Full Length Research paper

Forecasting Turkey's Lumber Industry: an analysis

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In this study, models are established and projections are developed for production, import and export of Turkish Lumber manufacturing industry by econometric method. Parameters of the econometric modeling rest on time series of past 25 years and projection was made for the next 15 years around on basis of a variety of reasonable assumption and scenarios. For establishment of the most appropriate regression models for the projection operations, while the production, import and export were dealt with as dependant variables, the industrial wood sales by General Directorate of Forestry (m^3), gross national product per capita, population, building area (m^2) as per occupancy permit, construction materials price index, economic growth, consumer price index, producer price index and foreign exchange were used as independent variables, all of which are considered to be effective in the production, import and export quantities of the forest industry products.

Keywords: Lumber trade, production, import, export, regression analysis.

INTRODUCTION

The purpose of the economy to meet human needs. Forestry tries to resolve people's forest products needs constantly and with the most favorable conditions. Wood raw material obtained from the forests always and under every condition occupies an important place in human economic life. Similarly, the importance of logging industry in human life can not be denied (CAEA, 2005).

It is observed that the sawmills were established without taking into consideration important factors such as market needs, capacity, forests yield power as a technology and product type. Therefore the desirable quality and required delivery time of raw material demand of the sector can not be met. However, as part of the free market economy, with Turkey's international trade and world markets integration, this shortage decreases rapidly. Especially in recent years, imports of raw material from Russian and Turkic Republics with lower prices showed a positive effect in log trade industry as well as in lumber industry.

Timber industry in Turkey is the oldest branch of the

forest products industry dates back to 15th century. Timber needs were provided using water powered saw mills or hand saws until the end of the 19th century. Steam powered gang saw mill was first established in Zeytinburnu, Istanbul in 1992. The latest inventory study about the current situation of lumber industry of Turkey was carried out in 1981.

According to this study, lumber industry is composed of many different capacity enterprises from small workshops to integrated mills (Forest Industry Inventory, 1982). In the inventory, 6351 lumber manufacturing facility were determined and the total capacity per shift was determined as 9,262,000 m³ logs/year. Moreover, there were 1609 small sized enterprises working only two or three months in a year and usually used for providing personal lumber needs. Their capacity is determined as 1 million m³ logs/year. Thus, the total number of private owned timber industry factories reaches to 7960, and their annual capacity is 10.7 million m³. In the following years, the number of plants was up to 8887. The total installed public and private sector lumber manufacturing capacity is calculated to be 12.9 million m³/year.

In this case, the average plant capacity was found to be 1500 m³/year. 5000 m³/year capacity plant is considered large in European Union countries. 7% of the total

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Table 1. The production, export and import amounts of timber in Turkey (m^3) (FAO, 2008).

Years	Production	Export	Import	Years	Production	Export	Import
1982	4424000	43400	2800	1995	4331000	154000	180700
1983	4343000	91200	2800	1996	4268000	23000	191000
1984	4923000	72800	22300	1997	3833000	28000	168000
1985	4923000	47900	54000	1998	4891000	15000	266000
1986	4923000	16500	31000	1999	5039000	36000	307000
1987	4923000	68100	228400	2000	5528000	43000	312000
1988	4923000	68900	75200	2001	5036000	168000	178000
1989	4923000	35200	19400	2002	5579000	158562	196000
1990	4923000	43200	26100	2003	5615000	99714	236363
1991	4928000	43200	26100	2004	6215000	57000	372953
1992	4891000	48348	39026	2005	6445000	122010	469350
1993	5241000	52300	148333	2006	6471000	44000	626000
1994	4037000	131700	107400				
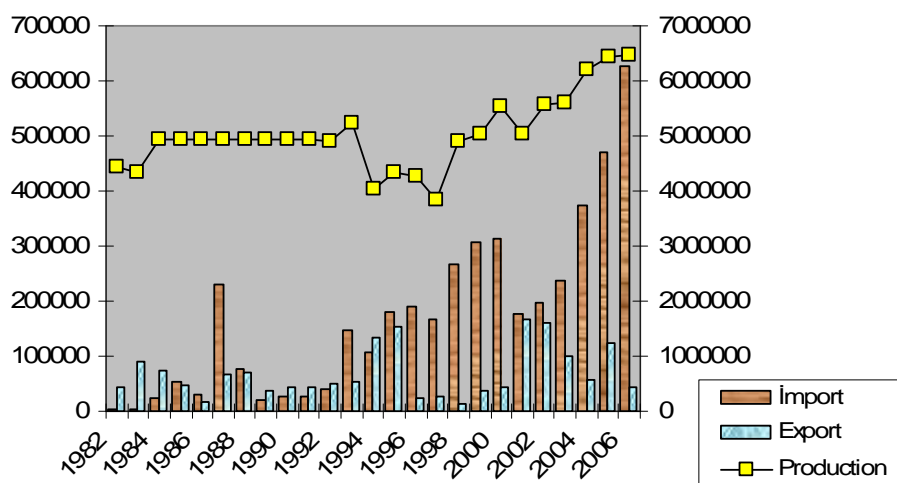
Figure 1. The production, export and import amounts of timber in Turkey (FAO, 2008).

number of facilities in these countries is large plants and at the same time they have the 65% of the total sawing capacity. Between 1990 and 1998, the share of timber forest products industry in foreign trade averaged 10.1% in exports, while imports are around 8.7% (Çabuk, 2006).

