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# Statistical analysis and projection of wood veneer industry in Turkey: 2007 - 2021

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While development and change of the social life in recent years has noticeably increased demand for forest products, the production, export and import of the forest products accordingly changed in terms of quantity and quality as well. This change have, of course, transformed the forest products economic sector to a more dynamic structure, ensuring it find itself a place in the leading ranks among other sectors. In this development, in addition to the increased social and international demand, particularly the EU-oriented international development and policies have also played important role. In this study, models are established and projections are developed for production, import and export of Turkish wood veneer 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.

**Key words:** Wood veneer trade, production, import, export, regression analysis.

## INTRODUCTION

Currently there are 27 enterprises having the manufacturing capacity of 98 million  $m^2$ /year wood veneers as of 2004 in Turkey. 55 million  $m^2$  veneers was produced. Average production per plant was 3.5 million  $m^2$ . Wood veneer production is constantly increasing. In the last 5 years, there has been a significant increase in veneer production, and the rate of increase was 7.5%. The projected production amount is 93.5 million  $m^2$  for 2015 (Ors and Kilic, 2005).

According to TOBB (2001) (Union of Chambers and Commodity Exchanges of Turkey) database, there are 47 enterprises having the annual production capacity of 200.378.814  $m^2$ /year as of 2007. Based on the number of

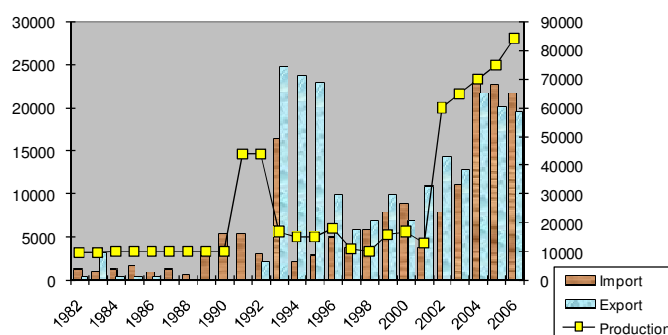
employees, 77% of the enterprises have less than 50 employees and they are classified as small sized enterprises. The number of large size enterprises is 11. Enterprises are concentrated in the provinces of Duzce, Kocaeli, Bursa and Bolu (TOBB, 2007). Foreign trade balance has been negative, and there was an average of 36 million of U.S. \$ imports and 15 million U.S. \$ to export in 2004. The average export-import ratio for the last 7 years was 41.5%. Capacity utilization rate is 80.2%, and there are total of 1095 employees in this sector. In the last 7 years, 9 governmental financial assistance documents were issued (DPT, 1995; DPT, 2006).

According to Table 1, the wood veneer production was around 10000  $m^3$  between 1982 and 1990. Between 1991 and 1992 it was 44000  $m^3$  and between 1993 and 2001 it was decreased to 16000  $m^3$ . The annual

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**Table 1.** The production, export and import amounts of wood veneer in Turkey (m<sup>3</sup>) (FAO, 2008).

Years	Production	Export	Import
1982	9700	400	1400
1983	9700	3200	1200
1984	10000	400	1500
1985	10000	400	1800
1986	10000	400	1000
1987	10000	0	1400
1988	10000	0	700
1989	10000	0	3500
1990	10000	0	5500
1991	44000	0	5500
1992	44000	2226	3093
1993	17000	4800	16500
1994	15000	3700	
1995	15000	23000	2900
1996	18000	10000	5000
1997	11000	6000	4000
1998	10000	7000	6000
1999	16000	10000	8000
2000	17000	7000	9000
2001	13000	11000	4000
2002	60000	14400	8000
2003	65000	12954	11187
2004	70000	21766	23021
2005	75000	20192	22780
2006	84000	19682	21804

**Figure 1.** The production, export and import amounts of wood veneer in Turkey (FAO, 2008).

production was increased to 60000 m<sup>3</sup> in 2002 and it was gradually increased and reached to 84000 m<sup>3</sup>. The export was very limited between 1982 and 1986 and it was stopped between 1987 and 1991. The export began in 1992 by 2226 m<sup>3</sup> and it was around 23000 m<sup>3</sup> between 1993 and 1995, and it was decreased to 10000 m<sup>3</sup> between 1996 and 2003. And again, it was increased to

20000 m<sup>3</sup> between 2004 and 2006. Similarly, the import amount was around 1200 m<sup>3</sup> between 1982 and 1988. And it was constantly increased by 4500 m<sup>3</sup> annually until 1993. In 1993 the import was 16500 m<sup>3</sup>. From the beginning of 1994, import decreased to 2200 m<sup>3</sup>. It was then gradually increased and reached to 23021 m<sup>3</sup> in 2004 and stayed at the same level in 2006.

