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Reasons for Seasonal Potato Prıce Fluctuatıons in Turkey

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Authors' contributions

This work was carried out in collaboration between all authors. Author ED designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors TK and ADC managed the analyses of the study. Authors TK and ADC managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

In this study, potato price fluctuations in Turkey were presented by examining the changes in prices between 2005 and 2014. The objective of this study was to present the fluctuations in potato prices and their reasons, and offer solutions to deal with the severity of price fluctuations. In the study, secondary statistical data that were gathered from the Food and Agriculture Organization, and the Turkish Statistical Institute were used as parent material. Seasonal and annual price fluctuations were calculated by means of the Basic and Chain Index, and the Table Analysis Method. Projections were conducted by the Least Squares (Regression) Method. According to the research results, during the time period between 2005 and 2014, potato prices generally had an increase trend, and followed a fluctuating pattern in 2 and 3 year time periods. Seasonally, it was examined that potato prices started increasing by January and continued until the harvest season. Prices started to decrease slighly by harvest time, and started increasing again by September. In the time periods that were examined, the current price average of potato was 0.62 TL/kg and the real price average was 0.70 TL/kg. It could be said that potato real prices decreased in general. One of the important outcomes of this study was that although price fluctuations are limited in agricultural

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products that can be stocked like potato, an opposite result was observed because of the speculative stockpiling in 2014. It is neccessary to take some precautions, such as licensed warehouses, in order to prevent speculative actions.

Keywords: Seasonal fluctuation; potato; price.

1. INTRODUCTION

Potato is one of the staple and strategic products, and can be grown almost everywhere in Turkey and in the world. However, serious fluctuations can be seen in the potato supply and accordingly in the prices. Potato is prefered especially by low and medium income families. According to the Giffen Paradox; an increase in prices of some staple foods, like potatoes, could also cause an increase in low income families' consumption of these products [1]. Potatoes are also important for the food industry as well as a daily consumption food product.

By 2014, potatoes were grown in an area of 19.098.328 ha, and 382 million tons of potatoes were produced in the world. That same year in Turkey, 4.2 million tons of potatoes were produced in a 128.392 ha area. Potato is also an important product in terms of foreign trade. By 2013, the world potato export volume was 12 million tons worth 4.6 billion $ a year, and it had 13 million tons of import volume worth 5.1 billion $. In Turkey, the potato export volume was 316.979 tons worth 43.2 million $ in 2013, and it had 9.431 tons of import volume worth 7.9 million $ [2].

The common potato species that grow in Turkey are; Marfana, Resy, Ausania, Concorde, Russent, Bur Bank, Granda, Cosmos, Agria, and Fianna [3].

Agricultural product prices show yearly and seasonal fluctuations at different levels of severity and length that depend on species and specific characteristic of the products. For example, price fluctuation is common and severe in onion and watermelon, but could be less severe and extend over longer time periods in other products [4].

There are 4 main kinds of fluctuations [1], these are;

1. Annual fluctuations due to changes in the total amount of agricultural products (King's Law).
2. Periodic fluctuations derived from delays in adjusting production to price changes (Cobweb Theorem).
3. Cyclical fluctuations.
4. Seasonal fluctuations.

In different studies, it was found that prices in agricultural products fluctuate based on the cobweb theorem [5-8].

In a study, it was found that agricultural products are inflexible, and small changes in demand and supply can cause severe fluctuations [9].

In another study, it was found that price fluctuations were limited in some products that can be stocked up such as; corn, wheat, etc. [10].

One of the most important reasons of price fluctuation especially in onion, potato and rice is that producers are hoarding the products to increse prices when the demand is known [11]. In Turkey especially, potato prices are open to speculation due to the lack of potato merchants, and an efficient stock management [12].

There are 9 agricultural areas in Turkey and potato is grown widely in all of these areas. Many farmers make their living from potato growth. Potato also has a market for all seasons. Usually the potato price decreases in summers based on the harvest, and peaks at the times that production decreases, such as winter. Especially in 2014, potato prices fluctuated and peaked dramatically.

The purposes of this study are; examining the fluctuation in potato prices in Turkey, presenting the severty of fluctuations, determining the periods of fluctuation, presenting the length of these periods, and presenting the reasons for the price fluctuations. For these purposes, potato price data from the last 10 years were used, and production and price projections were carried out for the next ten years by using the data. In this study; the situation of potato production in Turkey and in the world were examined in terms of production area, production amount, and foreign trade.

2. MATERIALS AND METHODS

Parent material of this study consisted of secondary statistical data that were gathered from the Food and Agriculture Organization (FAO) and the Turkish Statistical Institute (TSI). Also, previous studies about the topic were used. These data were analysed by the Microsoft Excel software program.

