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Determination of the Seasonal Effect on the Auction Prices of Timbers and Prediction of Future Prices

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Abstract

Seasonality can be expressed as the periodic fluctuations that occur depending on the season. Forestry is at the forefront of the sectors that are affected by seasonal fluctuations due to being a nature-oriented enterprise. The seasonal effect has an important role, in the afforestation activities in spring, fire extinguishment works in the summer, production of wood raw materials in the spring and summer. Especially the change of the production of wood raw materials depending on seasonal conditions directly affect the log sale prices. In this research, seasonal effects were examined on 3rd class Normal length fir, black pine, beech and Scots pine logs price which are sold by auction method in Kastamonu Regional Directorate of Forestry which performs an important part of the wood supply in Turkey. In addition, timber price estimates for the coming years have been made. For this purpose, Time Series Analysis was used. As a result of the analysis, it was determined that all 3rd Class normal length fir, black pine, beech and yellow pine logs are exposed to a seasonal effect of auction sale prices. It was determined that the spring and summer seasons are positive, and the autumn and winter seasons are negative effects on all kind of log prices.

Keywords: Auction timber sales price, seasonality effect, Kastamonu Regional Forest Directorate, Turkey.

Açık Artırmalı Tomruk Satış Fiyatlarındaki Mevsimsel Etkinin Belirlenmesi ve Gelecek Dönem Fiyat Tahmini

Öz

Mevsimsellik, mevsimlere bağlı olarak meydana gelen periyodik dalgalanmalar olarak ifade edilebilir. Ormancılık, doğaya açık bir işletme şekli olmasından dolayı mevsimsel dalgalanmalardan etkilenen sektörlerin başında gelmektedir. Baharda ağaçlandırmada, yazın yangın söndürmede, bahar ve yaz aylarında odun hammaddesi üretiminde görülen faaliyet artışlarında mevsimsel etkinin önemli bir payı vardır. Özellikle odun hammaddesi üretim işlerinin mevsim şartlarına bağlı olarak değişmesi, tomruk satış fiyatlarını doğrudan etkilemektedir. Bu araştırmada, Türkiye'deki odun arzının önemli bir kısmını gerçekleştiren Kastamonu Orman Bölge Müdürlüğü'ndeki açık artırma yöntemi ile satışı yapılan 3. Sınıf Normal Boy göknar, karaçam, kayın ve sarıçam fiyatları üzerindeki mevsimsel etki incelenmiştir. Ayrıca bahsi geçen ürünler için gelecek yıla ilişkin fiyat tahminleri yapılmıştır. Bu amaçla çalışmada, Zaman Serisi Analizi kullanılmıştır. Analiz sonucunda, tüm 3. Sınıf Normal Boy göknar, karaçam, kayın ve sarıçam tomrukları açık artırmalı satış fiyatları üzerinde mevsimsel etkinin olduğu belirlenmiştir. Ayrıca, hesaplamalar sonucunda tomruk fiyatlarına ilkbahar ve yaz mevsimlerinin pozitif yönde, sonbahar ve kış mevsimlerinin ise negatif yönde etkisi olduğu belirlenmiştir.

Anahtar Kelimeler: Açık artırmalı tomruk satış fiyatı, mevsimsel etki, Kastamonu Orman Bölge Müdürlüğü, Türkiye.

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1. Introduction

The protection, increase and operation of forests in Turkey, is the responsibility of the General Directorate of Forestry (GDF) affiliated with the Ministry of Forestry. GDF presents the products of wood raw materials that it produces to the market in different ways. These ways are divided into two as sales made before the trees become mature (pre-sale) and sales from the depots after the cutting of trees (post sales) (Ok and İlter, 2012). State Forest Enterprises (SFE) within the GDF mostly use the auction sales method, one of the post-sales methods. Nevertheless, the method of planted tree selling, one of the pre-sales methods, has been increasing in recent years.

The total area of forests in Turkey is 22.342.935 hectares. 56.9% of these forests are productive forests and 43.1% are from degraded forests (GDF, 2015). All of these forests are state-owned and are GDF is the largest source of wood supply to the market. Industrial wood production, which was 7.347 thousand m^3 in 2003, reached 17,010 thousand m^3 value in 2016 (GDF, 2017). A significant portion of the production in 2016 was sold at auctions while 22.6% were offered to the market with the planted tree sales method (GDF, 2017).

Like all products whose price is determined by the market, wood raw materials are also influenced by many factors. These factors include the price of other related goods, average consumer income, income distribution, preferences, real interest rate and future price expectations (Ertek, 2010; Ok, 1998). Like in other products, the prices of forest products are also influenced by many factors which are or are not under the control of the enterprise (Daşdemir, 2003). Although the auction prices of timbers are formed in a competitive environment, in a structure where 99.9% of the forests are state-owned, the industrial wood market has incomplete competition conditions. Given the growing need for industrial wood, determining the role of these variables in the price formation is rather important in the determination of production, sales planning, and supply policy. The creation of an effective marketing strategy is also important for the realization of sustainable forest management. Although these variables which are effective on price are analysed by various methods, especially Time Series is one of the most common methods used in this regard (Daşdemir, 2008). There are many domestic and foreign studies in the literature that determine the causes that affect the price of forestry products and the effects of seasonality (Ok, 1998; Daşdemir, 2008; Kolis et al., 2014; Parajuli et al., 2016; Michinaka et al., 2016). However, since price formation is affected by regional differences, it is a factor that must be identified for each SFE.

