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Policy Assessment of Wheat Production in Turkey

Abstract. Turkey plays a significant role in global wheat trade, importing wheat grain and exporting processed wheat products such as pasta, flour and biscuits. Wheat growing areas in Turkey have shown a decrease of about 10% over the last decade. Although an increase in yields keeps the production amount in balance, policies toward the wheat sector have reached a more critical point due to an increasing population and growing demand on the wheat flour sector. In this study, the profitability and sustainability of the sector were analyzed by using the Policy Analysis Matrix (PAM) approach, and by examining the effects of the policies that have been applied on the wheat market recently. According to the PAM results, domestic wheat prices are higher than world prices due to existing policies and the wheat sector is not competitive without support.

Key words: Policy analysis matrix, wheat production, Turkey

JEL Classification: Q02, Q18

Introduction

As of 2018, the wheat-growing area in Turkey constituted 3.5% of global wheat planted area, while representing around 20% (7.3 million ha) of Turkey's total cultivated arable land. Despite minor improvements in the last decade, crop yield has remained quite low compared to the world average (Table 1). On the other hand, the long-term trend shows that wheat cultivation areas have been gradually decreasing in the country. Producers tend to choose more profitable products to increase their income. However, improvements in cultivation techniques, adopting new varieties and balanced precipitations have compensated for the decrease in wheat cultivation areas thus far.

Turkey needs to produce at least 18-20 million tons of wheat every year to ensure domestic food security. Otherwise, the country can face serious food deficits due to its consistently increasing population. Therefore, finding the solution for problems that arise in all stages of production, trade and industry related to this specific product group means solving many of the problems in the agriculture of the entire country.

The outcomes of the state's agricultural support policies have become increasingly important with regard to sustainability of agricultural activities and increase of farmer income. In particular, the right policies applied to strategically important products such as wheat can contribute to the competitiveness of the sector. In order to maintain sustainability in Turkish agriculture and increase productivity, Agricultural Basin Based Support came into force in 2017. Under this program, the country was divided into various agricultural basins according to their soil and climate conditions to provide support for particular crops (suitable for their region) for each basin (USDA, 2018).

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Table 1. Wheat Production, Yield & Harvested Area

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Production, 1000 MT	20,600	19,674	21,800	20,100	22,050	19,000	22,600	20,600	21,500	20,000
Area harvested, 1000 Ha	8,100	8,103	8,096	6,530	7,773	7,919	7,867	7,672	7,669	7,299
Yield, MT/Ha	2.54	2.43	2.69	2.67	2.84	2.40	2.87	2.69	2.80	2.74
Yield, MT/Ha (World average)	3.05	3.00	2.16	3.06	3.26	3.30	3.30	3.40	3.49	3.40

Source: Turkish Statistical Institute, USDA.

Compared to other countries, the level of farm support in Turkey has been slightly higher than the average for the OECD area over the period of 2016-2018 (OECD, 2019). Premium payments constitute one of the major subsidies in Turkey and have a wide reach. Following premium payments, diesel, fertilizer and soil analysis subsidies also have a significant share of government support. Table 2 demonstrates the government subsidies for farmers to support and ensure sustainability of wheat production. Subsidies given to wheat reached their highest level in 2018. The support increased to 0.16 Turkish Lira (TL) per kg in 2018 while it was only 0.12 TL per kg in 2013 (SGB, 2019).

Table 2. Wheat subsidies in 2018

Support (TL)	
Deficiency payment, TL/Kg	0,05
Soil analysis, TL/Da	0,8
Certified seed, TL/Da	8,5
Fertiliser, TL/Da	4
Diesel, TL/Da	15

Source: The Official Journal Republic of Turkey.

Considering the importance of agricultural support policies in terms of sufficient farmer income and sustainable agriculture, this paper aims to analyse efficiency and sustainability in the Turkish wheat sector in light of existing policies. Section 2 provides an outline of the theoretical background and recent studies on policy analysis in the agri-food sector. In Section 3, the PAM methodological approach is described. Section 4 presents the obtained results of policy analysis, while the last section summarises and concludes the effect of the policies applied in the wheat market.

Selective Review of Literature

Various macro and micro models for policy assessment have been asserted and successfully applied in numerous studies. Generally, these models can be classified as General Equilibrium or Partial Equilibrium models. Partial equilibrium models focus on agricultural markets and policies without considering effects between sectors, while general equilibrium models consider these impacts. Partial equilibrium models involve elaborative remarks on agricultural markets and policies but these models have been criticized for lack of inter-sectoral effects. By contrast with partial equilibrium models, general equilibrium models consider the inter-sectoral impacts and provide useful ways of calculating prosperity changes, despite deficiency of detail (Stout, 1991).