As of the end of 2007, it was reported that there were 684 lumber manufacturing enterprises registered to Turkish Association of Chambers and Exchanges (TOBB) database and their installed capacity is 8,425,458 m^3/year. Based on the number of enterprises, lumber manufacturers makes 70% of the total forest products industry, and 43% in terms of contribution to employment. 95% of the enterprises are small scale (TOBB, 2007). As shown in Table 1 and Figure 1, in Turkey, the amount of timber production in 1982 to 1983 was about 4,300,000 m^3 and between the years 1984 to 1992 it was about 4,900,000 m^3. In 1993, the production reached 5,200,000

m^3 and then fell to 4,200,000 m^3 between 1994 and 1998. Between 1999 and 2006, it gradually increased to 6,741,000 m^3. Between 1982 and 1993, the amount of lumber exports was between 15000 and 90000 m^3 and it increased to 140000 m^3 between 1994 and 1995. After that, it decreased significantly from 1996 to 2000 down to 30,000 m^3. The export amount reached maximum in 2002 with 168,000 m^3 and fell again in 2006 to 44000 m^3. The amount of imports in the years 1982 to 1983 was 2800 m^3. In 1997 this amount increased to 228000 m^3 and then fell to 39026 m^3 from 1988 to 1992. From 1993 to 2006, it gradually increased to 626000 m^3.

At the same table, the maximum production level was 6,471,000 m^3 in 2006 and the minimum was 3,800,000 m^3 realized in 1997. In 1982 the production amount was 4,424,000 m^3 and in 1993 it increased by 18.5% and reached 5,241,000 m^3. Later, this amount gradually

Table 2. Population, GNP and GDP of Turkey (TUIK, 2008).

Years	Population (000)	Per Capita TL	GNP $	Per Capita TL	GDP $	Years	Population (000)	Per Capita TL	GNP $	Per Capita TL	GDP $
1982	46,688	227,293	1,375	224,730	1,360	1995	61,644	127,423,385	2,759	125,923,952	2,727
1983	47,864	291,096	1,264	290,528	1,261	1996	62,697	238,896,076	2,928	235,611,117	2,888
1984	49,070	451,758	1,204	448,281	1,195	1997	62,480	470,442,977	3,079	461,522,054	3,021
1985	50,306	702,706	1,330	697,640	1,320	1998	63,459	843,358,573	3,255	822,976,986	3,176
1986	51,433	995,174	1,462	993,124	1,459	1999	64,345	1,216,609,421	2,879	1,203,124,428	2,847
1987	52,561	1,427,282	1,636	1,421,623	1,629	2000	67,461	1,861,759,072	2,965	1,846,747,873	2,941
1988	53,715	2,404,824	1,684	2,405,743	1,685	2001	68,618	2,571,977,513	2,123	2,600,082,172	2,146
1989	54,893	4,196,709	1,959	4,141,220	1,933	2002	69,626	3,950,138,827	2,598	3,986,643,746	2,622
1990	56,203	7,066,839	2,682	6,993,580	2,655	2003	70,712	5,044,135,199	3,383	5,087,720,980	3,412
1991	57,305	11,070,462	2,621	10,995,846	2,603	2004	71,789	5,974,903,440	4,172	5,996,900,319	4,187
1992	58,401	18,897,021	2,708	18,721,735	2,682	2005	72,065	6,749,476,615	5,008	6,760,596,160	5,016
1993	59,491	33,573,525	3,004	33,313,730	2,981	2006	72,974	7,890,261,766	5,477	7,897,637,938	5,482
1994	60,576	64,182,233	2,184	63,860,757	2,173						

decreased to 3.833.000 m^3 in 1997 with 26.86% decrease. The production amount has shown some increase between 1998 and 2006, and at the end of 2006, it was 6.471.000 m^3 with 68.8% increase compared to 1997.

However, lumber export was the highest (168,000 m^3) in 2001 and the lowest (15000 m^3) in 1998. In 1982, it was 43,400 m^3 and it fluctuated in 1993 and in 1994 it increased by 203% and reached 131700 m^3. In 1995, it was up to 154000 and then fell to 15,000 m^3 being the lowest in 1998. In subsequent years, the export increased by 1020% in 2001 to 168000 m^3 and fell again in 2006 to 44000 m^3 with 73.8% decrease. On the other hand, the import was 2,800 m^3 in 1982 and it increased by 8042% and reached 228000 m^3 in 1987. However, it decreased to 19400 m^3 in 1989 with 91.4% decrease. Between 1990 and 2006, import of lumber increased and in 2006 compared to 1989 it increased by 3126% and reached it highest level at 626000 m^3.