This study aimed to examine the seasonal effect on the auction sales prices of timbers at Kastamonu Regional Directorate of Forestry (KRDF) which provides a significant part of the supply of wood raw materials in Turkey and to make price estimations for the next year. It is thought that the results obtained will contribute both to the relevant literature and will help decision-makers in similar fields.

2. Material and Method

2.1. Research area

As the research area, the KRDF (GDF, 2017), which ranked first with a production volume of 2.048.000 m^3 in the GDF in terms of industrial wood production in 2016 was selected (Figure 1).

Figure 1. Geographical location of KRDF

The total surface area of KRDF covering Kastamonu and Sinop located in the mid-western part of the Black Sea region is 1,896,015.8 hectares. The forests in the KRDF are shown in Table 1 (URL 1). There are two national parks within the boundaries of KRDF. These are the Ilgaz Mountain National Park (IMNP) and the Küre Mountains National Park (KDMP), which has a Protected Areas Network (PAN) parks certificate (Anonymous, 2014; Öztürk and Ayan, 2015).

Table 1. Land use situation of KRDF

	Forest Land (ha)			Open area (ha)	Total Area (ha)
	Productive	Degrade	Total		
Kastamonu	626.483,1	208.530,1	835.013,2	469.021,2	1.304.034,4
Sinop	296.685,6	70.382,9	367.068,5	205.459,1	572.527,6
KDMP	15.254,0	2.965,8	18.219,8	331,2	18.551,0
IDMP	588,0	15,0	603,0	145,0	748,0
Private forests	77,6	65,0	142,6	12,2	154,8
Total	939.088,3	281.958,8	1.221.047,1	674.968,7	1.896.015,8

2.2. Material

In the study, Time Series Analysis was used to determine the seasonal effect on the auction sales prices of timbers at the KRDF and to estimate future prices. In order to test the said analysis, the auction prices of 103060 third class fir, black pine, beech and Scots pine timbers sold between 2009 and 2016 within the boundaries of the KRDF were used (Anonymus, 2017). The hypothesis of the study was determined as "H0: Seasons have no effect on the auction sale prices of third class fir, black pine, beech and Scots pine timbers" and "H1: Seasons have an effect on the auction sale prices of third class fir, black pine, beech and Scots pine timbers". For testing of the hypotheses, auction sale prices are used as seasonal averages. Used sales prices of timbers are shown in Table 2.

Table 2. 3rd class normal length fir, black pine, beach and scots pine average seasonal sale price

Year	Quarter	Fir Avarege prise	Black pine Avarege prise	Beech Avarege price	Scots pine Avarege prise
2009	1	136,34	140,28	148,89	170,17
	2	136,30	146,88	138,00	164,97
	3	132,55	135,22	131,67	145,45
	4	123,52	127,12	138,83	137,54
2010	1	136,91	135,39	143,06	148,05
	2	149,11	152,21	145,08	163,27
	3	154,47	150,62	138,18	162,21
	4	166,41	163,02	149,36	179,42
2011	1	209,72	197,36	152,99	209,34
	2	242,34	222,73	172,66	243,34
	3	224,88	215,61	164,01	235,68
	4	215,31	206,51	157,88	224,06
2012	1	224,24	210,57	176,78	228,12
	2	249,12	222,67	196,02	252,59
	3	220,61	202,91	189,22	221,19
	4	197,86	188,43	183,42	210,62
2013	1	194,62	184,49	184,05	205,58
	2	196,12	181,74	145,91	202,54
	3	182,43	174,56	141,43	198,21
	4	188,74	194,54	127,12	213,83
2014	1	244,49	245,98	142,09	261,94
	2	285,97	270,20	231,77	297,53
	3	280,68	254,55	213,74	276,75
	4	278,91	246,17	232,67	268,49
2015	1	280,67	253,12	267,06	282,10
	2	300,47	274,80	290,07	295,05
	3	256,40	235,83	253,47	254,25
	4	247,28	226,91	272,39	252,07
2016	1	252,84	228,35	298,62	257,10
	2	257,96	225,66	273,20	258,18
	3	233,71	216,17	224,70	240,58
	4	230,97	227,04	204,23	246,06

2.3. Method

For testing the hypotheses and estimating future prices, Classical Additive Decomposition CAD Method), one of

time series analysis methods is used.

2.3.1. Time Series Analysis

A series of observations of a variable at equal time intervals is called time series. Time series can be listed as time units such as "hour, day, week, month, three months and year". When the data of an observation were examined at a certain time unit, they were observed to be under the influence of some fluctuations. These effects, which we can also define as components of time series, are called trend (T), seasonal fluctuations (S), cyclical fluctuations (C) and random movements (S) (Saraçoğlu, 1990).

