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Full Length Research Paper

Estimating future development of the Turkish plywood sector by the use of models affecting this forest industry sector

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In order to benefit more rationally from the wood raw material, a very important natural source today, we should especially deal with the industrial branch processing it. Change and development in the production, import and export quantity and values of Turkish forestry and forest industrial sector has eventually required planning both national forest resources and the sector using these resources on scientific criteria. In this study, based on the last 25 years data, production, import and export potentials of plywood and blockboard in Turkey were analyzed using regression analysis. Consequently, it was estimated that the plywood and blockboard production in 2021 will be 60,000 m^3, the export will be 30,000 m^3 and import will be 115, 000 m^3.

Key words: Plywood-block board trade, production, import, export, regression analysis.

INTRODUCTION

Plywood industry being one of the oldest industries in the world has been in Turkey more than fifty years. After lumber industry, it is the second industry developed in Turkey. However, in terms of technological and capacity use ratio, Turkey is still behind the European Union countries and the other European countries. The first plywood plant was established in Istanbul as "Turk Kontrplak Fabrikasi" in 1932 (Bozkurt and Goker, 1986). The production amount increased 1.5 times between 1999 and 2006, export amount increased 4 times, but the increase in import amount was 10 times. According to TOBB (Union of Chambers and Commodity Exchanges of Turkey) database, there are 56 enterprises having the annual production capacity of 5,579,885 m^2 as of 2007 (TOBB, 2001; TOBB, 2007). In terms of the number of employees, 77% of the enterprises employ equal to or less than 50 workers and they are classified as small scale enterprises. The number of large scale enterprises is 13. The capacity of important enterprises in plywood industry is about 62% of the total production capacity. Block board industry is the least developed industry in wood based panel industry. Being relatively new for Turkey, the first block board was made by Makine Kimya Endüstrisi Kurumu translated as Machinery Chemistry Industry Corporation (MKEK) in 1967, because of the technology used and being a newly developed industry, the domestic demand for block board in Turkey is limited. Although it has a very large area of use, this industry is not developed enough. There are 1 state owned (3200 m^3/year capacity) and 5 private enterprises in Turkey manufacturing blockboards (Çabuk, 2006).

As can be seen in Table 1, the plywood-blockboard manufacturing in Turkey in 1982 was 34000 m^3, between1983 and 1991 it was 65000 m^3, between 1992 and 1995 it was 75000 m^3 and for the later years it was around 50000 m^3. The export was between 1000 and 10000 m^3 between the years of 1982 and 2001. But from 2002, it exceeded 20000 m^3 annually. The import was begun with 28395 m^3 in 1992. Until 1995, it was around70000 m^3 and this increased gradually to 36071 in

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

Years	Production	Export	Import	Years	Production	Export	Import
1982	34000	2000	0	1995	75000	6000	79000
1983	54000	3000	0	1996	61000	8000	42000
1984	65000	1500	0	1997	66000	4000	26000
1985	65000	1500	0	1998	50000	3000	16000
1986	65000	700	0	1999	35000	5000	14000
1987	65000	700	0	2000	47000	6000	33000
1988	65000	3800	0	2001	35000	13000	15000
1989	65000	3100	0	2002	55000	26000	21000
1990	65000	7400	0	2003	57000	20757	36071
1991	65000	7400	0	2004	60000	27527	63973
1992	74000	5582	28395	2005	64000	25500	109335
1993	77000	1900	72100	2006	55000	20000	146000
1994	77000	11600	67400				

