table 5. Here *TOT* variable was specified as first row difference stable, and other variables as stable at the level.

Granger causality test results for three VAR models in this study are shown in Table 6. Granger causality test determines the existence and direction of the relation between variables. There is a unidirectional cau-

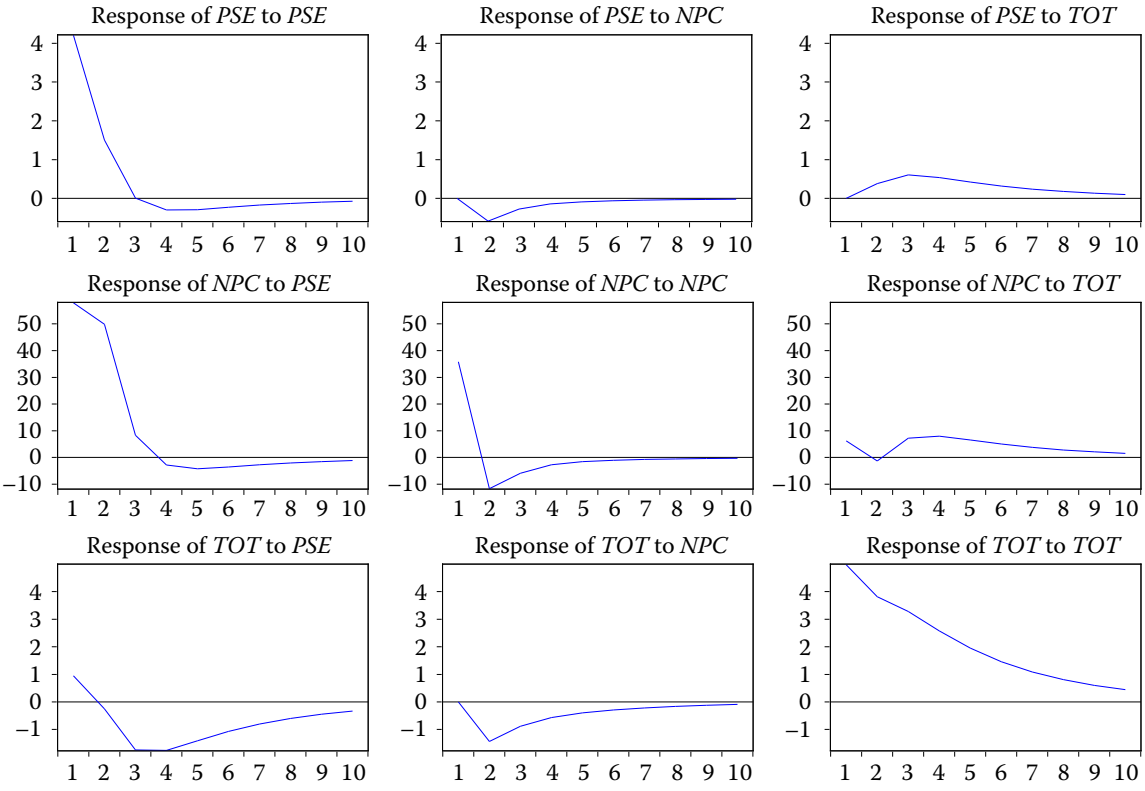

Figure 1. Figures of impulse-response function between variables

Source: Author's calculation (FAO 2018; OECD 2018; TSI 2018)

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sality between *NPC* and *TOT* according to test results. Accordingly, *NPC* is the reason for *TOT*s. Therefore, while *NPC* influences *TOT*, the opposite is not true. *TOT* has impact on *PSE*, while the opposite is not true. Another relation was observed between *PSE* and *NPC*, and the *PSE* influence on *NPC* was specified (Table 6).

Delay value of VAR model was specified and is shown in Table 7. VAR analysis takes into account the delayed values of variables taking part in the model. Thus, delayed value was taken as one for all the models in VAR analysis conducted, and Granger causality test. Sequential modified LR test statistic (LR), final prediction error (FPE), Akaike information criterion (AIC) and Hannan-Quinn information criterion (HQ) were taken into consideration to specify delay values.