A time series is a cluster of time-sequenced measurements of a size that is of interest. The purpose of the analysis of the time series is to understand the truth represented in the observation cluster and to accurately forecast the future values of the variables in the time series (Schwager, 1984). Time series consists of four components (Ferris, 1998; Newbold, 2000);

1. Trend (General Tendency) Component; it is the stable state that occurs after the falling and rising periods the time series show in a long period. Time series tend to decline or rise steadily in the long term. For example, the data for the amount of rainfall per country over a century may give information about trend effects.
2. Season Component; this represents change according to the seasons in the time series. Some periods of the data used in terms of time series differ from other periods. Seasonal fluctuations are an effect that can be monitored easily and encountered frequently in the time series. It manifests itself in periodic movements. It expresses the effect of seasonal movements on the data in the full circular process that takes place in a year and less than a year. It is possible to see its effects on the variables such as sales figures, temperature indicators, and tourism statistics.
3. Cyclical Component; these are periodic changes in the economy that are not related to seasonal changes. These are circular movements; the length and intensity of each movement may be different. For example, short-term expansion or contraction independent of the general trend in the economy expresses the cyclical process.
4. Irregular Movements Component; these are variations that are not definite like other elements and can be expressed in terms of error. That is, they show non-periodic changes. These are the fluctuations caused by random events, whose existence is unpredictable. Examples include increases or decreases in data with the impact of natural disasters.

These components are used to define the time series model of a variable observed in “t” time. These definitions are of two kinds (Saraçoğlu, 1990);

$Y_t = T_t + S_t + C_t + I_t$ Addition Method
$Y_t = T_t \times S_t \times C_t \times I_t$ Multiplication Method

In statistical studies, statistical interpretations can be reached about the whole with the aid of the sample taken from the universe. The same technique applies to the analysis of time series; that is, analysis of the stochastic process of the observation data obtained from a theoretical time series is performed and interpretations are made for the whole (Schwager, 1984). In this way, implications may include forward-looking estimates. Time series may contain one or all of the factors we listed above and the effect of one of these movements may show itself in another in a series. In order to make a realistic analysis of the time series and to make forward-looking estimates, the series should be free from these effects (Ünsal, 1997).

In the preliminary analyses carried out within the scope of the research, the most sensitive result was given by the (CAD Method and with this, further analyses were carried out. Introductory information on the relevant method is presented below.

2.3.2. Classical Additive Decomposition Method

This method, which was developed in the 1920’s, form the basis of typical existing decomposition method (URL 2). The diagram (Figure 2) shows a time series model of an additive decomposition model (URL 3; URL 4).

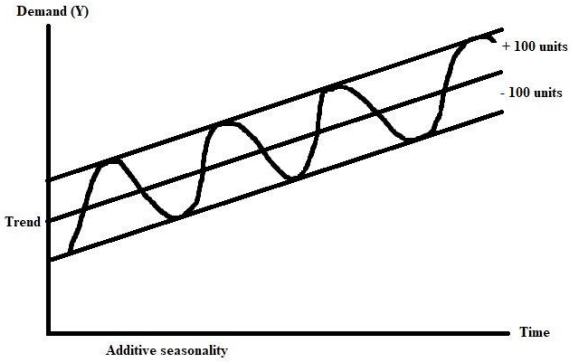

Figure 2. A time series conforming to CAD Method

The CAD Method is described using a multi-factor model (URL 2).

$$Y_t = T_t + S_t + C_t + I_t$$

A seven-step process is followed in the Classical Additive Decomposition Method (Wooldridge, 2002). These include;

Y : The series to be forecast,
T : The long-term trend based on deseasonalized data. (It is often called the centered moving-average trend (CMAT) since the deseasonalized data are centered moving averages (CMA) of the original Y values.)
S : Seasonal indexes (SI). (These are a normalized average of seasonal factors that are determined as the ratio of each period's actual value y to the deseasonalized value (CMA) for that period.),
C : The cycle component (The cycle factor (CF) is the ratio of CMA to CMAT and represents the gradual wavelike movements in the series around the trend line.)
I : The irregular component (This is assumed equal to 1 unless the forecasters have reason to believe a shock may take place, in which case I could be different from 1 for all or part of the forecast period) (URL 5; Ünsal, 1997)

3. Findings

Seasonal effect on the auction sale prices of fir, black pine, beech and yellow-pine timbers logs obtained as a result of the calculations performed with the CADMethod and the results of the analysis on future price forecasts are shown in Tables 3, 4, 5 and 6.