MATERIALS AND METHODS

Model building and regression analysis

The basic econometric method used in this study is multiple regression modeling. In this method, the aim is to show relationship of one dependant variable and multiple independent (explanatory) variables over some certain past period and, accordingly, to make projections on present and future quantity of a dependant variable at an acceptable confidence level.

For the establishment of the most appropriate regression models for the projection operations, while the lumber production, import and export were dealt with as dependant variables, the industrial wood sales (m^3) from General Directorate of Forestry (OGM), gross national product per capita (TL and USD, separately), population, number of buildings by area (m^2) as per the occupancy permit; number of buildings constructed as per the occupancy permit, inflation rate [on annual consumer price index (CPI) and producer price index (PPI) basis], exchange rates (USD), economic growth rate, construction materials price index, gross domestic product per capita, timber sales (m^3) by General Directorate of Forestry (TL and USD, separately) were used as independent variables,

all of which are considered to be effective in the production, import and export quantities of the forest industry products. Parameters of the econometric modeling rest on time series of past 25-years and projection was made for the next 15 years around on basis of a variety of reasonable assumption and scenarios.

The data in question were obtained either by direct access to or via websites of Turkish Statistics Institute (TUIK), Undersecretariat of Foreign Trade (DTM), State Planning Organization (DPT), Export Development Center, Ministry of Industry and Trade (IGEME), World Agricultural organization (FAO), Forest Certification Council (FSCC), and General Directorate of Forestry (OGM). Furthermore, some information and document of the organizations operating in the sector, the records of TOBB and websites of the organizations and enterprises having direct or indirect relation to the subject of the study were all used. 25 years (1982 to 2006) data on the aforementioned independent and dependant variables are organized in independent variables (Table 2, 3 and 4) and transferred to the computer environment for multiple regression analysis to be conducted at SPSS statistical package program. Information about calculations made for missing or unavailable data are given under the tables.

In Table 1, the data set formed by the production, export

Table 3. The industrial wood and Log sales by General Directorate of Forestry, number of buildings by area and number of buildings constructed as per the occupancy permit and Exchange Rates ($) of Turkey (OGM, 2008; TUIK, 2008).

Years	Log (000m³)	Industrial Wood (000m³)	Buildings Number of building	Permits Area	Annual Exchange Rates ($)	Years	Log (000m³)	Industrial Wood (000m³)	Buildings Number of building	Permits Area	Annual Exchange Rates ($)
1982	4,066	5,821	*45,995	22,945,123	164.07	1995	3,578	8,046	137,905	83,956,863	46,558.58
1983	3,945	6,665	58,968	25,554,984	228.14	1996	3,172	7,528	126,722	78,477,686	83,043.91
1984	4,078	7,596	63,153	28,887,793	369.75	1997	2,845	6,974	126,956	83,388,824	165,170.83
1985	3,892	7,407	71,844	37,251,360	522.91	1998	2,817	7,051	116,235	78,568,789	264,183.08
1986	3,746	7,570	102,888	55,624,440	676.56	1999	2,833	7,066	92,469	62,761,914	427,202.08
1987	3,687	7,251	138,155	70,912,137	866.08	2000	3,007	7,329	79,140	61,694,941	628,804.5
1988	3,572	7,447	139,995	67,861,304	1,448.46	2001	2,738	6,778	77,430	57,449,494	1,245,609.58
1989	3,393	7,460	136,015	62,923,939	2,137.81	2002	3,297	8,005	47,242	36,187,021	1,517,018.41
1990	3,310	6,581	123,304	60,083,035	2,634.47	2003	2,827	7,320	53,843	45,516,030	1,493,827.91
1991	3,159	6,513	121,486	61,447,817	4,264.53	2004	3,065	8,253	75,495	69,719,611	1,421,467.33
1992	3,353	6,897	137,990	73,062,016	6,994.97	2005	2,936	8,100	114,254	106,424,587	**1,344,966.66
1993	3,199	7,010	147,033	85,080,806	11,193.6	2006	3,480	9,299	114,204	122,909,886	**1,433,958.33
1994	2,939	6,712	143,281	81,715,801	30,266.88						

*, The calculation is based on 22% being the average of three year increase on the number of buildings; **, the US$ and Turkish Lira exchange rates were ignored for 2005 and 2006 US$ rates.

and import figures about the lumber industry is the statistics of the dependant variables used in the regression model of this study. By help of this data set of past 25 years (1982 to 2006), the projection values for the next 15 years were calculated. Production, export and import values of the lumber industry were verified comparatively from the records of TUIK, FAO and OGM. This study lasted long because the products in the records held by TUIK are quite in a mess with the products given by items and divided to sub-branches. The working team sorted out and classified these data and obtained the annual data by gathering the items related to the product and, finally, compared accuracy of the resulting figures with data from FAO, However, as FAO data were simpler and more appropriate for the study, these values were used and shown as reference here. For missing values and other equivocal cases, the accessible OGM records were used.