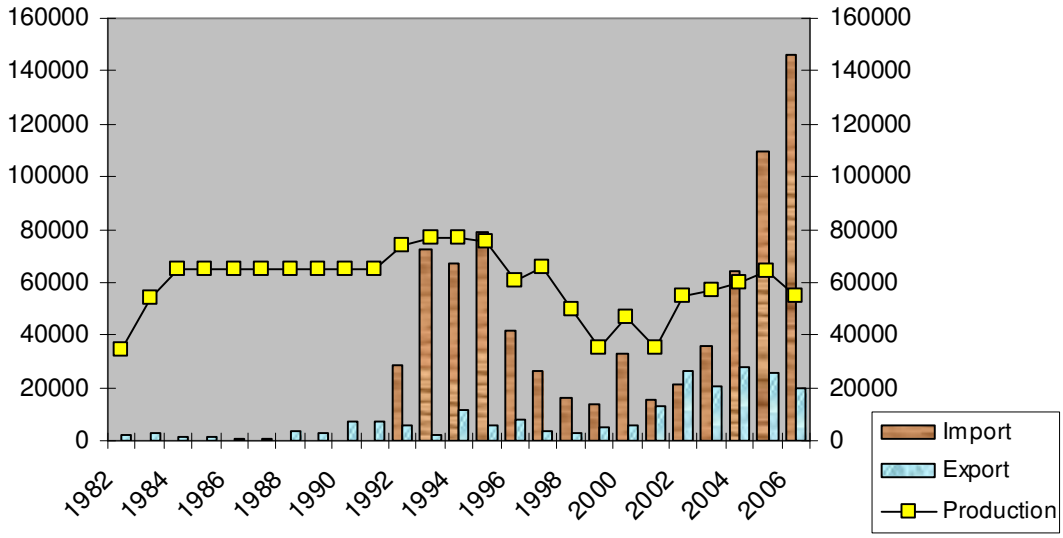

Figure 1. The production, export and import amounts of plywood-block board in Turkey.

2003. The import amount increased again between 2005 and 2006 and reached 146000 m^3. It can also be seen in Table 1 and Figure 1 that, the highest amount of plywood-block board manufacture was realized between 1993 and 1994 as 77000 m^3 and the lowest one was in 1982 as 34000 m^3. The highest export amount was reached in 2004 as 27527 m^3 and the lowest one was realized between 1986 and 1987 as 700 m^3. The highest plywood –block board import was done in 2006 as 146000 m^3 and the lowest import amount was in 1999 as 14000 m^3. The plywood-block board export was 700 m^3 and it was increased by 1557% in 1994 as 11600 m^3. Then again, it was increased by 124% in 2002 and reached to 26000 m^3.The import begun in 1992 and rapidly increased in 1993 and it was 72100 m^3. However, it was decreased by 80% in 1999 and it was realized as 14000 m^3. Later it was increased by 942.8% and reached to 146000 m^3.

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 plywood-block board production, import and export

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

Years	Population	Per Capita	GNP	Per Capita	GDP	Years	Population	Per Capita	GNP	Per Capita	GDP
	(000)	TL	$	TL	$		(000)	TL	$	TL	$
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						

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 (CPI) 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 the 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. 25-years (1982 to 2006) data on the aforementioned independent and dependant variables were 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 import figures for the years 1982 to 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, import of Turkey was taken as zero as they are actually very small or at a 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 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 plywood-block board (production-import- export)

Plywood-block board production

As it may be seen from the summary (Table 5) the regression model built with one independent (NUMBER OF BUILDINGS) 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 and independent

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	Years	Log	Industrial	Buildings	Permits	Annual
	($000m^3$)	Wood ($000m^3$)	Number of building	Area	Exchange rates ($)		($000m^3$)	Wood ($000m^3$)	Number of building	Area	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 to 2006 US$ rates.

variables is significant at a significance level of α= 0.05. Here r^2 = 0.400 is a coefficient of determination which can be considered high. 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 (a) Table 7, regression equation for the plywood-blockboard production shall be as follows (model 1) Y = 36264.490 + 0.227 NUMBER OF BUILDINGS.

Plywood-block board import

As it may be seen in the summary of Table 8 given, both regression models, one built with one independent variable (BUILDING AREA), and the other with two independent variables (BUILDING AREA, OGM WOOD 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 and independent variables is significant at α = 0.05. However, in this case of projection, the regression model with two independent variables (BUILDING AREA, OGM WOOD SALES) shall be used. Here, r^2=0.831 is a very high coefficient of determination. This figure indicates that, the selected independent variables express the plywood-block board import around 83%, demonstrating that the 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 plywood-block board import shall be as follows (model 2) Y = 3854.071 + 0.009PPI.

Plywood-block board export

As it may be seen from the summary in Table 11, all regression models, with one independent variable (PPI), two independent variables (CPI, PPI) and three independent (PPI, CPI, FOREIGN EXCHANGE $), 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 three regression models and F statistical values are significant when the models are valid or when the relationship between the dependant and Independent variables is significant at

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 as 15% and 2006 values were calculated according to this rate. **PPI was calculated according to the last four years increase rates (23.88, 12.17, 7.67, 15%) respectively.

Table 5. Model summary(b).

Model	R	R Square	Adjusted R square	Std. Error of the estimate
1	0.632(a)	0.400	0.373	9615.00376

a Predictors: (Constant), NUMBERBUILD; b Dependent variable: PLYWOODPRODUCT.

Table 6. ANOVA(b).