Moreover, the maximum wood veneer production was realized between 2004 and 2006, and the lowest level was between 1982 and 1983 (Figure 1). The maximum export amount was 24800 m<sup>3</sup> in 1993 and the minimum was 400 m<sup>3</sup> between 1982 and 1986. The veneer import reached highest in 2004 as 23021 m<sup>3</sup> and the lowest as 700 m<sup>3</sup> in 1988.

The production level was around 10000 m<sup>3</sup> until 1990 and between 1991 and 1992 it was increased by 340% and reached to 44000 m<sup>3</sup>. The production amount decreased even to 16000 m<sup>3</sup> between 1993 and 2002 and after then increased by 36% compared to 1992's amount and reached to 60000 m<sup>3</sup>. In 2006 the production amount increased by 40% compared to 2002 and reached to 84000 m<sup>3</sup>.

The average annual export was around 400 m<sup>3</sup> between 1982 and 1986. It was realized as 2226 m<sup>3</sup> in 1992 and reached to 24800 m<sup>3</sup> in 1993 with an increase of 1014%. The increase level was about the same for the next two years and it was decreased by 48% and in 2003, it was 12954 m<sup>3</sup>. The export again increased by 68.1% in 2004 and reached to 21766 m<sup>3</sup> and stayed at the same level until 2006. Similarly the import was around 1400 m<sup>3</sup> until 1988 and it was increased by 292% and reached to 5500 m<sup>3</sup> in 1991. And then it was increased again by 200% and reached to 16,500 m<sup>3</sup>. For the later years the average import was around 5500 m<sup>3</sup> annually until 2004. The import increased by 39.5% and reached to 23021 m<sup>3</sup> in 2004 and it was around 21804 m<sup>3</sup> in 2006 with 5.3% decrease.

## MATERIALS AND METHODS

### Model building and regression analysis

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 establishment of the most appropriate regression models for the projection operations, while the wood veneer production, import and export were dealt with as dependant variables, the industrial wood sales (m<sup>3</sup>) from General Directorate of Forestry (OGM), Gross National Product per Capita (TL and USD, separately), Population, number of buildings by area (m<sup>2</sup>) 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<sup>3</sup>) 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, 2008), State Planning Organization (DPT),

Export Development Center, Ministry of Industry and Trade (IGEME, 2008), World Agricultural organization (FAO), Forest Certification Council (FSCC, 2008), and General Directorate of Forestry (OGM). Furthermore, some information and document of the organizations operating in the sector, the records of Turkish Association of Chambers and Exchanges (TOBB) and websites of the organizations and enterprises having direct or indirect relation to the subject of the study were all used.

Twenty five years (1982 to 2006) data on the aforementioned independent and dependant variables are organized in independent variables (Tables 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. It is seen that export figures for the years 1987-1991 given in Table 1 are zero. This situation does not mean that no data was found for the said years, but shows the real status. In other words, zero values for some years show that export of Turkey was taken as zero as they are actually or very small or negligible level.

Furthermore, the economic growth rate (%), one of the independent variables given in Annex-A 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 both it 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.

## RESULTS AND DISCUSSION

### Regression analysis results of wood veneer industry (Production-import- export)

#### Wood veneer production

As it may be seen from the summary in Table 5, all regression models, with one independent variable (PPI), two independent variables (PPI, PRICE INDEX) and three independent (PPI, PRICE INDEX, POPULATION), 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 three independent variables (PPI, PRICE INDEX, POPULATION) shall be used. Here,  $r^2 = 0.887$  is a very high coefficient of determination. This figure indicates that the selected independent variables express the wood veneer production around 89%, 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.