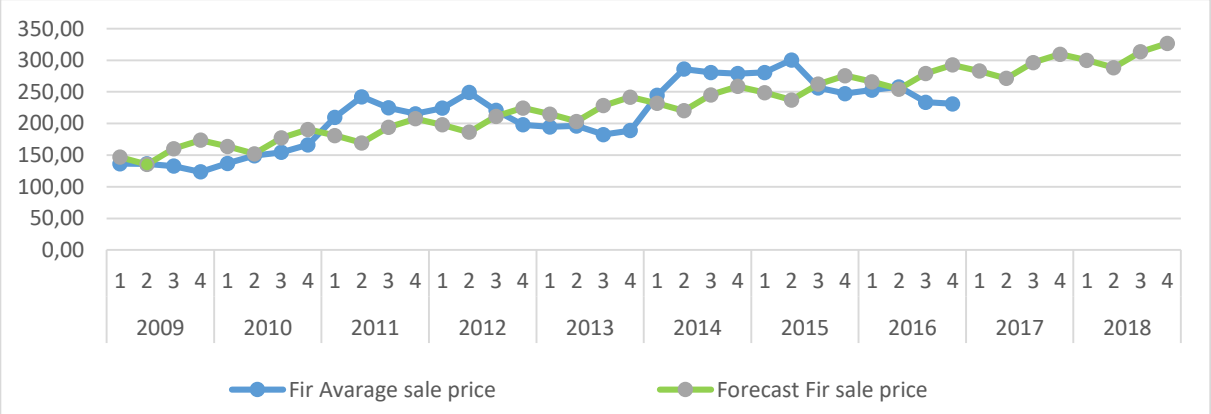

Figure 3. Time Series of Fir log sales

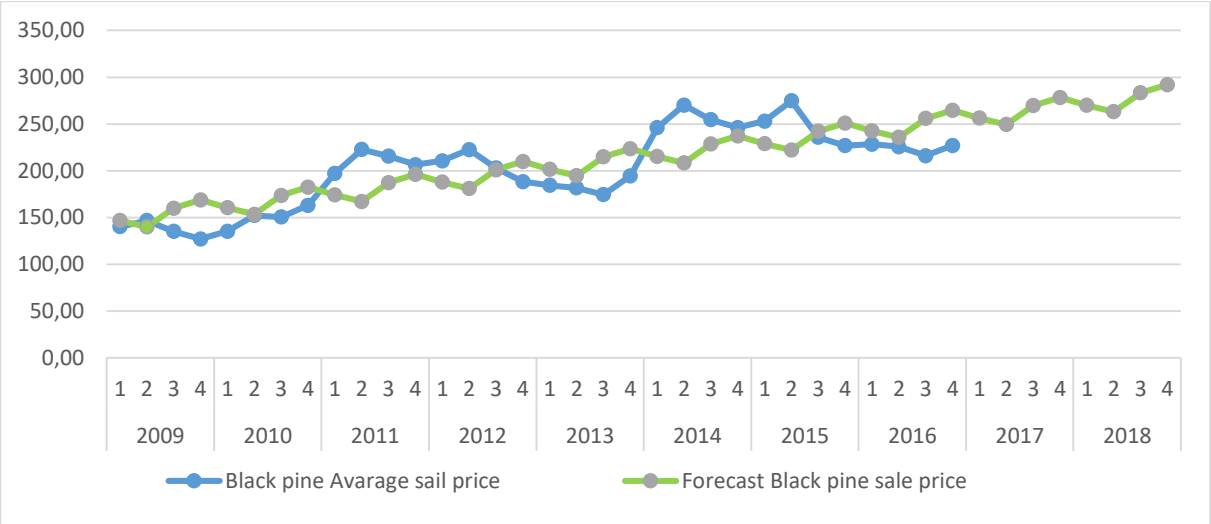

Figure 4 . Time Series of Black pine log sales.