Furthermore, the economic growth rate (%), one of the independent variables given in independent variables has caused some difficulties with the fixed prices and gross national product per capita (TL) in all models. It was considered that the reason is that, it both causes multiple linear connection when the economic growth rate (%) that may replace these variables is used together with current prices and gross national product per capita ($), and it is expressed by very high figures, thus the coefficients in the equations appear as zero. Consequently, when searching appropriate model, the said variables were not used together, but individually and the significant and valid variable out of them has taken its place in the model.

FINDINGS

Regression analysis results of lumber industry (production-import- export)

Lumber production

As it may be seen from the summary (Table 5), the regression model built with one independent

(CPI) variable is valid and significant. The resulting coefficient of determination (r^2) is sufficiently high, and F statistical values show the models are valid and relationship between the dependant variable and independent variables is significant at significance level of $\alpha = 0.05$. Here, $r^2 = 0.707$ is a very high coefficient of determination. This figure indicates that the selected independent variable (CPI) express the lumber production around 71%, demonstrating that structure of the linear model is appropriate. Below other results of the solution, ANOVA (Table 6), coefficients (Table 7) and dispersion graphic (Figure 2) of the model are given.

Lumber import

As it may be seen from the coefficients (a) (Table

Table 4. Annual CPI, PPI, economic growth rate and construction materials price index of Turkey (TUIK, 2008).

Years	The base year 1978 CPI (%)	The base year 1981 PPI (%)	Economic growth rate (%) constant prices	Economic growth rate (%) current prices	Construction materials price index (1968 = 100)
1982	410.29	127.05	0.6	29.0	3882
1983	539.00	165.68	1.7	28.1	5441
1984	799.95	249.13	4.5	55.2	7878
1985	1159.63	356.79	1.7	55.5	12525
1986	1560.98	462.25	4.4	41.6	16916
1987	2167.51	610.40	7.5	43.4	23075
1988	3800.95	1027.30	-0.7	68.5	38744
1989	6447.44	1741.99	-0.6	74.5	62699
1990	10547.15	2741.10	6.8	68.4	91729
1991	17503.32	4260.36	-1.6	56.7	152580
1992	30052.64	7051.58	4.4	70.7	246594
1993	50392.45	11545.97	6.2	77.7	406756
1994	106102.03	25212.55	-7.8	91.2	887488
1995	206323.49	47528.46	6.1	98.5	1511717
1996	366475.34	84934.70	5.3	87.5	2765327
1997	672724.15	153300.04	8.7	96.9	5104892
1998	1225733.19	260825.50	2.3	79.3	8538854
1999	1943577.71	398121.90	-7.4	44.3	12277603
2000	2960721.26	600952.65	1.4	53.0	18851834
2001	4545059.66	998582.63	-11.1	38.1	31567385
2002	6733431.01	1510984.00	6.4	53.6	45494981
2003	8506320.48	1871847.92	4.2	27.7	**56359182
2004	9208409.60	2099693.40	8.2	18.5	**63218094
2005	10136772.60	2260856.62	7.2	13.0	**68066921
2006	*11657288.49	*2599985.11	4.6	16.9	**78276959

*, The increase rate of the last three year was found to be 15% and the 2006 values were calculated according to this rate; ****,** PPI was calculated according to last four years increase rates (23, 88, 12, 17, 7, 67 and 15% respectively).

Table 5. Model Summary (b).

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	0.841(a)	0.707	0.695	371939.17269

[a]Predictors: (Constant), CPI. [b]Dependent variable, LUMBERPRODUCT.

Table 6. ANOVA (b).

Model		Sum of squares	df	Mean Square	F	Sig.
	Regression	7692693751827.180	1	7692693751827.180	55.608	0.000(a)
1	Residual	3181791208172.810	23	138338748181.427		
	Total	10874484959999.990	24			

[a]Predictors: (Constant), CPI.[b]Dependent variable: LUMBERPRODUCT.

7), regression equation for the lumber production shall be as follows (model 1)

$$Y = 4671744.268 + 0.150 \text{ CPI.}$$

As it may be seen in the summary (Table 8) given, both regression models, one built with one independent variable gross national product per capita (GNP), and the other with two independent variables (GNP, OGM WOOD

Table 7. Coefficients (a).