As it may be seen from the coefficients (<sup>a</sup>) in Table 7, regression equation for the wood veneer production

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

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

**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	Industrial	Buildings	Permits	Annual
	(000m <sup>3</sup> )	Wood (000m <sup>3</sup> )	Number of building	Area	Exchange rates (\$)
1982	4,066	5,821	*45,995	22,945,123	164.07
1983	3,945	6,665	58,968	25,554,984	228.14
1984	4,078	7,596	63,153	28,887,793	369.75
1985	3,892	7,407	71,844	37,251,360	522.91
1986	3,746	7,570	102,888	55,624,440	676.56
1987	3,687	7,251	138,155	70,912,137	866.08
1988	3,572	7,447	139,995	67,861,304	1,448.46
1989	3,393	7,460	136,015	62,923,939	2,137.81
1990	3,310	6,581	123,304	60,083,035	2,634.47
1991	3,159	6,513	121,486	61,447,817	4,264.53
1992	3,353	6,897	137,990	73,062,016	6,994.97
1993	3,199	7,010	147,033	85,080,806	11,193.6
1994	2,939	6,712	143,281	81,715,801	30,266.88
1995	3,578	8,046	137,905	83,956,863	46,558.58
1996	3,172	7,528	126,722	78,477,686	83,043.91
1997	2,845	6,974	126,956	83,388,824	165,170.83
1998	2,817	7,051	116,235	78,568,789	264,183.08

Table 3. Contd.

1999	2,833	7,066	92,469	62,761,914	427,202.08
2000	3,007	7,329	79,140	61,694,941	628,804.5
2001	2,738	6,778	77,430	57,449,494	1,245,609.58
2002	3,297	8,005	47,242	36,187,021	1,517,018.41
2003	2,827	7,320	53,843	45,516,030	1,493,827.91
2004	3,065	8,253	75,495	69,719,611	1,421,467.33
2005	2,936	8,100	114,254	106,424,587	**1,344,966.66
2006	3,480	9,299	114,204	122,909,886	**1,433,958.33

\*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 2005-2006 US\$ rates.

Table 4. Annual CPI, PPI, Economic Growth Rate and Construction Materials Price Index of Turkey (TUIK, 2008).

Years	The base year 1978	The base year 1981	Economic growth rate (%)	Economic growth rate (%)	Construction materials price index (1968 = 100)
	CPI (%)	PPI (%)	Constant prices	Current prices	
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 as 15% and 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.

shall be as follows (model 3)  $Y = -36662.398 + 0.814 \text{ PPI} - 0.026 \text{ PRICE INDEX} + 0.965 \text{ POPULATION}$ .

### Wood veneer import

As it may be seen in Table 8, both regression models,

one built with one independent variable Gross National Product per Capita (GNP\$), and the other with two independent variables (GNP\$, ECONOMIC GROWTH) 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

**Table 5.** Model summary (d).

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.887 <sup>a</sup>	0.787	0.777	11621.91
2	0.929 <sup>b</sup>	0.863	0.85	9537.872
3	0.942 <sup>c</sup>	0.887	0.871	8847.188

<sup>a</sup>Predictors: (Constant), PPI. <sup>b</sup>Predictors: (Constant), PPI, PRICEINDX. <sup>c</sup>Predictors: (Constant), PPI, PRICEINDX, POPULATION. <sup>d</sup>Dependent Variable: VENEERPRODUCT.

**Table 6.** Anova(d).

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	11453615030	1	11453615030	84.798	0.000 <sup>a</sup>
	Residual	3106582570	23	135068807.4		
	Total	14560197600	24			
2	Regression	12558835736	2	6279417868	69.027	0.000 <sup>b</sup>
	Residual	2001361864	22	90970993.83		
	Total	14560197600	24			
3	Regression	12916470211	3	4305490070	55.006	0.000 <sup>c</sup>
	Residual	1643727389	21	78272732.82		
	Total	14560197600	24			

<sup>a</sup>Predictors: (Constant), PPI. <sup>b</sup>Predictors: (Constant), PPI, PRICEINDX. <sup>c</sup>Predictors: (Constant), PPI, PRICEINDX, POPULATION. <sup>d</sup>Dependent Variable: VENEERPRODUCT.

**Table 7.** Coefficients(a).

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	13091.532	2744.872		4.769	0.000
	PPI	0.026	0.003	0.887	9.209	0.000
	(Constant)	16344.156	2438.297		6.703	0.000
2	PPI	0.608	0.167	20.768	3.641	0.001
	PRICEINDX	-0.019	0.006	-19.883	-3.486	0.002
	(Constant)	-36662.398	24900.841		-1.472	0.156
3	PPI	0.814	0.183	27.815	4.462	0.000
	PRICEINDX	-0.026	0.006	-27.19	-4.316	0.000
	POPULATION	0.965	0.451	0.319	2.138	0.044

<sup>a</sup>Dependent variable: VENEERPRODUCT.