Table 8. Variance separation of the model's variables

Period	SE	*PSE*	*NPC*	*TOT*
Variance decomposition of *PSE*				
1	4.20411	100.0000	0.00000	0.00000
2	4.51957	97.62170	1.27465	1.10365
3	4.56808	95.55947	1.38500	3.05553
4	4.61180	94.17998	1.37039	4.44963
5	4.64109	93.38967	1.35468	5.25566
6	4.65815	92.95293	1.34520	5.70187
7	4.66771	92.71261	1.33988	5.94752
8	4.67301	92.58013	1.33693	6.08294
9	4.67595	92.50696	1.33530	6.15774
10	4.67758	92.46648	1.33440	6.19912
Variance decomposition of *NPC*				
1	68.31084	71.70581	28.29419	0.00000
2	85.37433	80.00369	19.98914	0.00717
3	86.28094	79.25407	19.85897	0.88697
4	86.73866	78.52750	19.67238	1.80012
5	87.10335	78.10669	19.51012	2.38319
6	87.32786	77.87420	19.41033	2.71547
7	87.45563	77.74611	19.35380	2.90009
8	87.52688	77.67542	19.32238	3.00221
9	87.56641	77.63634	19.30497	3.05869
10	87.58831	77.61471	19.29534	3.08995
Variance decomposition of *TOT*				
1	5.06958	3.50895	2.80755	93.68350
2	6.51114	2.27896	3.07499	94.64605
3	7.55013	7.02742	2.45641	90.51617
4	8.18855	10.56067	2.10986	87.32947
5	8.54423	12.42183	1.94299	85.63517
6	8.73860	13.37729	1.85956	84.76315
7	8.84498	13.87844	1.81611	84.30545
8	8.90346	14.14695	1.79287	84.06019
9	8.93571	14.29287	1.78025	83.92689
10	8.95353	14.37285	1.77333	83.85383

PSE – producer support estimate, *NPC* – producer nominal protection coefficient, *TOT* – internal terms of trade
Source: Author's calculation (FAO 2018, OECD 2018, TSI 2018)

Variance separation revealed which variables had more impact on *TOT* (Table 8). It is known that variance separation is an outcome of VAR model. Granger causality test specified which variables had direct impact on *TOT*. In variance separation, sizes of the impact of all variables were specified, together with variables having indirect impact on *TOT*. Therefore, an outcome of VAR model, variance separation has direct and indirect impacts. A break in *PSE* influences itself within a 10-year time with an average rate of 93%, while there is impact of 1.5% on *NPC* and 5% on *TOT*. However, an impact on *NPC* within a 10-year time influences *PSE* with 78% average rate, and 3% in case of *TOT*. Granger causality test turns result of *NPC* effect on *PSE*, while the same results were recorded with variance separation (Table 8).

Impulse-response function specifies whether or not the agents influencing *TOT* will be used as policy variable (Figure 1). Accordingly, *PSE* impact on *NPC* and *TOT* was revealed, while the same result was obtained with Granger causality test (Figure 1, Table 6). *NPC* impact on *TOT* is not at a significant level, estimating that *PSE* may be used as a policy variable. Thus, producer supports influence product prices, and this in turn changes *TOT* in favour of producers. It is concluded to take this impact into consideration, and *PSE* to be used as a policy variable.

CONCLUSION AND FURTHER REMARKS

Today, agriculture policies focus on agricultural sustainability. The first condition for this is that producers do not give up production. Producers target a certain income level. Generally, one of the main targets of agriculture policy is to enhance low producer income. Therefore, as in every country, agriculture sector is supported in Turkey. In many studies, the effects on production and trade, and the importance or even necessity of supports in terms of agricultural sustainability have been reviewed. By contrast with this, the effects of supports on the competition of the producers have not been examined much. This study is aimed at overcoming this deficiency. For this purpose, giving the opportunity to examine all variables simultaneously, VAR model is used. *TOT* variable which explained competition situation was also involved in the model,

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beside the variable which calculated supporting levels of *PSE* and *NPC*.

According to OECD data, *TOT* developed to the detriment of agriculture in long term, despite the fact that agricultural protectionism in Turkey is higher than in developed countries. This means capital transfer from agriculture sector to industry and service sectors. In other words, agriculture sector is taxed in this way. Therefore, the belief that agriculture is a protected sector has become controversial.

According to VAR model results, *PSE* and *NPC* are reasons of *TOT*. In other words, *PSE* and *NPC* will increase unless there are market conditions that will turn *TOT* to advantage of agriculture. Thereby, countries will have to further support their non-competitive producers.

Furthermore, it was found that *PSE* has a considerable impact on *TOT*. As a conclusion, it is suggested for agriculture organization to consider this impact, and for *PSE* to be used as policy variable.

Input price rise in Turkey is faster than the rise in product prices. Costs are high for agricultural products. Competition power is decreasing, while agricultural supports are increasing. Therefore, support implemented must be discussed rather than the amount of support. Supports that are especially competitive, boosting up product farmyard prices, will be more efficient and beneficial for farmers. Moreover, agricultural policy means must be expanded, such as input and credit subsidies, in order to lower production costs.

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