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	4671744.268	88050.128		53.058	0.000
	CPI	0.150	0.020	0.841	7.457	0.000

[a]Dependent variable: LUMBERPRODUCT.

Scatterplot
Dependent variable: Lumberproduct
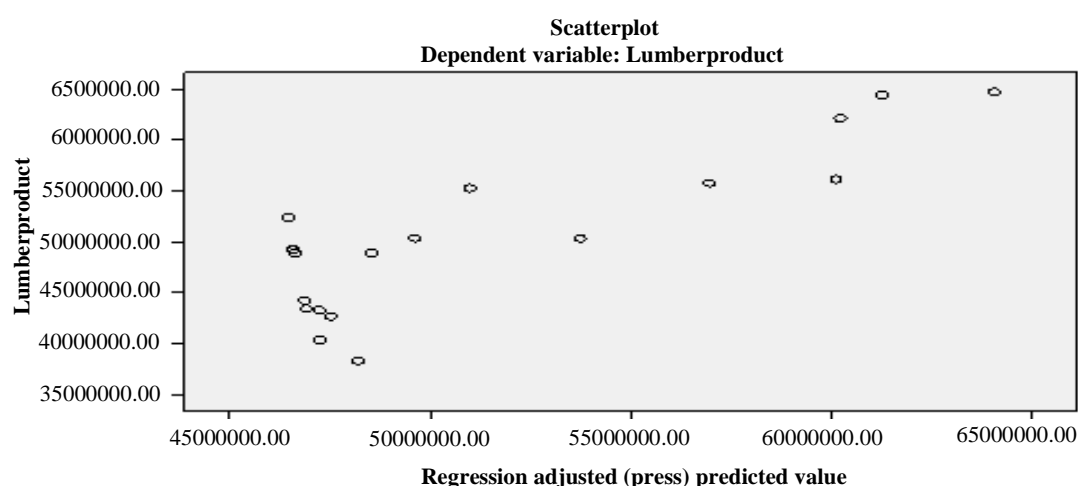
Figure 2. The scatter diagram of lumber production.

Table 8. Model summary (c).

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.865(a)	0.748	0.737	81085.63965
2	0.896(b)	0.803	0.785	73386.35841

[a]Predictors: (Constant), GNP$; [b]Predictors: (Constant), GNP$, OGMSALES; [c]Dependent variable: LUMBERIMPORT.

SALES) are valid and significant, that is, usable for projection. The reason is that it indicates that the coefficient of determination (R square) (r^2) is quite high is high in both regression models and F statistical values are significant when the models are valid or when the relationship between the dependant variable and independent variable is significant at $\alpha = 0.05$. However, in this case of projection, the regression model with two independent variables (GNP, OGM WOOD SALES) shall be used. Here, $r^2 = 0.803$ is a very high coefficient of determination. This figure indicates that the selected independent variables express the lumber import around 80%, demonstrating that structure of the linear model is appropriate. Below other results of the solution, ANOVA (Table 9), coefficients (Table 10) and dispersion graphic

(Figure 3) of the model are given. As it may be seen from the coefficients (a) Table 10, regression equation for the lumber import shall be as follows (model 2) Y = -570403.584 + 99.899 GNP$ + 65.574 OGM WOOD SALES)

Lumber export

As it may be seen in the summary (Table 11) given, both regression models, one built with one independent variable (FOREIGN EXCHANGE), and the other with two independent variables (FOREIGN EXCHANGE, GNP) are valid and significant, that is, usable for projection. The reason is that, it indicates that the coefficient of

Table 9. ANOVA[(c).]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	449852885983.475	1	449852885983.475	68.420	.000(a)
	Residual	151222262034.525	23	6574880958.023		
	Total	601075148018.000	24			
2	Regression	482592880810.452	2	241296440405.226	44.804	.000(b)
	Residual	118482267207.548	22	5385557600.343		
	Total	601075148018.000	24			

[a]Predictors: (Constant), GNP$; [b]Predictors: (Constant), GNP$, OGMSALES; [c]Dependent Variable: LUMBERIMPORT.

Table 10. Coefficients[(a).]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	-155805.701	42758.215		-3.644	0.001
	GNP$	124.452	15.046	0.865	8.272	0.000
2	(Constant)	-570403.584	172547.928		-3.306	0.003
	GNP$	99.899	16.870	0.694	5.922	0.000
	OGMSALES	65.574	26.596	0.289	2.466	0.022