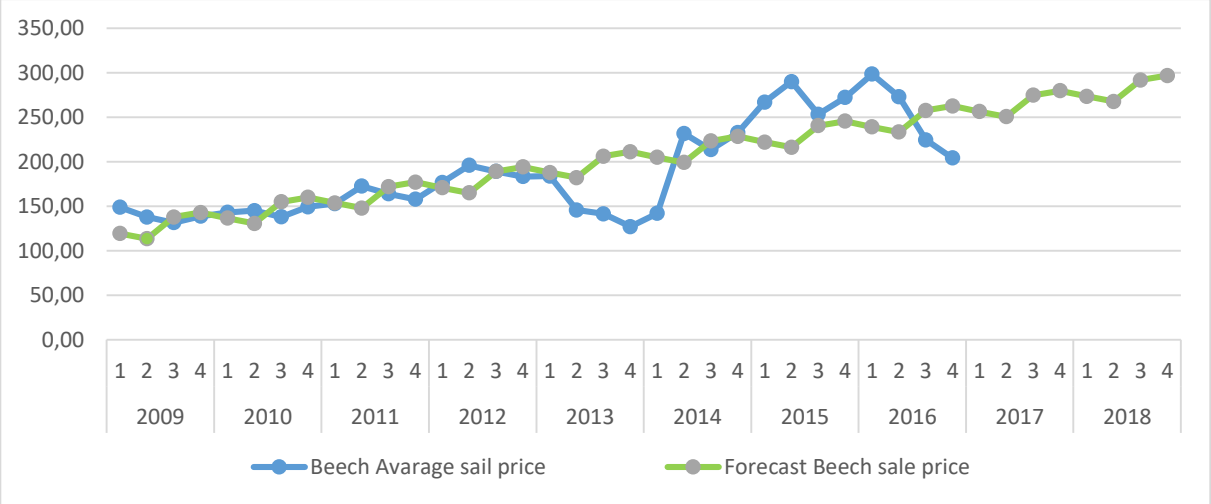

Figure 5. Time Series of Beech log sales

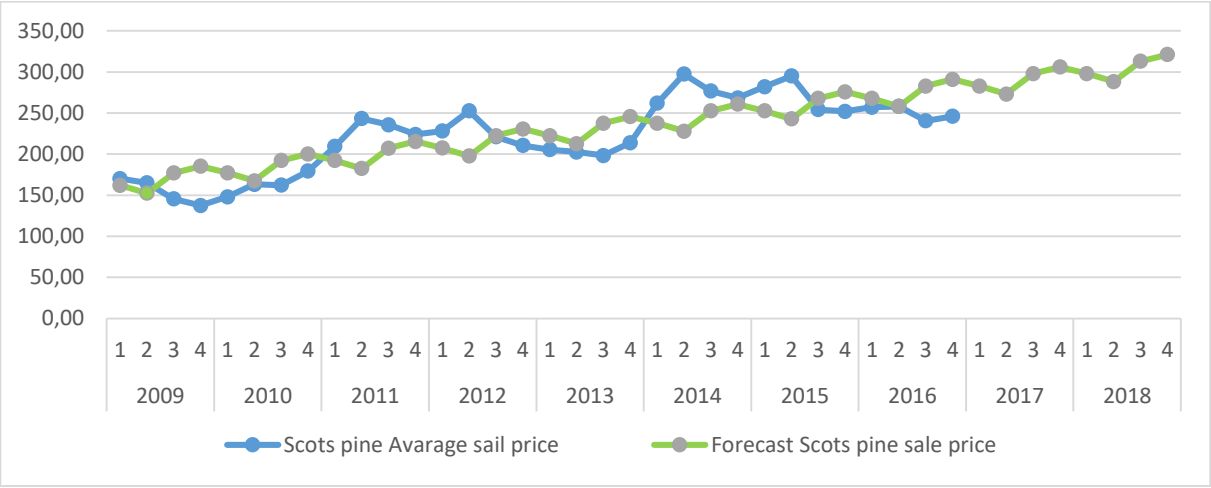

Figure 6.Time Series of Scots pine log sales

Tablo 3. CAD Method results for Fir and future price forecasts

				4 period MA							
Period (t)	Year	Quarter	Fir Avarege Prise (Yt)	Simple (MA)	Centered (Ct) (CMA)	S+I	Seasonal component (S_t)	Deseason alized price (CMAT)	Trend (Tt)	Forecast	Error2
1	2009	1	136,34				-0,71	137,05	147,60	146,89	111,2445
2		2	136,30				-16,64	152,94	151,85	135,20	1,199485
3		3	132,55	132,18	132,25	-0,30	4,12	128,43	156,10	160,22	765,8368
4		4	123,52	132,32	133,92	10,40	13,23	110,29	160,35	173,58	2506,401
5	2010	1	136,91	135,52	138,26	1,35	-0,71	137,62	164,60	163,89	728,1272
6		2	149,11	141,00	146,36	-2,75	-16,64	165,75	168,86	152,21	9,618489
7		3	154,47	151,73	160,83	6,36	4,12	150,35	173,11	177,23	518,0329
8		4	166,41	169,93	181,58	15,17	13,23	153,18	177,36	190,59	584,6991
9	2011	1	209,72	193,24	202,04	-7,68	-0,71	210,43	181,61	180,90	830,5688
10		2	242,34	210,84	216,95	-25,39	-16,64	258,98	185,86	169,22	5346,835
11		3	224,88	223,06	224,88	0,00	4,12	220,76	190,11	194,24	938,9987
12		4	215,31	226,69	227,54	12,23	13,23	202,08	194,37	207,60	59,48836
13	2012	1	224,24	228,39	227,85	3,62	-0,71	224,95	198,62	197,91	693,1642
14		2	249,12	227,32	225,14	-23,98	-16,64	265,76	202,87	186,22	3955,841
15		3	220,61	222,96	219,25	-1,36	4,12	216,49	207,12	211,24	87,73146
16		4	197,86	215,55	208,93	11,07	13,23	184,63	211,37	224,60	715,226
17	2013	1	194,62	202,30	197,53	2,91	-0,71	195,33	215,62	214,91	412,0319
18		2	196,12	192,76	191,62	-4,50	-16,64	212,76	219,88	203,23	50,56782
19		3	182,43	190,48	196,71	14,28	4,12	178,31	224,13	228,25	2099,479
20		4	188,74	202,94	214,18	25,44	13,23	175,51	228,38	241,61	2795,267
21	2014	1	244,49	225,41	237,69	-6,80	-0,71	245,20	232,63	231,92	157,8755
22		2	285,97	249,97	261,24	-24,73	-16,64	302,61	236,88	220,24	4320,737
23		3	280,68	272,51	277,03	-3,65	4,12	276,56	241,13	245,26	1254,814
24		4	278,91	281,56	283,37	4,46	13,23	265,68	245,39	258,62	411,8113
25	2015	1	280,67	285,18	282,15	1,48	-0,71	281,38	249,64	248,93	1007,635
26		2	300,47	279,11	275,16	-25,31	-16,64	317,11	253,89	237,24	3997,494
27		3	256,40	271,21	267,73	11,33	4,12	252,28	258,14	262,26	34,37746
28		4	247,28	264,25	258,93	11,65	13,23	234,05	262,39	275,62	803,3509
29	2016	1	252,84	253,62	250,78	-2,06	-0,71	253,55	266,64	265,93	171,4346
30		2	257,96	247,95	245,91	-12,05	-16,64	274,60	270,90	254,25	13,75785
31		3	233,71	243,87			4,12	229,59	275,15	279,27	2075,696
32		4	230,97				13,23	217,74	279,40	292,63	3801,959
33	2017	1					-0,71		283,65	282,94	80054,98
34		2					-16,64		287,90	271,26	73580,59
35		3					4,12		292,15	296,28	87779,7
36		4					13,23		296,41	309,64	95874,83
37	2018	1					-0,71		300,66	299,95	
38		2					-16,64		304,91	288,26	
39		3					4,12		309,16	313,28	
40		4					13,23		313,41	326,64	
SSE				41261,30081			MSE			1289,41565	

Tablo 4. CAD Method results for Black pine and future price forecasts.