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\$, ECONOMIC GROWTH) shall be used. Here,  $r^2 = 0.855$  is a very high coefficient of determination. This figure indicates that the selected independent

variables express the wood veneer import around 86%, 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 (<sup>a</sup>) in Table 10, regression equation for the wood veneer import shall be as follows (model 2)  $Y = -2539.286 + 5.164 \text{ GNP\$} -$

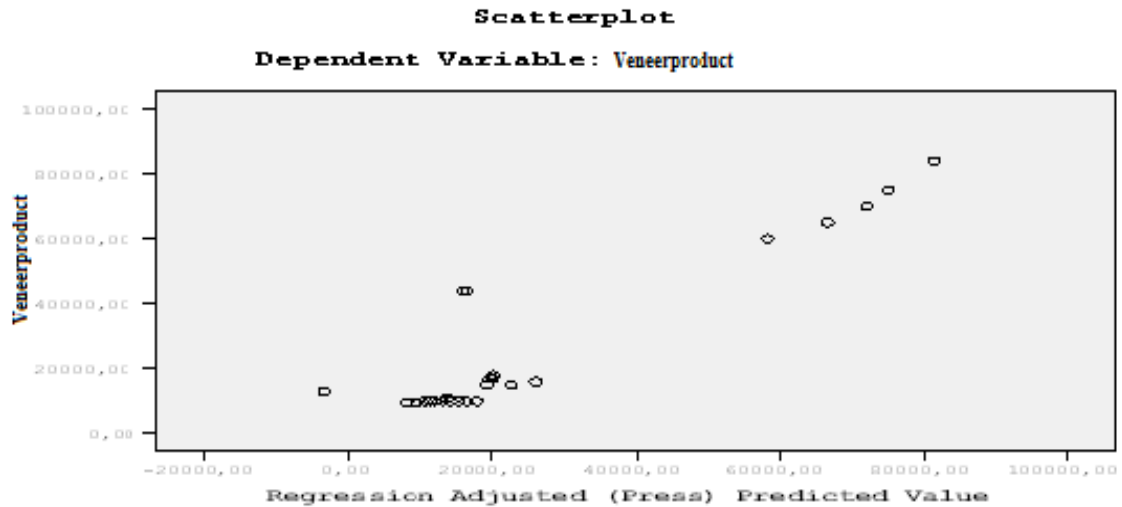


Figure 2. The scatter diagram of wood veneer production.

Table 8. Model Summary(c).

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.885(a)	0.783	0.774	3309.434447
2	0.925(b)	0.855	0.842	2767.53332

<sup>a</sup>Predictors: (Constant), GNP\$. <sup>b</sup>Predictors: (Constant), GNP\$, ECOGROWTH. <sup>c</sup>Dependent variable: VENEERIMPORT.

Table 9. ANOVA(c).

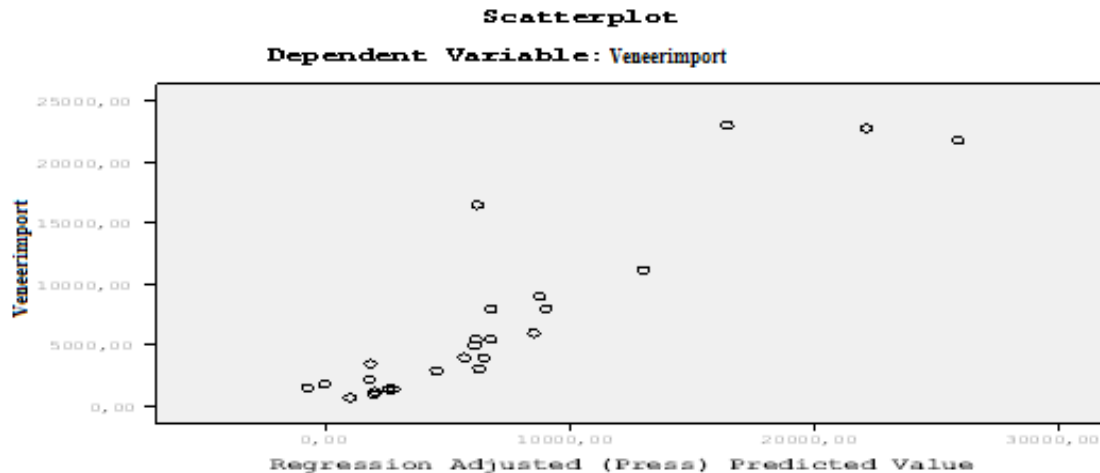
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	910275865.936	1	910275865.936	83.112	0.000 <sup>a</sup>
	Residual	251904200.064	23	10952356.525		
	Total	1162180066.000	24			
2	Regression	993676771.160	2	496838385.580	64.868	0.000 <sup>b</sup>
	Residual	168503294.840	22	7659240.675		
	Total	1162180066.000	24			

<sup>a</sup>Predictors: (Constant), GNP\$. <sup>b</sup>Predictors: (Constant), GNP\$, ECOGROWTH. <sup>c</sup>Dependent Variable: VENEERIMPORT.