[a]Dependent variable: LUMBERIMPORT.
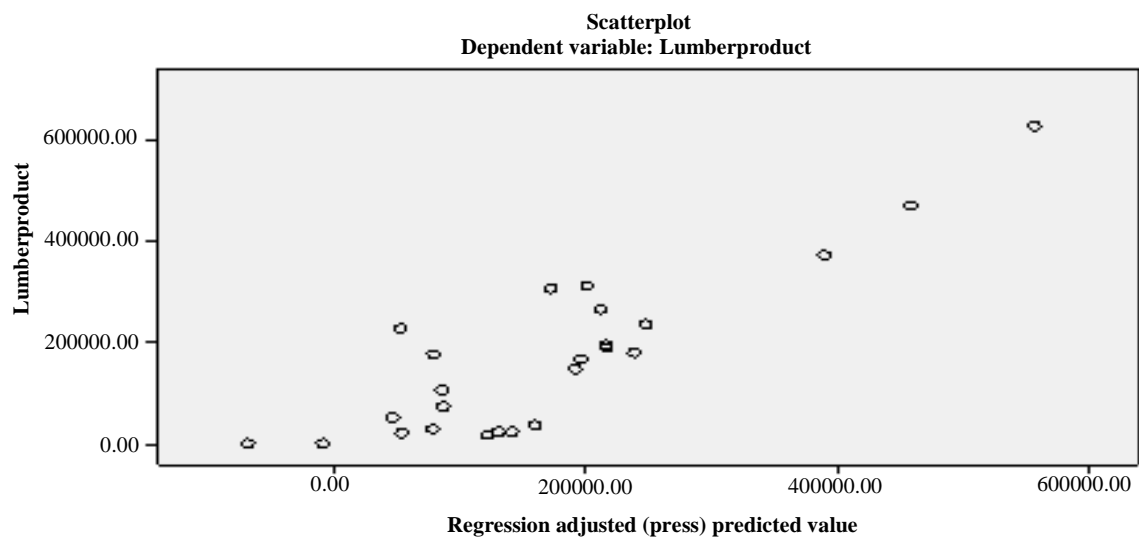
Figure 3. The scatter diagram of lumber import.

Table 11. Model summary (c).

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.429(a)	0.184	0.148	41914.04975
2	0.570(b)	0.325	0.264	38973.39802

[a]Predictors: (Constant), EXCHANGE$; [b]Predictors: (Constant), EXCHANGE $, GNP$; [c] Dependent variable: LUMBEREXPORT.

Table 12. ANOVA (c).

Model		Sum of squares	df	Mean square	F	Sig.
	Regression	9109170857.724	1	9109170857.724	5.185	0.032(a)
1	Residual	40406114020.036	23	1756787566.089		
	Total	49515284877.760	24			
	Regression	16098918301.967	2	8049459150.984	5.299	0.013(b)
2	Residual	33416366575.793	22	1518925753.445		
	Total	49515284877.760	24			

[a]Predictors: (Constant), EXCHANGE$; [b]Predictors: (Constant), EXCHANGE$, GNP$; [c]Dependent variable: LUMBEREXPORT.

Table 13. Coefficients [a.]

Model		Unstandardized Coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta	B	Std. Error
1	(Constant)	55209.014	10200.009		5.413	0.000
	EXCHANGE $	0.033	0.014	0.429	2.277	0.032
2	(Constant)	99546.372	22740.653		4.377	0.000
	EXCHANGE $	0.058	0.018	0.764	3.255	0.004
	GNP$	-20.797	9.695	-0.504	-2.145	0.043

[a]Dependent variable: LUMBEREXPORT.

determination (R square) (r^2) is quite high is high in both regression models and F statistical values are significant when the models are valid or when the relationship between the dependant variable and independent variable is significant at α = 0.05. However, in this case of projection, the regression model with two independent variables (FOREIGN EXCHANGE, GNP) shall be used. Here, the value of $r^2 = 0.325$, may seem low compared to other models, is a sufficient coefficient of determination. Below other results of the solution, ANOVA (Table 12), coefficients (Table 13) and dispersion graphic (Figure 4) of the model are given. As it may be seen from the coefficients (a) Table 13, regression equation for the lumber export shall be as follows (model 2)
Y = 99546.372 + 0.058 FOREIGN EXCHANGE$ - 20.797 GNP$.

Calculation of the estimated value of the independent variables in the projection models

In the estimated values of the independent variables (Tables 14, 15, 16 and 17), the independent variables of POPULATION, OGM WOOD SALES, FOREIGN EXCHANGE, CPI, PPI, PRICE INDEX, BUILDING AREA, NUMBER OF BUILDINGS, GNP and ECONOMIC GROWTH are projected by years (x), using the data for the period of 1982 to 2006 by help of regression analysis. For the said projection, the following regression

equations were found and these equations were used for the calculations (Table 18).

Lumber production, export and import projection values in Turkey

In Table 19, Turkish lumber production, export and import projection values are given for the period of 200 to 2021.