				4 period MA							
Period (t)	Year	Quarter	Fir Avarege Prise (Yt)	Simple (MA)	Centered (Ct) (CMA)	S+I	Seasonal componen t (S_t)	Deseason alized price (CMAT)	Trend (Tt)	Forecast	Error2
1,00	2009	1	140,28				-1,98	142,27	148,71	146,73	41,5067
2,00		2	146,88				-12,29	159,17	152,14	139,84	49,50908
3,00		3	135,22	137,38	136,76	1,54	4,46	130,76	155,56	160,02	615,1942
4,00		4	127,12	136,15	136,82	9,70	9,81	117,31	158,99	168,80	1737,15
5,00	2010	1	135,39	137,48	139,41	4,02	-1,98	137,37	162,41	160,43	627,1198
6,00		2	152,21	141,33	145,82	-6,39	-12,29	164,50	165,84	153,54	1,780953
7,00		3	150,62	150,31	158,06	7,44	4,46	146,16	169,26	173,72	533,7902
8,00		4	163,02	165,80	174,62	11,60	9,81	153,21	172,69	182,50	379,4673
9,00	2011	1	197,36	183,43	191,56	-5,80	-1,98	199,34	176,11	174,13	539,4864
10,00		2	222,73	199,68	205,12	-17,62	-12,29	235,02	179,54	167,25	3078,55
11,00		3	215,61	210,55	212,20	-3,41	4,46	211,15	182,96	187,42	794,4116
12,00		4	206,51	213,86	213,85	7,34	9,81	196,70	186,39	196,20	106,2814
13,00	2012	1	210,57	213,84	212,25	1,68	-1,98	212,55	189,81	187,83	517,1556
14,00		2	222,67	210,67	208,41	-14,27	-12,29	234,96	193,24	180,95	1740,883
15,00		3	202,91	206,15	202,89	-0,03	4,46	198,45	196,66	201,13	3,184497
16,00		4	188,43	199,63	194,51	6,08	9,81	178,62	200,09	209,90	461,0255
17,00	2013	1	184,49	189,39	185,85	1,36	-1,98	186,47	203,51	201,53	290,3527
18,00		2	181,74	182,31	183,07	1,33	-12,29	194,03	206,94	194,65	166,5881
19,00		3	174,56	183,83	191,52	16,96	4,46	170,10	210,36	214,83	1621,373
20,00		4	194,54	199,20	210,26	15,72	9,81	184,73	213,79	223,60	844,617
21,00	2014	1	245,98	221,32	231,32	-14,66	-1,98	247,96	217,21	215,23	945,2225
22,00		2	270,20	241,32	247,77	-22,43	-12,29	282,49	220,64	208,35	3825,708
23,00		3	254,55	254,22	255,12	0,57	4,46	250,09	224,06	228,53	677,193
24,00		4	246,17	256,01	256,59	10,42	9,81	236,36	227,49	237,30	78,62213
25,00	2015	1	253,12	257,16	254,82	1,70	-1,98	255,10	230,92	228,93	585,0922
26,00		2	274,80	252,48	250,07	-24,73	-12,29	287,09	234,34	222,05	2782,722
27,00		3	235,83	247,67	244,57	8,74	4,46	231,37	237,77	242,23	40,93262
28,00		4	226,91	241,47	235,33	8,42	9,81	217,10	241,19	251,00	580,5151
29,00	2016	1	228,35	229,19	226,73	-1,62	-1,98	230,33	244,62	242,63	203,9788
30,00		2	225,66	224,27	224,29	-1,37	-12,29	237,95	248,04	235,75	101,7935
31,00		3	216,17	224,31			4,46	211,71	251,47	255,93	1580,75
32,00		4	227,04				9,81	217,23	254,89	264,70	1418,628
33,00	2017	1					-1,98		258,32	256,33	65706,56
34,00		2					-12,29		261,74	249,45	62225,34
35,00		3					4,46		265,17	269,63	72700,04
36,00		4					9,81		268,59	278,41	77509,6
37,00	2018	1					-1,98		272,02	270,03	
38,00		2					-12,29		275,44	263,15	
39,00		3					4,46		278,87	283,33	
40,00		4					9,81		282,29	292,11	
SSE (Total errors)					26970,58509			MSE (Avarage errors)		842,830784	