Seasonal and annual price fluctuations were calculated by means of the Basic and Chain Index and the Table Analysis Methods. Projections were conducted by the Least Squares (Regression) Method. The reason for using this method was due to it being the most reliable and most common method among the other trend analysis methods [13]. The Least Squares Method is being represented by a mathematical formula, and the tendency of the time series could be either linear or curvilinear [13]. The mathematical function of Least Squares Method is shown below;

$$Y=a+bX \quad (1)$$

In the formula 'a' represents constant, and 'b' represents the slope. By means of these constants, Y value would be calculated for any X value, so that future periods would be possible to forecast.

$$a = \bar{Y} - b\bar{X} \quad (2)$$

$$b = \frac{n\sum XY-(\sum X)(\sum Y)}{n\sum X^2-(\sum X)^2} \quad (3)$$

X: Independent variable
Y: Dependent variable
a: Constant
b: Constant (slope)
n: Number of observations

3. RESULTS AND DISCUSSION

Global potato production increased by 46 million tons between 2004 and 2014; from 336 million tons to 382 million tons. The most important producers are; China (95.6 million tons), India (46.4 million tons), Russia (31.5 million tons), Ukraine (23.7 million tons), and USA (20 million tons). Turkey takes 13th place in the global potato production with 4.2 million tons [2].

Turkey has both a suitable soil structure and a suitable climate to grow potatoes in almost every region. However, potato production mostly takes place in the regions of Central Anatolia, and Aegean.

Turkey's potato production and foreign trade data were presented in Table 1 [14]. Potato is especially grown widely in the cities of Niğde, Nevşehir, İzmir, Bolu, and Afyon. These five cities provide 60% of Turkey's total potato production.

Table 1. Turkey's potato production, foreign trade, and consumption values by years

Years	Production Area (1000ha)	Production (1000 ton)	Export (1000 ton)	Import (1000 ton)	Supply (1000 ton)	Consumption Per Person (Kg)	Sufficiency Rate (%)
2000	205.0	5370.0	125.9	29.0	5273.1	---	---
2001	200.0	5000.0	85.9	30.8	4944.9	67.67	101.87
2002	198.0	5200.0	116.7	38.9	5122.2	62.14	101.13
2003	195.0	5300.0	231.7	39.2	5107.5	63.85	101.55
2004	177.6	4770.0	123.5	47.8	4694.2	63.34	103.84
2005	152.8	4060.0	20.5	56.4	4096.0	58.25	101.63
2006	157.9	4366.2	169.4	48.0	4244.8	---	99.11
2007	152.6	4227.7	236.8	54.7	4045.7	---	102.89
2008	147.9	4196.5	65.1	40.2	4171.6	49.41	104.56
2009	142.9	4397.7	69.9	60.9	4388.7	50.77	100.60
2010	138.9	4513.5	163.7	63.9	4413.7	53.04	100.21
2011	143.0	4613.1	70.3	62.2	4604.9	52.74	102.28
2012	172.1	4795.1	309.6	60.2	4545.8	54.36	100.18
2013	125.0	3948.0	---	---	3948.0	51.86	105.55

There were significant fluctuations in the potato production between 2000 and 2013 in Turkey; when either production area or production amount decreased by 26%. This situation caused serious fluctuations in potato prices especially in 2004, 2005, 2009, and 2013. It put the prices into a trend of increase. Since Turkey is a self sufficient country in potato production, there wasn't any significant fluctuation in the foreign trade of potatoes (Table 1).

Surplus potato production due to overplanting in 2012 decreased farmers' income and caused an imbalance of income and expenses. Potato stock from 2011 caused a decrease in summer potato prices; and political and economic issues in some neighboring countries effected Turkey's 2012 potato export negatively. Because of all of these reasons, producers had to sell their products below the cost price, and they started to abandon potato growing. Abandonment of potato growth caused inadequate production in 2013 which boosted prices up until the potato harvest season in 2014.

According to changes in potato production and prices during the years, potato prices were fluctuating either up or down during every other two year period since 2005 (Table 2) [14]. In this period, the overall level of price was fluctuating and tended to rise. As seen in the table; prices were high in the years of 2005, 2006 and 2007, were low between 2008 and 2009, were high again between 2010 and 2011, and were low between 2012 and 2013, before going up again by 2014. In other words, potato prices were fluctuating in two year periods. When examining these years, they were periods of either global or local economic crisis. Monthly prices were highest between January and April, and were fairly low between May and June because the old potatoes in stock were losing their value. Prices were low between July and September because of the new harvest season. Producers and enterprises which process potatoes could make a great profit if they consider those price changing periods.