These values were obtained by putting in place the estimated values of the valid and significant independent variables build for these equations for the period of 2007 to 2021 in the equation found as a result of regression analysis conducted for the lumber production, export and import values previously for the period of 1982 to 2006. In the projection, the following regression models were used with the results as follows:

For Lumber Production; Y= 4671744.268 + 0.150 CPI

For Lumber Import; Y= –570403.584 + 99.899 GNP$ +65.574 OGM WOOD SALES

For Lumber Export; Y= 99546.372 + 0.058 FOREIGN EXCHANGE$ – 20.797 GNP$

CONCLUSION AND RECOMMENDATIONS

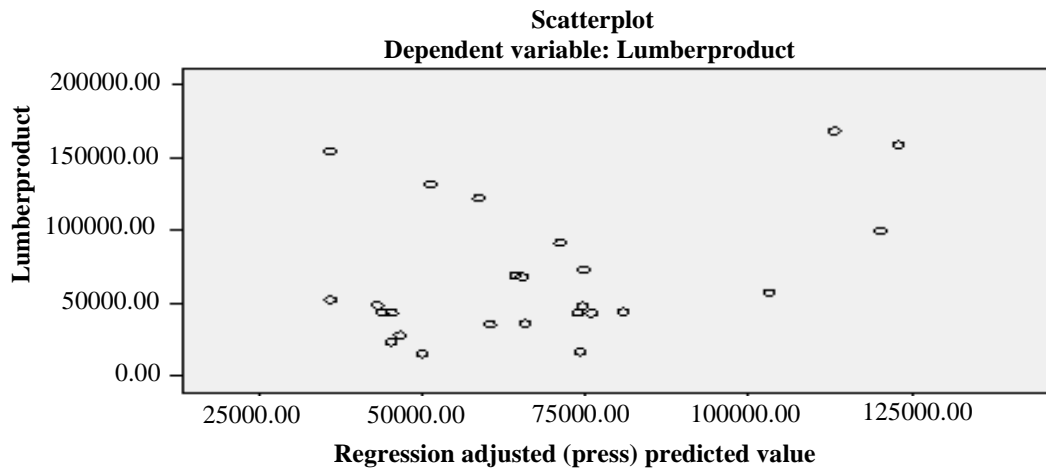In the regression analyses performed for projection of

Figure 4. The scatter diagram of lumber export.

Table 14. The estimated values of the independent variables between the years of 2007 to 2021 (Population, OGM wood sales, foreign exchange).

Years	Population (000) person	OGM wood sales (m³)	Foreign exchange (USD$)	Years	Population (000)person	OGM wood sales (m³)	Foreign exchange (USD$)
2007	74609.64	7970.756	1286324.672	2015	83443.24	8379.124	1828467.128
2008	75713.84	8021.802	1354092.479	2016	84547.44	8430.170	1896234.935
2009	76818.04	8072.848	1421860.286	2017	85651.64	8481.216	1964002.742
2010	77922.24	8123.894	1489628.093	2018	86755.84	8532.262	2031770.549
2011	79026.44	8174.940	1557395.900	2019	87860.04	8583.308	2099538.356
2012	80130.64	8225.986	1625163.707	2020	88964.24	8634.354	2167306.163
2013	81234.84	8277.032	1692931.514	2021	90068.44	8685.400	2235073.970
2014	82339.04	8328.078	1760699.321				

Table 15. The estimated values of the independent variables between the years of 2007 to 2021 (CPI, PPI, price index).

Years	CPI	PPI	Price Index	Years	CPI	PPI	Price Index
2007	13886464	1719991	52165111.15	2015	17214102	2459845	74568501.25
2008	14302418	1812472	54965534.91	2016	17630057	2552327	77368925.01
2009	14718373	1904954	57765958.68	2017	18046011	2644809	80169348.77
2010	15134328	1997436	60566382.44	2018	18461966	2737291	82969772.53
2011	15550283	2089918	63366806.20	2019	18877921	2829773	85770196.30
2012	15966238	2182400	66167229.96	2020	19293876	2922255	88570620.06
2013	16382192	2274882	68967653.72	2021	19709831	3014736	91371043.82
2014	16798147	2367363	71768077.49				

lumber production, import and export, the nine independent variables used include round timber and industrial wood sales by the General Directorate of Forestry (m³), gross national product per capita (thousand person), building area as per the occupancy permit (m²), inflation rate, exchange rates, economic growth and construction materials price index. All possible models for lumber production, import and export projections and their combinations were tried and the most appropriate regression models were searched and thus regression models were formed. As period up to the year 2021 was target in the projection of lumber

Table 16. The estimated values of the independent variables between the years of 2007 to 2021 (building area, number of building, GNP).

Years	Building Area	Number of building	GNP	Years	Building area	Number of building	GNP
2007	89153950.80	102594.396	4301.642	2015	104130998.7	101926.284	5330.618
2008	91026081.78	102510.882	4430.264	2016	106003129.6	101842.770	5459.240
2009	92898212.77	102427.368	4558.886	2017	107875260.6	101759.256	5587.862
2010	94770343.75	102343.854	4687.508	2018	109747391.6	101675.742	5716.484
2011	96642474.73	102260.340	4816.130	2019	111619522.6	101592.228	5845.106
2012	98514605.71	102176.826	4944.752	2020	113491653.6	101508.714	5973.728
2013	100386736.7	102093.312	5073.374	2021	115363784.6	101425.200	6102.350
2014	102258867.7	102009.798	5201.996				

Table 17. The estimated values of the independent variables between the years of 2007 to 2021 (Economic growth %).