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	1415049162.600	1	1415049162.600	15.306	0.001(a)
	Residual	2126310837.400	23	92448297.278		
	Total	3541360000.000	24			

a Predictors: (Constant), NUMBERBUILD; b Dependent variable: PLYWOODPRODUCT.

A = 0.05. -215626.528 + 0.0010 BUILDING AREA + 24.954 OGM WOOD SALES.

However, in this case of projection, the regression model with one independent variable (PPI) shall be used. The reason is that the difference between the r^2 = 0.891 value of the model represented by three independent variables and r^2 = 0.818 value of the model represented by one independent variable is at a negligible level. Another reason is that, use of a single independent variable in the projection makes the operation easy.

Table 7. Coefficients (a).

Model		Unstandardized coefficients		Standardized coefficients	T	Sig.
		B	Std. error	Beta	B	Std. error
1	(Constant)	36264.49	6325.337		5.733	0.000
	NUMBERBUILD	0.227	0.058	0.632	3.912	0.001

a Dependent variable: PLYWOODPRODUCT.

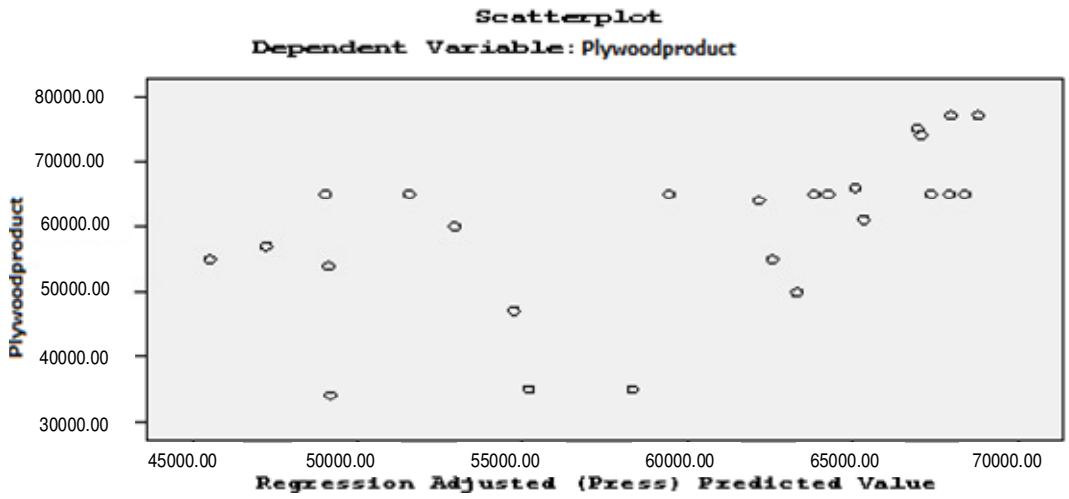

Figure 2. The scatter diagram of plywood-block board production.

Table 8. Model summary (c).

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	0.811(a)	0.657	0.631	23339.74604
2	0.912(b)	0.831	0.803	17041.74859

A Predictors: (Constant), BUILDAREA; b Predictors: (Constant), BUILDAREA, OGMSALES; c Dependent variable: PLYWOODIMPORT.

Table 9. ANOVA(c).

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	13565415526.095	1	13565415526.095	24.902	0.000(a)
	Residual	7081668688.838	13	544743745.295		
	Total	20647084214.933	14			
2	Regression	17162029873.788	2	8581014936.894	29.547	0.000(b)
	Residual	3485054341.145	12	290421195.095		
	Total	20647084214.933	14			

a Predictors: (Constant), BUILDAREA; b Predictors: (Constant), BUILDAREA, OGMSALES; c Dependent variable: PLYWOODIMPORT.

Furthermore, here r^2 = 0.818 is a coefficient of determination which can be considered high. This figure indicates that the selected independent variables express plywood-block board export around 82% and the structure of the linear model built is suitable. 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 10. Coefficients(a).

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta	B	Std. error
1	(Constant)	-56040.860	22335.521		-2.509	0.026
	BUILDAREA	0.0010	0	0.811	4.990	0.000
2	(Constant)	-215626.538	48191.664		-4.474	0.001
	BUILDAREA	0.0010	0	0.604	4.565	0.001
	OGMSALES	24.954	7.091	0.466	3.519	0.004

a Dependent variable: PLYWOODIMPORT.