Tablo 5. CAD Method results for Beech and future price forecasts

				4 period MA							
Period (t)	Year	Quarter	Fir Avarege Prise (Yt)	Simple (MA)	Centered (Ct) (CMA)	S+I	Seasonal component (S_t)	Deseasonalized price (CMAT)	Trend (Tt)	Forecast	Error2
1,00	2009	1	148,89				-2,60	151,49	122,05	119,45	866,884
2,00		2	138,00				-12,64	150,64	126,33	113,69	591,0883
3,00		3	131,67	139,35	138,62	6,95	7,22	124,45	130,61	137,83	37,95628
4,00		4	138,83	137,89	138,78	-0,06	8,03	130,80	134,89	142,92	16,73049
5,00	2010	1	143,06	139,66	140,47	-2,59	-2,60	145,66	139,17	136,57	42,15508
6,00		2	145,08	141,29	142,60	-2,48	-12,64	157,72	143,45	130,81	203,6931
7,00		3	138,18	143,92	145,16	6,98	7,22	130,96	147,73	154,95	281,2687
8,00		4	149,36	146,40	149,85	0,49	8,03	141,33	152,01	160,04	114,0729
9,00	2011	1	152,99	153,30	156,53	3,54	-2,60	155,59	156,29	153,69	0,493514
10,00		2	172,66	159,75	160,82	-11,84	-12,64	185,30	160,57	147,93	611,6673
11,00		3	164,01	161,88	164,86	0,85	7,22	156,79	164,85	172,07	64,98401
12,00		4	157,88	167,83	170,75	12,87	8,03	149,85	169,13	177,16	371,745
13,00	2012	1	176,78	173,67	176,82	0,05	-2,60	179,38	173,41	170,81	35,60861
14,00		2	196,02	179,97	183,17	-12,85	-12,64	208,66	177,69	165,05	959,2468
15,00		3	189,22	186,36	187,27	-1,95	7,22	182,00	181,97	189,19	0,000814
16,00		4	183,42	188,18	181,91	-1,51	8,03	175,39	186,25	194,28	117,9589
17,00	2013	1	184,05	175,65	169,68	-14,37	-2,60	186,65	190,53	187,93	15,03814
18,00		2	145,91	163,70	156,67	10,76	-12,64	158,55	194,81	182,17	1314,678
19,00		3	141,43	149,63	144,38	2,95	7,22	134,21	199,09	206,31	4209,63
20,00		4	127,12	139,14	149,87	22,75	8,03	119,09	203,37	211,40	7103,302
21,00	2014	1	142,09	160,60	169,64	27,56	-2,60	144,69	207,65	205,05	3964,352
22,00		2	231,77	178,68	191,87	-39,90	-12,64	244,41	211,93	199,29	1055,036
23,00		3	213,74	205,07	220,69	6,95	7,22	206,52	216,21	223,43	93,93224
24,00		4	232,67	236,31	243,60	10,93	8,03	224,64	220,49	228,52	17,2118
25,00	2015	1	267,06	250,89	255,85	-11,21	-2,60	269,66	224,77	222,17	2015,264
26,00		2	290,07	260,82	265,78	-24,29	-12,64	302,71	229,05	216,41	5425,959
27,00		3	253,47	270,75	274,69	21,22	7,22	246,25	233,33	240,55	166,8731
28,00		4	272,39	278,64	276,53	4,14	8,03	264,36	237,61	245,64	715,4829
29,00	2016	1	298,62	274,42	270,82	-27,79	-2,60	301,22	241,89	239,29	3519,633
30,00		2	273,20	267,23	258,71	-14,49	-12,64	285,84	246,17	233,53	1573,781
31,00		3	224,70	250,19			7,22	217,48	250,45	257,67	1087,17
32,00		4	204,23				8,03	196,20	254,73	262,76	3425,959
33,00	2017	1					-2,60		259,01	256,41	65745,42
34,00		2					-12,64		263,29	250,65	62825,07
35,00		3					7,22		267,57	274,79	75510,9
36,00		4					8,03		271,85	279,88	78333,87
37,00	2018	1					-2,60		276,13	273,53	
38,00		2					-12,64		280,41	267,77	
39,00		3					7,22		284,69	291,91	
40,00		4					8,03		288,97	297,00	
SSE				40018,85739			MSE		1250,589293		

Tablo 6. CAD Method results for Scots pine and future price forecasts

Period (t)	Year	Quarter	Fir Avarege Prise (Yt)	4 period MA Simple (MA)	Centered (Ct) (CMA)	S+I	Seasonal component (S_t)	Deseasonalized price (CMAT)	Trend (Tt)	Forecast	Error2
1,00	2009	1	170,17				-1,44	171,61	163,52	162,09	65,34452
2,00		2	164,97				-14,98	179,95	167,30	152,32	160,1059
3,00		3	145,45	154,53	151,77	6,32	6,05	139,40	171,08	177,13	1003,552
4,00		4	137,54	149,00	148,79	11,25	10,37	127,17	174,85	185,22	2273,79
5,00	2010	1	148,05	148,58	150,67	2,62	-1,44	149,49	178,63	177,20	849,4582
6,00		2	163,27	152,77	158,00	-5,27	-14,98	178,25	182,41	167,43	17,2704
7,00		3	162,21	163,24	170,90	8,69	6,05	156,16	186,19	192,24	901,6774
8,00		4	179,42	178,56	188,57	9,15	10,37	169,05	189,96	200,33	437,3675
9,00	2011	1	209,34	198,58	207,76	-1,57	-1,44	210,77	193,74	192,30	290,037
10,00		2	243,34	216,94	222,52	-20,82	-14,98	258,32	197,52	182,53	3697,269
11,00		3	235,68	228,10	230,45	-5,23	6,05	229,63	201,30	207,35	802,7586
12,00		4	224,06	232,80	233,96	9,90	10,37	213,69	205,07	215,44	74,26312
13,00	2012	1	228,12	235,11	233,30	5,18	-1,44	229,56	208,85	207,41	428,7555
14,00		2	252,59	231,49	229,81	-22,78	-14,98	267,57	212,63	197,64	3019,075
15,00		3	221,19	228,13	225,31	4,12	6,05	215,14	216,40	222,46	1,602924
16,00		4	210,62	222,50	216,24	5,62	10,37	200,25	220,18	230,55	397,263
17,00	2013	1	205,58	209,98	207,11	1,53	-1,44	207,02	223,96	222,52	287,0534
18,00		2	202,54	204,24	204,64	2,10	-14,98	217,52	227,74	212,75	104,3044
19,00		3	198,21	205,04	212,08	13,87	6,05	192,16	231,51	237,57	1548,826
20,00		4	213,83	219,13	231,00	17,17	10,37	203,46	235,29	245,66	1013,182
21,00	2014	1	261,94	242,88	252,69	-9,24	-1,44	263,37	239,07	237,63	590,6498
22,00		2	297,53	262,51	269,34	-28,19	-14,98	312,51	242,85	227,86	4853,628
23,00		3	276,75	276,18	278,70	1,95	6,05	270,70	246,62	252,67	579,6447
24,00		4	268,49	281,22	280,91	12,42	10,37	258,12	250,40	260,77	59,60489
25,00	2015	1	282,10	280,60	277,79	-4,32	-1,44	283,54	254,18	252,74	861,9642
26,00		2	295,05	274,97	272,92	-22,13	-14,98	310,03	257,95	242,97	2712,214
27,00		3	254,25	270,87	267,74	13,49	6,05	248,20	261,73	267,78	183,1489
28,00		4	252,07	264,62	260,01	7,94	10,37	241,70	265,51	275,88	566,8514
29,00	2016	1	257,10	255,40	253,69	-3,41	-1,44	258,53	269,29	267,85	115,6665
30,00		2	258,18	251,98	251,23	-6,95	-14,98	273,16	273,06	258,08	0,009973
31,00		3	240,58	250,48			6,05	234,53	276,84	282,89	1790,332
32,00		4	246,06				10,37	235,69	280,62	290,99	2018,498
33,00	2017	1					-1,44		284,40	282,96	80065,74
34,00		2					-14,98		288,17	273,19	74632,34
35,00		3					6,05		291,95	298,00	88804,82
36,00		4					10,37		295,73	306,10	93695,23
37,00	2018	1					-1,44		299,50	298,07	
38,00		2					-14,98		303,28	288,30	
39,00		3					6,05		307,06	313,11	
40,00		4					10,37		310,84	321,21	
SSE				31705,16823			MSE			990,7865071	