Computable General Equilibrium (CGE) models can be counted as one of the most widely applied general equilibrium models which help to estimate how an economy might respond to certain policy changes, while the Social Accounting Matrix (SAM) provides an extensive and economy-wide database for the complex CGE models. On the other hand, OECD's producer and consumer support estimate represents policy transfers to agricultural producers, (calculated at the farm-gate and denoted as a share of gross farm receipts) just like the Policy Analysis Matrix (PAM) developed by Monke and Pearson in 1989. The PAM approach was recommended by FAO[2] and has been used in many scientific studies up to the present. By using PAM, Nelson and Pangabean (1991) investigated the effects of Indonesian sugar policy on sugar production to identify the distribution of resource transfers. The study revealed that sugar production in Indonesia was unprofitable in terms of both social and private profitability. Yao (1997) assessed the cost of the Thai agricultural diversification policy in the period 1994-1996. Three competitive crops (rice, soybeans and mung beans) were investigated within the frame of PAM. Results from the study suggested that rice was more profitable than soybeans and mung beans for farmers.

In their study on the competitiveness of agroforestry-based technologies for maize production, Adesina and Coulibaly (1998) applied policy matrix analysis to find out the social profitability of agroforestry-based technologies for maize production in Cameroon. The results of the study showed that maize production in the relevant sector had a high comparative advantage. Fang and Beghin (2000) examined the comparative advantage and protection of major agricultural crops (rice, wheat, sorghum etc.) in China. As a result of PAM analysis, it was suggested that China had a comparative advantage in labor-intensive crops and had a disadvantage in land-intensive crops. Mohanty et al. (2002) identified the efficiency of cotton production in major producing states in India by using a modified policy analysis matrix approach. Findings of their study proved that Indian policies directed at maintaining the availability of cheap cotton for relevant sectors had caused major inefficiencies in the sector.

Pearson et al. (2003) conducted a comprehensive study on applications of PAM in Indonesian agriculture with various case studies on different products. Their study also put emphasis on the problems that researchers faced during the designing process of the study and gave recommendations for those who want to perform similar research. Bahadir (2006) analysed and compared the competitiveness of cotton production in the Cukurova region in Turkey. According to the findings of PAM analysis, despite its negative private profitability, cotton has a very high social profitability compared to wheat and second crop maize. Martinez et al. (2008) combined data envelopment analysis techniques with a policy analysis matrix to search out profitability in rice cultivation in Eastern Spain. It was found that the average farm in the observed region made losses both at private and social prices, and the system was not sustainable due to lack of international competitiveness.

[2] Value Chain Analysis for Policymaking: Methodological Guidelines for a Quantitative Approach. URL: http://www.fao.org/3/a-at511e.pdf.

Methodology

The policy analysis matrix (PAM) is a quantitative tool developed by Monke & Pearson (1989) to measure the effects of distorting policies and market failures in an agricultural system. A PAM table consists of three columns; revenues, costs (tradable inputs and domestic factors) and profits, as well as three rows; private prices, social prices and divergences (Table 3).

Table 3. Policy Analysis Matrix[3]

Specification	Revenues	Costs		Profits
		Tradable inputs	Domestic factors	
Private prices	A	B	C	D
Social prices	E	F	G	H
Divergences	I	J	K	L

Source: Monke, Pearson (1989).

Private profitability (D) is calculated by subtracting costs (B + C) from revenues (A). It demonstrates whether an agricultural system is competitive or not, with existing technologies, prices and policy transfers. The social profitability (H) on the other hand, measures the efficiency or comparative advantage and reveals the effects of the policy interventions. Negative social profitability indicates an unsustainable system that can only survive with government support. The third row of the matrix represents divergences that result from government policies.