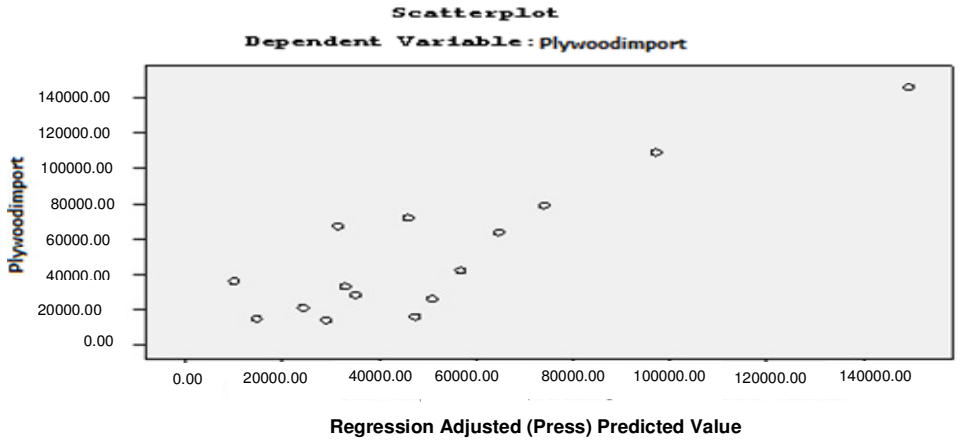

Figure 3. The scatter diagram of plywood-blockboard import.

Table 11. Model summary(d).

Model	R	R Square	Adjusted R square	Std. error of the estimate
1	0.905(a)	0.818	0.811	3708.84767
2	0.921(b)	0.849	0.835	3461.26257
3	0.944(c)	0.891	0.876	3005.60446

a Predictors: (Constant), PPI; b Predictors: (Constant), PPI, CPI; c Predictors: (Constant), PPI, CPI, EXCHANGE$; d Dependent variable: PLYWOODEXPORT.

Table 12. ANOVA(d).

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	1426424582.252	1	1426424582.252	103.698	0.000(a)
	Residual	316377673.508	23	13755551.022		
	Total	1742802255.760	24			
2	Regression	1479234807.197	2	739617403.599	61.736	0.000(b)
	Residual	263567448.563	22	11980338.571		
	Total	1742802255.760	24			
3	Regression	1553095434.067	3	517698478.022	57.308	0.000(c)
	Residual	189706821.693	21	9033658.176		
	Total	1742802255.760	24			

a. Predictors: (Constant), PPI; b. Predictors: (Constant), PPI, CPI; c. Predictors: (Constant), PPI, CPI, EXCHANGE$; d. Dependent variable: PLYWOODEXPORT.

Table 13. Coefficients(a).

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta	B	Std. error
1	(Constant)	3854.071	875.959		4.400	0.000
	PPI	0.009	0.001	0.905	10.183	0.000
2	(Constant)	4216.575	835.518		5.047	0.000
	PPI	0.092	0.039	9.072	2.332	0.029
	CPI	-0.018	0.009	-8.169	-2.100	0.047
3	(Constant)	3794.165	740.413		5.124	0.000
	PPI	0.118	0.035	11.683	3.338	0.003
	CPI	-0.026	0.008	-11.471	-3.213	0.004
	EXCHANGE$	0.010	0.004	0.724	2.859	0.009

a. Dependent variable: PLYWOODEXPORT.

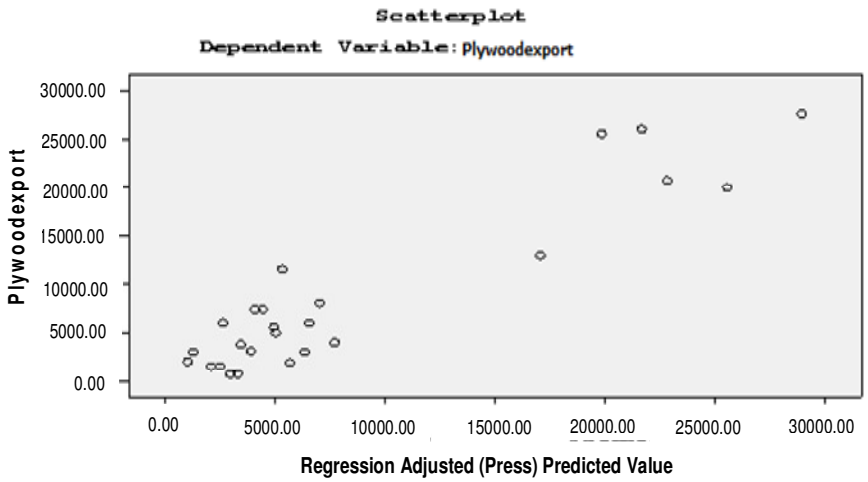

Figure 4. The scatter diagram of plywood-blockboard export.