When current price changes were considered, there was up to a 50% change from the begining to the end of the year (Fig. 1). The price pattern in 2013 was expected, however the price pattern in 2014 was different from all the data and predictions. There was an increase in prices of more than 2 times what was expected from the begining of the year to the end of the year.

In the same time period, it was observed that real prices were intended to decrease from January to harvest season, but continued to decrease around 10% during the 4 or 5 months of harvest season. Prices started to increase slightly after the harvest season (Fig. 2). According to the data, real prices were parallel with expectations, and overall tendency was in a downward direction. The trend equation was found as Y= -0,041x+1,3297.

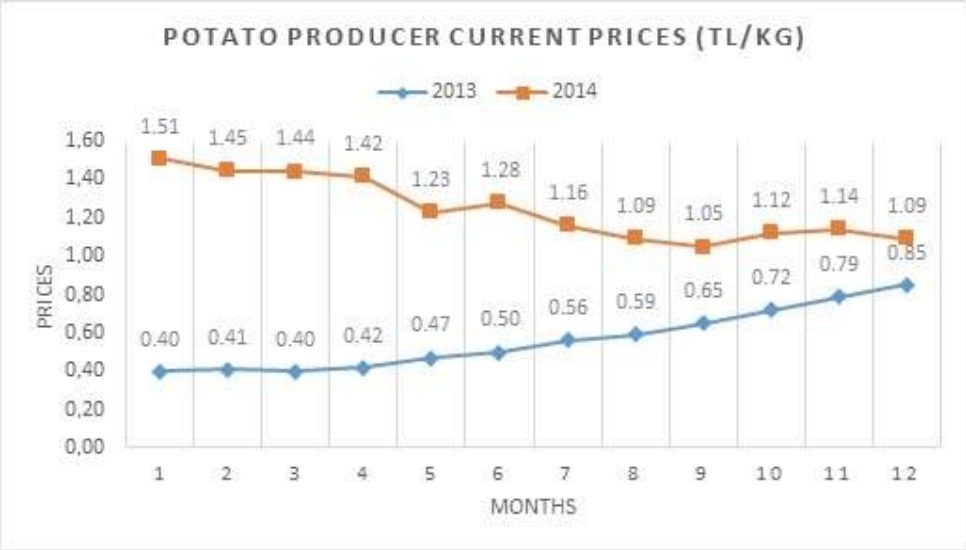

Fig. 1. Monthly indicator of potatoes' current prices in 2013 and 2014 (TL/Kg)

Table 2. Potato producer prices in Turkey (TL/Kg)

Years	Jan.	Feb.	March	April	May	June	July	Agust	Sept.	Oct.	Nov.	Dec.
2005	0.42	0.44	0.44	0.40	0.42	0.43	0.43	0.44	0.45	0.43	0.47	0.47
2006	0.48	0.50	0.51	0.55	0.58	0.50	0.49	0.49	0.47	0.46	0.46	0.47
2007	0.61	0.63	0.64	0.69	0.68	0.63	0.60	0.59	0.60	0.61	0.61	0.63
2008	0.48	0.47	0.51	0.51	0.54	0.51	0.56	0.53	0.50	0.46	0.42	0.43
2009	0.47	0.47	0.48	0.52	0.57	0.57	0.61	0.64	0.58	0.56	0.57	0.58
2010	0.61	0.69	0.75	0.77	0.70	0.59	0.51	0.42	0.48	0.60	0.66	0.67
2011	0.72	0.74	0.75	0.80	0.83	0.76	0.71	0.70	0.64	0.58	0.59	0.56
2012	0.53	0.53	0.55	0.51	0.51	0.49	0.48	0.43	0.41	0.40	0.38	0.38
2013	0.40	0.41	0.40	0.42	0.47	0.50	0.56	0.59	0.65	0.72	0.79	0.85
2014	1.51	1.45	1.44	1.42	1.23	1.28	1.16	1.09	1.05	1.12	1.14	1.09

Fig. 2. Monthly fluctuations in potatoes' real prices in 2014 (TL/Kg)

The annual average of potato real prices between 2005 and 2014 were presented in Fig. 3, and an increase trend was observed in real prices during these time periods. The trend equation was found as Y= -0,041x+0,7271.

Annual average real price trend between 2005 and 2014 was presented in Table 3. Annual average prices were converted into real prices by using monthly average prices. Based upon the 2005 base year price, the highest increase in the price occured in 2014 (149%).