Several policy indicators can be derived from PAM:

- *The Effective protection coefficient* (EPC) is the ratio of value added in private prices (A - B) to value added in social prices (E - F). This indicator measures the policy effects in product markets and tradable input markets. EPC value less than 1 means effective taxation of value added by producers. The ratio indicates positive protection of value added by producers when it's greater than 1.
- *The Nominal protection coefficient* (NPC), is the ratio of domestic price/revenue (A) to the border parity price/social price (E) of a product. NPC<1 indicates implicit nominal tax paid by producers and NPC>1 indicates implicit nominal protection or subsidy. NPC can also be calculated for tradable inputs as the ratio of private values of tradable inputs to their social value (B / F).
- *The Domestic cost ratio* (DRC) is the ratio of social costs of domestic factors (G) to the value added (E – F) in social prices to produce a certain amount of output. As a significant indicator of competitiveness, DRC measures the opportunity cost of the domestic resources involved in production. DRC<1 indicates the country has a competitive advantage in production of the analysed commodity while DRC>1 means the country is not competitive.
- *The Private cost ratio* (PCR) is calculated as the ratio of actual domestic factors (C) to the value added (A – B) in private prices.
- *The Profitability coefficient* (PC) is the ratio of private profit to social profit, measuring the effects of all transfers on profitability.

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[3] Private profit: D= A-B-C, Social profit: H=E-F-G, Output transfers: I= A-E, Tradable input transfers: J=B-F, Domestic factor transfers: K=C-G, Net transfers: L=D-H=I-J-K.

In this study, Value Chain Analysis Software[4] developed by FAO was used for forming the Policy Analysis Matrix and calculating the policy indicators for Turkish wheat sector policy assessment.

Findings

Private prices

To investigate the effects of policy on the Turkish wheat sector, the Policy Analysis Martix approach was employed. The data for the current wheat market situation (production, yield and harvested area) have been collected from the official website of the Turkish Statistical Institute. The revenues in private prices have been calculated based on the wheat farm gate price and average yield data published by the Turkish Statistical Institute while government subsidies for 2018 were taken from the Official Journal Republic of Turkey. As a residual product, average straw price from different wheat growing areas[5] was added to the private revenue calculation.

In order to form a Policy Analysis Matrix, it is essential to display quantities and unit prices of the production cost items. Therefore, input quantities per decare were adopted from Tokat and Eskisehir provinces' crop reports while prices were taken from various sources (Turkish Ministry of Agriculture and Forestry, Turkish Statistical Institute, Konya, Tokat, Manisa crop reports and Turkish Grain Board).

Total costs of production include the opportunity cost of working capital. Opportunity cost of working capital denotes the expected rate of return that would have been acquired if the capital was employed for another production activity or investment. Therefore, a 10% nominal interest rate offered by Ziraat Bank in 2018 was used for calculating the cost of working capital. Since the Ministry of Agriculture and Forestry supported 50% of the interest rates on credit for crop production, the interest on working capital was taken as 5%. In addition, 3% of all expenses were taken as general administrative costs.

Social prices

The CIF Marmara import price of Russian wheat, 210 $/Ton was used for social revenue assessment. Calculation of social prices for tradable inputs was based on border prices (adjusted to the farm-gate level) by using Intracen trade data. The exchange rate for the calculation of social prices was the average exchange rate in 2018 Turkish Lira against 1 US Dollar[6], according to the data of the Central Bank of Turkey. The exchange rate risk premium of 10.9% was estimated in the Central Bank report (Onay & Korkmaz, 2018).

Import parity prices were calculated for importable inputs by adding marketing costs to border prices, while export parity prices were computed for exportable inputs using the same method. In this study, social price assessments for fertiliser and pesticide were based on

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[4] Value Chain Analysis Software: FAO VCA Tool 3.2, URL: http://www.fao.org/sustainable-food-value-chains/training-and-learning-center/details-materials/en/c/327858/

[5] Provinces from three different regions; Tokat, Antalya and Manisa.

[6] 1 USD = 4.8294 TRY

import parity price while seed border price was based on export parity price. Estimated transportation and handling costs were taken at 20 $/Ton based on interviews with the sector[7].

As domestic factors (land, labor and capital) do not have world prices, their social prices were estimated according to the social opportunity cost principle. The aim was to find how much output and income are foregone because the factor is used to produce the commodity. For social assessment, transfer payments such as subsidies and taxes were not counted as they are transferred from one entity to another. Therefore, their social values equal zero (Agraja, 2006). In order to estimate the social cost of labor, a shadow wage rate factor of 0.64 was taken (Bahadir, 2006). For the estimation of the social costs of land, profit of an alternative product – barley – was taken into account. The social price of capital was estimated according to the shadow interest rate of 12% calculated by Mashayekhi (1980) while a social discount rate for working capital of 5.06 % estimated by Halicioglu & Karatas (2011) was applied for assessment of the interest rate on working capital.

The major outcomes of the analysis are presented in Table 4.