Table 13, regression equation for the plywood-block board export shall be as follows (model 1) Y = 3854.071 + 0.009PPI.

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 the help of regression analysis. For the said projection, the following regression equations were found and these equations were used for the calculations (Table 18).

Plywood-block board production, export an import projection values in Turkey

In Table 19, Turkish plywood-blockboard production, export and import projection values are given for the period of 2007 to 2021.

These values were obtained by putting in place the estimated values of the valid and significant independent variables built for these equations for the period between 2007 to 2021, in the equation found as a result of regression analysis conducted for the plywood-block board 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 plywood-block board production; Y = 36264.490 + 0.227 NUMBERBUILD

For plywood-block board import; Y = -215626.528 + 0.0010 BUILDAREA + 24.954 OGMSALES

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^3)	Foreign exchange (USD$)	Years	Population (000) person	OGM Wood sales (m^3)	Foreign exchange (USD$)
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				

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. Plywood-blockboard production, export and import projection values in Turkey (m^3).

Years	Production	Export	Import	Years	Production	Export	Import
2007	59553	19334	72430	2015	59402	25993	97597
2008	59535	20166	75576	2016	59383	26825	100743
2009	59516	20999	78722	2017	59364	27657	103889
2010	59497	21831	81868	2018	59345	28490	107035
2011	59478	22663	85013	2019	59326	29322	110181
2012	59459	23496	88159	2020	59307	30154	113327
2013	59440	24328	91305	2021	59288	30987	116473
2014	59421	25160	94451				

For plywood-block board export; Y = 3854.071 + 0.009PPI

CONCLUSION AND RECOMMENDATIONS

By production of wood-origin forest products, the forestry sector supplies raw materials to a great number of industrial branch. In other words, the forestry sector supports a number of industries, thus playing an active role in creating added value and improving employment. Due to this specific role, it is considered among “Main Primary Sectors” in the science of industrial economy (DPT, 1995). In Turkey, there are 27 plywood plants operating with an annual production capacity of about 130,000 m^3 and block board plants, one of which is owned by the public. While the capacity usage rate in the plywood industry is around 70%, it showed a reduction to around 35% in recent years. It is alleged to have resulted by the increased demand for other board products by substitute products used instead of plywood. Plywood production in Turkey has been around 65,000 m^3 for years, but it showed a slight reduction today, retreating to around 50,000 m^3; and the export and import quantities have also indicated development in this line, with the export of 20,000 m^3 in 2006 and import above 100,000 m^3 from the year 2005 on.

In this study made for the said purposes, the following results were obtained and evaluations made:

In the regression analyses performed for projection of plywood-block board production, import and export, the 9 independent variables used include round timber and industrial wood sales by the General Directorate of Forestry (m^3) gross national product per capita (thousand person), building area as per the occupancy permit (m^2), inflation rate, exchange rates, economic growth and construction materials price index. All possible models for plywood-block board 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 plywood-block board production, import and export quantities made, the estimated values of the independent variables significant and valid for the models built were calculated by a separate regression analysis, proceeding to the projection operation.

It is seen from the results of the regression analysis, in the plywood-block board production projection, the independent variable of the NUMBER OF BUILDINGS as a significant variable by itself provides explanation (r^2 = 0.400) and that it can be used as a projection tool.

Similar operations in the plywood-block board export projection were performed by using same data and changes in the period. It is seen from the results of the regression analysis that PPI by itself as a significant and independent variable provides explanation (r^2 = 0.818), and that the variables BUILDING AREA and OGM WOOD SALES in the plywood-block board import projection provide explanation as significant variable (r^2 = 0.831) and can be used as a projection tool. When examining the plywood-block board production, export and import estimated figures, the following results appear:

It was found that plywood-block board production figures of 55,000 m^3 in 2006 shall have the projection value of around 60,000 m^3 and the plywood-block board export

quantity shall increase 1.5 times, reaching to 30,000 m^3 and the export quantity to 115,000 m^3, that the foreign trade enjoys an important place in the industrialization policies shows the need to develop plywood-block board 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 the plywood-block board industry in Turkey over time, determine short and long term development, strategy and policies for the plywood-block board industry and perform realistic projections about production-import-export in future.

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

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