Table 10. Coefficients(a).

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	-7881.595	1745.136		-4.516	0.000
	GNP\$	5.598	0.614	0.885	9.117	0.000
2	(Constant)	-2539.286	2179.639		-1.165	00.256
	GNP\$	5.164	0.530	0.816	9.742	0.000
	ECOGROWTH	-75.676	22.933	-0.277	-3.300	0.003

<sup>a</sup>Dependent Variable: VENEERIMPORT.



**Figure 3.** The scatter diagram of wood veneer import.

**Table 11.** Model summary(b).

Model	R	R square	Adjusted R square	Std. error of the estimate
1	0.695 <sup>(a)</sup>	0.484	0.461	6548.7627

<sup>a</sup>Predictors: (Constant), POPULATION. <sup>b</sup>Dependent Variable: VENEEREXPORT.

**Table 12.** ANOVA(b).

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	924163584.095	1	924163584.095	21.549	0.000(a)
	Residual	986384735.905	23	42886292.865		
	Total	1910548320.000	24			

<sup>a</sup>Predictors: (Constant), POPULATION. <sup>b</sup>Dependent Variable: VENEEREXPORT.

**Table 13.** Coefficients(a).

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	-37158.949	9974.066		-3.726	0.001
	POPULATION	0.762	0.164	0.695	4.642	0.000

<sup>a</sup>Dependent Variable: VENEEREXPORT.

75.676 ECONOMIC GROWTH.

### **Wood veneer export**

As it may be seen from the summary Table 11, the regression model built with one independent (POPULATION) 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  $r^2 = 0.484$  can be an acceptable coefficient of determination. Because the correlation coefficient  $R = 0,695$  value of aforementioned regression model established shows near 70% positive linear relationship between two variables. 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 (<sup>a</sup>) Table 13, regression equation for the wood veneer export shall be as follows (model 1)  $Y = -37158.949 + 0.762$



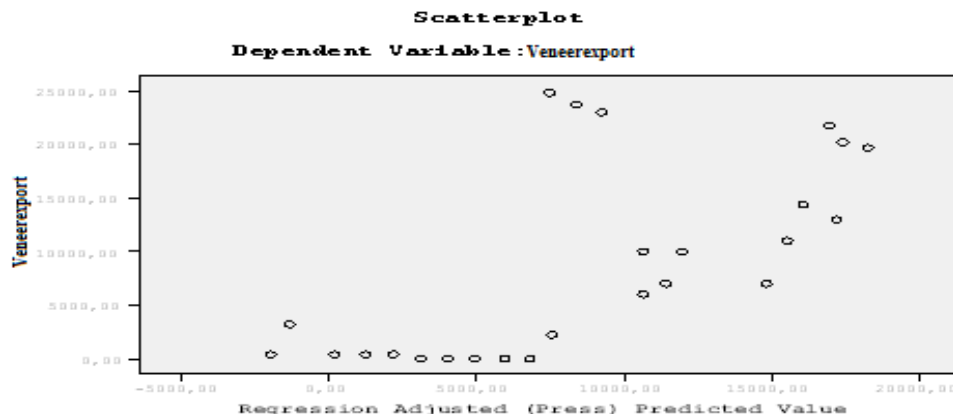


Figure 4. The scatter diagram of wood veneer export.

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 (m <sup>3</sup> )	Foreign exchange (USD\$)
2007	74609.64	7970.756	1286324.672
2008	75713.84	8021.802	1354092.479
2009	76818.04	8072.848	1421860.286
2010	77922.24	8123.894	1489628.093
2011	79026.44	8174.940	1557395.900
2012	80130.64	8225.986	1625163.707
2013	81234.84	8277.032	1692931.514
2014	82339.04	8328.078	1760699.321
2015	83443.24	8379.124	1828467.128
2016	84547.44	8430.170	1896234.935
2017	85651.64	8481.216	1964002.742
2018	86755.84	8532.262	2031770.549
2019	87860.04	8583.308	2099538.356
2020	88964.24	8634.354	2167306.163
2021	90068.44	8685.400	2235073.970

POPULATION.