Table 4. PAM for wheat production in Turkey in 2018[8]

Wheat	Revenues	Tradable inputs	Domestic factors	Profits
Private prices	A 450.0	B 92.2	C 190.6	D 167.2
Social prices	E 337.0	F 87.9	G 168.1	H 81.0
Divergences	I 113.0	J 4.3	K 22.5	L 86.2
PCR (Private Cost Ratio): C/(A-B)			0.53	
DRC (Domestic Resource Cost Ratio): G/(E-F)			0.67	
NPCO (Nominal Protrction Coefficient on Tradable Outputs): A/E			1.34	
NPCI (Nominal Protection Coefficient on Tradable Inputs): B/F			1.05	
EPC (Effective Protection Coefficient): (A-B)/(E-F)			1.44	

Source: Author's own calculations.

Table 4 presents a comparison between private and social profitability of wheat production in Turkey. Calculation of the difference between revenues and expenses in private prices shows that, on average, wheat producers received 167.2 TL/Da of profit in wheat production. However, the difference between private and social prices indicates that domestic producers, functioning in the conditions of the existing market and state policy, received 86.2 TL/Da more profit. In other words, revenues at private prices were higher than revenues at social prices, which points out a strong domestic price support through input subsidies and deficiency payment.

Results of the PAM analysis also showed that wheat producers in Turkey paid relatively high prices for internal resources. Expenses on internal production factors were 190.6 TL/Da, which was higher than the level of social prices (168.1 TL/Da). A similar situation was observed with tradable production factors, but it is important to mention that the imperfect economic system makes tradable resource costs more expensive. Turkish farmers spent, on average, 92.2 TL per decare in total for inputs such as seed, fertiliser and pesticide while social prices for inputs were 87.9 in the same period.

[7] Estimated transportation and handling costs from Samsun port to domestic market (Ankara or Konya).

[8] Figures were calculated for rainfed wheat.

The effective protection coefficient (1.44) derived from the PAM table indicates that the government policies resulted in a net positive incentive or an equivalent subsidy to wheat production. As one of the important indicators, Domestic Resource Cost Ratio (0.68) points out that the value of domestic resources used in wheat production was greater than the value of foreign exchange saved. Therefore it infers that the country has no comparative advantage in wheat production. The Nominal Protection Coefficient for tradable inputs (1.05) shows the policy distortion of all tradable input markets as a whole. NPCI higher than 1 indicates that market prices of inputs were higher than their social prices. On the other hand, the Nominal Protection Coefficient for tradable outputs (1.34) means that government policy was protective against output. In other words government policy was able to maintain the price of agricultural production output of domestic wheat at a rate of 34 percent higher than social prices, or producers got 34 percent higher profit than social prices.

Conclusions

Wheat-growing areas have decreased substantially over the last decade in Turkey. Considering the increasing population and improving wheat flour industry, this situation may endanger food security in the country. Therefore, evaluating and upgrading existing agricultural policies are of great importance for agricultural development in terms of sustainability of food safety. In this study, assessment of the policy effects on wheat production in Turkey was performed on the basis of Policy Analysis Matrix calculations. Findings pointed out a decreasing trend in wheat cultivation. As wheat production becomes less profitable, producers tend to plant more profitable crops to increase their income. PAM analysis also showed that inputs of wheat production such as seed, fertiliser and pesticide happened to be high when compared with world prices. Since the production cost is a major factor affecting profitability, incentives to make wheat production more profitable and productive will help farmers increase the planting of this strategically important product. On the other hand, despite government efforts to extend certified seed usage, crop yield figures were still below the world average. Policies devoted to increasing wheat yield to the world average not only serve to improve the income of farmers but also can heighten the sector's competitiveness and enable entering international markets.

Consequently, results of the study affirmed that the government support mechanism of the Turkish wheat sector needs to be improved or partly changed. For future research, it is also important to determine the qualitative level of state support of the wheat sector by reviewing governmental policy on accessibility of production resources. Measures to make resources less expensive and accessible for farmers will favor decreases in wheat production costs, and improve efficiency of wheat cultivation.

References

Adesina, A.A., Coulibaly, O.N. (1998). Policy and competitiveness of agroforestry-based technologies for maize production in Cameroon: An application of policy analysis matrix. *Agricultural Economics*, 19(1-2), 1-13.

Agraja, L. (2006). Assessing the Comparative Advantage of Wheat Produced in Albania. Cuvillier Verlag.