Table 3. Potato current and real price indexes between 2005 and 2014

Year	Current price	Producer price ındex	Real price	Basic ındex	Chain ındex
2005	0.44	60.88	0.72	100.00	-
2006	0.50	65.32	0.76	106.41	106.41
2007	0.63	70.27	0.89	125.28	117.58
2008	0.49	78.42	0.63	87.83	70.58
2009	0.55	80.26	0.69	95.72	109.49
2010	0.62	96.24	0.65	90.68	95.56
2011	0.70	101.41	0.69	96.60	110.26
2012	0.47	107.53	0.43	60.70	63.10
2013	0.56	106.10	0.53	73.21	127.05
2014	1.25	117.65	1.06	149.18	219.43
Average	0.62	88.41	0.70	98.56	113.27

1)In the process of converting annual average prices into real prices, inflation was adjusted by means of multiplying the current price with the producer price index. 2) Basic Index was calculated using real prices based upon 2005. 3) In the Chain Index column, differences were presented in comparison to the previous year

Fig. 3. Annual average real price trend between 2005 and 2014 (TL/Kg)

3.1 Future Potato Price Predictions in Turkey

Periodic movements of potato prices in Turkey were examined by means of the time series, and the annual potato price change progress for the last ten years was examined based on real prices. Therefore, annual change projections in potato current prices for the next ten years were calculated by means of the Least Squares Method.

Potato current prices increased 64.8% in the last ten year period from 0.44 TL/kg in 2005 to 1.25 TL/kg in 2014. While there were fluctuations during this period, the overall price tendency was intended to increase (Table 4).

Table 4. Turkey's potato prices and projections

Year	Current Price (TL/kg)	Year	Price Projection (TL/kg)
2005	0.44	2015	0.88
2006	0.50	2016	0.92
2007	0.63	2017	0.97
2008	0.49	2018	1.01
2009	0.55	2019	1.06
2010	0.62	2020	1.11
2011	0.70	2021	1.15
2012	0.47	2022	1.20
2013	0.56	2023	1.25
2014	1.25		

Potato prices in the last ten years and future projections were shown below in Fig. 4. Speculative price changes based on different reasons in 2014 are seen clearly.

Table 5. Turkey's potato production and projections

Year	Potato Production (Million ton/year)	Year	Potato production projections (Million ton/year)
2000	5.37	2014	4.08
2001	5.00	2015	4.01
2002	5.20	2016	3.93
2003	5.30	2017	3.86
2004	4.77	2018	3.79
2005	4.06	2019	3.72
2006	4.37	2020	3.64
2007	4.23	2021	3.57
2008	4.20	2022	3.50
2009	4.40	2023	3.42
2010	4.51		
2011	4.61		
2012	4.80		
2013	3.95		

Potato production amounts between 2000 and 2013, and production projections until 2023 are shown in Table 5. The potato production amount decreased 20% between 2000 and 2013, which was from 5.37 million tons to 3.95 million tons. According to potato production projection, the amount of potato production was predicted to decrease by 3.42 million tons by 2023 in Turkey.

Fig. 4. Annual current prices and projections (TL/Kg)

Even though this situation seems profitable in terms of potato producers, it is a concern in terms of consumers and the country's self sufficiency. This situation should be taken into consideration when planning future agricultural policies.

4. CONCLUSION

One of the most remarkable price fluctuations in agricultural products is seen in potato. Especially in recent years where price fluctuations occured frequently in different agricultural products. In this study, potato price fluctuations between 2005 and 2014 were examined, and it was found that potato prices fluctuated in 2-3 year time periods. This situation causes risk and uncertainty in terms of producers.

By 2013, the potato production amount dropped because of weather (frost) conditions. According to a report that was published by the ''Monitoring and Evaluation Committee of Food and Agricultural Product Market''; even though there wasn't any serious problem in potato production in 2014, speculative potato hoarding and an increase in the immigrant population in Turkey boosted the potato demand up and caused a sharp increase in prices which put consumers in a difficult situation as well.

One of the biggest reasons for price increases in the producer-consumer marketing chain is the intermediaries. In the time periods that were examined; while the farm gate price was 1.50 TL/kg, it was up to 4.5 - 5 TL/kg at the markets. The market margin was over 300%. This situation was an injustice in terms of both the producers and consumers. It is necessary to shorten the market chain and decrease the intermediary profit margin.

These kinds of price fluctuations are undesirable in terms of both the consumers and the producers. Providing a regular and sustainable income guarantee for producers, and protecting consumers from excessive prices are necessary. In addition, precautions should be taken such as; a market regulatory support system for producers, and prevention of speculative commerce. Otherwise, Turkey could loose sustainability in potato production and may become foreign-dependent.

Price fluctuations are usually limitied in some agricultural products that can be stocked. However, this research found an opposite result because of the speculative stockpiling in 2014. In order to prevent such speculative actions, licenced warehouses that are already enforced by law should be extended across Turkey. Stockpiles should be registered, and inspected more adequately and regularly.

In order to monitor agricultural products, an effective data gathering system is crucial. Agricultural production data should be collected and analyzed in more detail to make an efficient

production plan, and to develop more efficient policies.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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