Years	Economic growth (%)	Years	Economic growth (%)
2007	46.574	2015	41.070
2008	45.886	2016	40.382
2009	45.198	2017	39.694
2010	44.510	2018	39.006
2011	43.822	2019	38.318
2012	43.134	2020	37.630
2013	42.446	2021	36.942
2014	41.758		

Table 18. Regression equations used for the estimation of the independent variables.

$Y_{Population} = 45900.440 + 1104.200.x$ $Y_{CPI} = 3071639.325 + 415954.780.x$

$Y_{OGM} = 6643.560 + 51.046.x$ $Y_{PPI} = -684537.362 + 92481.844.x$

$Y_{Pricet\ Indx} = -2E+007 + 2800423.762.x$ $Y_{E.Growth} = 64.462 - 0.688.x$

$Y_{B.Area} = 40478545.270 + 1872130.982.x$ $Y_{GNP} = 957.470 + 128.622.\ x$

$Y_{Number\ Build.} = 104765.760 - 83.514.x$ $Y_{Foreign\ exch.} = -475638.310 + 67767.807.x$

Table 19. Lumber production, export and import projection values in Turkey.

Years	Production	Export	Import	Years	Production	Export	Import
2007	6754714	84692	382000	2015	7253860	94736	511573
2008	6817107	85947	398197	2016	7316253	95993	527769
2009	6879500	87203	414394	2017	7378646	97248	543966
2010	6941893	88458	430590	2018	7441039	98504	560162
2011	7004287	89714	446787	2019	7503432	99759	576359
2012	7066680	90970	462983	2020	7565826	101015	592555
2013	7129073	92225	479179	2021	7628218	102270	608752
2014	7191466	93481	495376				

production, import and export quantities made, the estimated values of the independent variables significant and valid for the models built ware calculated by a separate regression analysis, proceeding to the projection

operation.

As of the end of 2007, it was reported that, there are 684 lumber manufacturing enterprises registered to TOBB database and their installed capacity is 8,425,458 m^3/year. Based on the number of enterprises, lumber manufacturers makes 70% of the total forest products industry, and 43% in terms of contribution to employment. 95% of the enterprises are small scale. It is known that timber companies are concentrated in cities such as Kocaeli, Bursa, Mersin, Adana, Kutahya and Sakarya of Turkey (TOBB, 2007). For many year Turkey's timber production remained around 4 million m^3 and reached levels of around 6 million m^3 in 2006. Foreign trade figures increased in favor of imports, the exports in 2006 were 45,000 m^3 while the imports were above 600,000 m^3.

As a result of different regression model trials performed, it was concluded from the results of the regression analysis that out of the independent variables used, CPI ($r^2 = 0.707$) in the timber production projection and GNP and industrial wood sales by the General Directorate of Forestry ($r^2 = 0.803$) in the timber import projection, exchange rate and GNP in the timber export projection ($r^2 = 0.325$) provide sufficient explanation and that they can be used as projection tool. When examining the lumber production, export and import estimated figures, the following results appear: as a result of regression analysis performed, it is seen that lumber production of 6,4 millions m^3 in 2006 shall increase 1,2 millions m^3 in the year 2021, reaching 7.6 millions m^3; and that the lumber export shall increase from 40 thousands m^3 to 100 thousands m^3 and the lumber import shall increase above 600 thousand m^3 in the year 2021.

All conclusions and evaluations above can be summarized as follows: Turkey is well behind most of EU-member countries with respect to all criteria of the production, export and import indicators in the field of forest products industry. According to the projections, although the world economic growth decreased compared to previous years, on the basis of the fact that it will show a tendency to increase and as a natural result of it, demand for the forest products shall increase, highlighting the fact that necessary and sufficient importance should be given without negligence to this sector ranking 8th among 34 manufacturing industrial sectors.

That the foreign trade enjoys an important place in the industrialization policies shows the need to develop lumber industry and give important to this sector. For this reason, it has become very important to examine changes to occur in the production and foreign trade structure of lumber industry in Turkey over time, determine short and long term development, strategy and policies for the lumber industry and perform realistic projections about production-import-export in future. And

hence this study has been a very new, important and comprehensive one in filing the gap of search mentioned previously with the production, import and export projections for the lumber industry with a confidence level and acceptable error extent. By this study, the relations explaining production and foreign trade of the lumber industry in Turkey have been set forth and projection data were obtained by scientific data.

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