Agricultural Economic And Policy Development Institute of Turkey (SGB), (2019). Wheat Report, January, 2019.

Bahadır, B. (2006). Competitiveness of cotton production in cukurova region and Turkey: Policy analysis matrix (PAM) approach.

Eskisehir Odunpazarı Ziraat Odası, (2019). Retrived December 8 from http://www.ezo.org.tr/Maliyet.
Fang, C., Beghin, J.C. (2000). Food self-sufficiency, comparative advantage, and agricultural trade: a policy analysis matrix for Chinese agriculture. Food and Agricultural Policy Research Institute (FAPRI) Publications, Center for Agricultural and Rural Development (CARD) at Iowa State University.
Halicioglu, F., Karatas, C. (2011). A social discount rate for Turkey. *Quality & Quantity*, 47(2), 1085-1091.
International Trade Centre (ITC), (2019). Intracen database. Retrived December 10 from https://trademap.org/Index.aspx.
Martinez, E.R., Tadeo, A.J.P., Estruch, V. (2008). The policy analysis matrix with profit-efficient data: evaluating profitability in rice cultivation. *Spanish Journal of Agricultural Research*, (3), 309-319.
Mashayekhi, A. (1980). Shadow prices for project appraisal in Turkey. The World Bank.
Mohanty, S., Fang, C., Chaudhary, J. (2002). Assessing the competitiveness of Indian cotton production: a policy analysis matrix approach. CARD Working Papers. 328.
Monke, E.A., Pearson, S.R. (1989). The policy analysis matrix for agricultural development (Vol. 201). Ithaca: Cornell University press.
Nelson, G.C., Panggabean, M. (1991). The costs of Indonesian sugar policy: a policy analysis matrix approach. *American Journal of Agricultural Economics*, 73(3), 703-712.
OECD, (2019). OECD Database. Retrived December 2 from https://www.compareyourcountry.org/support-for-agriculture?cr=aus&lg=en&page=2&visited=1.
Onay, Y., Korkmaz, H.I., (2018). The Determinants of Currency Risk Premium in Emerging Market Countries. CBT Research Notes in Economics from Central Bank of the Republic of Turkey.
Pearson, S., Gotsch, C., Bahri, S. (2003). Applications of the policy analysis matrix in Indonesian agriculture. Jakarta: Yayasan Obor Indonesia.
Stout, J.V. (1991). Direct comparison of general equilibrium and partial equilibrium models in agriculture (No. 1799). US Dept. of Agriculture, Economic Research Service.
The Central Bank of the Republic of Turkey, Exchange rates database. Retrived December 8 from https://evds2.tcmb.gov.tr/index.php?/evds/serieMarket/#collapse_2.
The Official Journal Republic of Turkey. (2018).URL: https://www.resmigazete.gov.tr/eskiler/2018/02/20180226-15.pdf.
The Official Journal Republic of Turkey. (2018).URL: https://www.resmigazete.gov.tr/eskiler/2018/02/20180210-4.pdf.
Turkish Statistical Institute (TUIK), Agricultural statistics database. Retrived November 25 from http://www.tuik.gov.tr/PreTablo.do?alt_id=1001.
Turkish Ministry of Agriculture and Forestry, (2018). Antalya Province Crop Report. URL: https://antalya.tarimorman.gov.tr/Belgelerb/2018%20ANTALYA%20TARIMSAL%20ÜRÜN%20MALİYETLERİ.pdf.
Turkish Ministry of Agriculture and Forestry, (2018). Konya Province Crop Report. URL: https://konya.tarimorman.gov.tr/Belgeler/konyatarimi20092018.pdf.
Turkish Ministry of Agriculture and Forestry, (2018). Manisa Province Crop Report. URL: https://manisa.tarimorman.gov.tr/Belgeler/Dokumanlar/2018%20Tarımsal%20Maliyetler.pdf.
Turkish Ministry of Agriculture and Forestry, (2018). Tokat Province Crop Report. URL: https://tokat.tarimorman.gov.tr/Belgeler/2018%20YILI%20TÜM%20ÜRÜNLER%20MALİYETİ%20ve%20AĞAÇ%20DEĞERİ%20(27.12.2018).pdf.
United States Department of Agriculture (USDA), (2018). Turkey Grain and Feed Annual Report, Report Number: TR8010, March 2018.
Yao, S. (1997). Comparative advantages and crop diversification: a policy analysis matrix for Thai agriculture. *Journal of Agricultural Economics*, 48(1-3), 211-222.

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