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

**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 1982-2006 by help of regression analysis. For the said projection, the following regression

**Wood veneer production, export and import projection values in Turkey**

In Table 19, Turkish wood veneer production, export and import projection values are given for the period of 2007-2021. 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 between 2007 to 2021 in the equation found as a result of regression analysis conducted for the wood veneer

**Table 15.** The estimated values of the independent variables between the years of 2007-2021 (CPI, PPI, Price Index).

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

**Table 16.** The estimated values of the independent variables between the years of 2007-2021 (Building Area, Number of Building, GNP).

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

production, export and import values previously for the period of 1982-2006. In the projection, the following regression models were used with the results below:

For wood veneer production;  $Y = -36662.398 + 0.814 \text{ PPI} - 0.026 \text{ PRICE INDEX} + 0.965 \text{ POPULATION}$

For wood veneer import;  $Y = -2539.286 + 5.164 \text{ GNP\$} - 75.676 \text{ ECONOMIC GROWTH}$

For wood veneer export;  $Y = -37158.949 + 0.762 \text{ POPULATION}$ .

## CONCLUSION AND RECOMMENDATIONS

An indispensable part of human life, the forest industrial products occupy a great place in the world economy. Considering that value of the forest industrial products is close to iron-steel, textile and chemical products in the world trade, it is clearly seen how important this industrial branch is. Products produced in the forest products industry and launched to the market are products with which people encounter in all environments of life such

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

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

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

$Y_{\text{Population}} = 45900.440 + 1104.200.x$	$Y_{\text{CPI}} = 3071639.325 + 415954.780.x$
$Y_{\text{OGM}} = 6643.560 + 51.046.x$	$Y_{\text{PPI}} = -684537.362 + 92481.844.x$
$Y_{\text{Pricet Indx}} = -2E+007 + 2800423.762.x$	$Y_{\text{E.Growth}} = 64.462 - 0.688.x$
$Y_{\text{B.Area}} = 40478545.270 + 1872130.982.x$	$Y_{\text{GNP}} = 957.470 + 128.622.x$
$Y_{\text{Number Build.}} = 104765.760 - 83.514.x$	$Y_{\text{Foreign exch.}} = -475638.310 + 67767.807.x$

as working, resting, etc in direct interaction. For this reason, in addition to direct contribution of this industrial branch to total production, they have a great number of important, but indirect contributions not possible to express by numbers.

When examining the wood veneer production, export and import estimated figures, the following results appear:

As a result of different regression model trials, the independent variables of PPI, PRICE INDEX and POPULATION have provided sufficient explanation ( $r^2 = 0.887$ ) for the wood veneer production and used as estimation tool for the projection of wood veneer production.

Similar operations in the wood veneer export projection were performed by using same data and changes in the period. It is seen from the results of the regression analysis that POPULATION by itself as a significant and independent variable provides explanation ( $r^2 = 0.484$ ), and that the variables GNP and ECONOMIC GROWTH in the wood veneer import projection provide explanation

as significant variable ( $r^2 = 0.855$ ) and can be used as projection tool. It has been calculated as a result of the regression analysis that the estimated wood veneer production figures shall increase by 1.5 times as of the year 2006, exceeding 125 thousands  $m^3$  in 2021 and that the wood veneer export shall increase from 19 thousands  $m^3$  to 30 thousands  $m^3$  and the wood veneer import of 20 thousands  $m^3$  shall increase above 25 thousand  $m^3$ .

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 8<sup>th</sup> among 34 manufacturing industrial sectors.

That the foreign trade enjoys an important place in the

**Table 19.** Wood veneer production, export and import projection values in Turkey (m<sup>3</sup>).

Years	Production	Export	Import
2007	79116	19694	16150
2008	82650	20535	16866
2009	86185	21376	17582
2010	89720	22218	18299
2011	93254	23059	19015
2012	96789	23901	19731
2013	100324	24742	20448
2014	103858	25583	21164
2015	107393	26425	21880
2016	110928	27266	22596
2017	114463	28108	23313
2018	117998	28949	24029
2019	121533	29790	24745
2020	125068	30632	25461
2021	128602	31473	26178

industrialization policies shows the need to develop wood veneer 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 wood veneer industry in Turkey over time, determine short and long term development, strategy and policies for the wood veneer 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 filling the gap of search mentioned above with the production, import and export projections for the wood veneer industry with a confidence level and acceptable error extent. By this study, the relations explaining production and foreign trade of the wood veneer industry in Turkey have been set forth and projection data were obtained by scientific data.

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