4. Discussion

CAD Method was used to determine the seasonal effect on the auction sale prices of third class fir, black pine, beech and Scots pine, which the KRDF realized between 2009 and 2016. When the results obtained are evaluated autumn and winter months have a negative effect on the auction sales prices of these four tree species while spring and summer months have a positive effect. While black pine is the species whose price fell the most in autumn, fir is the species whose price fell the most in winter. It was also determined that the species whose price rose the most in spring is black pine while fir in summer (Table 7).

Tablo 7. Seasonal impact rates on timber prices.

3rd Class Normal Length	**Seasonal effect on auction price (%)**			
	Autumn	**Winter**	**Spring**	**Summer**
Fir Log	- 0.71 %	- 16.64 %	+ 4.12 %	+ 13.23 %
Black Pine Log	- 2.60 %	- 12.64 %	+ 7.22 %	+ 8.03 %
Beech Log	- 1.98 %	- 12.29 %	+ 4.46 %	+ 9.81 %
Scots Pine Log	- 1.44 %	- 14.98 %	+ 6.05 %	+ 10.37 %

One of the main factors affecting the timber prices in the KRDF is time of timber production planning (cutting,

ground skidding, transport). Production planning begins with the melting of snow and the climatic conditions hotter than winter (spring and summer). Another factor is that factories and industries that process large-scale wood raw materials in Kastamonu and its vicinity increase their production capacities in spring and summer. Therefore, competition intensifies at times when the raw material industry operates the most, and raw material prices rise in the SFEs which are monopolies. Another factor affecting the price formation is that because the forest area of the KRDF is rugged, cutting, skidding and transportation can only be done in spring and summer when the snow has melted, and the climatic conditions are relatively better. In addition, high transport costs can be specified as another element that encourages the purchase in the summer months. It can be said that all of these factors are effective in increasing the prices, especially in spring and summer.

A study in Bartın and Yenice state forest enterprises similarly determined that spring and summer months have a positive effect on beech log prices (Daşdemir, 2008). Similar results were obtained in a study conducted in the middle southern part of the United States. Timber prices fall due to availability of stocks in dry weather and as a result, there is no impact on timber prices in Texas in the first quarter, while in the second and third quarters, lumber prices were reported to have fallen between 4% and 6% in Louisiana, Mississippi and Arkansas (Parajul et al., 2016).

On the other hand, some of the studies that were conducted revealed results in contrast to those of the KRDF. A study in Bucak, Gazipaşa, Mersin, Mut, Silifke and Tarsus forest enterprises showed that the prices rose especially during the autumn and winter seasons. In a study conducted in Japan's Sugi and Hinoki regions, it was determined that the timber prices fell during the spring and summer but rose during the autumn and winter months. The most important reason for this is stated as the construction of wooden houses. The prices rising with raw material purchases in autumn and summer begin to fall with the decline of construction work in spring and summer (Michinaka et al., 2016). A study conducted in Germany also obtained findings which are contrary to the findings of this study. This study noted that low temperatures reduced the timber prices (Zwirglmaier, 2010.)

According to the analysis results made, in KRDF, the highest price of the third-class normal size fir price was estimated at 292.11 TL (71,4 $), the price of black pine timber at 282,79 TL (69,1 $), the price of beech timbers at 297.0 TL (72,6 $) and the price of Scots pine timbers at 321.21 TL (78,5 $) in 2018.

4. Conclusions

Timber prices are affected differently by the seasonal effect in different regions. Therefore, these studies should be carried out for each regional directorate or each forestry department and the effects on price formation should be revealed. In this way, both production planning, pricing, and sales-marketing activities can be more efficient and more profitable sales can be made.

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