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A regression analysis of fiberboard production, import and export amounts in Turkey, with projections to 2021

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Abstract: That the foreign trade enjoys an important place in the industrialization policies shows the need to develop fiberboard 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 fiberboard industry in Turkey over time. And hence in this study, models are established and projections are developed for production, import and export of Turkish fiberboard industry by econometric method. As a result of regression analysis performed, it is seen that fiberboard production of 2 million m^3 in 2006 shall increase 1.5 times in the year 2021, reaching to 3.4 million m^3, and the fiberboard export around 200 thousands m^3 in 2004-2006 shall reach to 330 thousands m^3 and import of 500 thousands m^3 to 900 m^3 thousands in 2021.
Keywords: Fiberboard trade, Production, Import, Export, Regression analysis

Türkiye'de liflevha üretimi, ithalat ve ihracat değerlerine ilişkin regresyon analizi ve 2021 yılına kadar tahmini

Özet: Sanayileşme politikalarında dış ticaretin önemli bir yerinin olması liflevha endüstrisinin geliştirilmesini ve bu sektöre önem verilmesi gereğini ortaya koymaktadır. Bu nedenle, Türkiye'nin liflevha endüstri üretim ve dış ticaret yapısının zaman içinde meydana gelecek değişmelerinin incelenmesi son derece önemli duruma gelmiştir. Bu çalışmada, Türkiye liflevha endüstrisinin üretim, ithalat ve ihracatının ekonometrik yöntemle modelleri kurulmuş ve tahminleri geliştirilmiştir. Yapılan regresyon analizi sonucunda 2006 yılı itibarıyla 2 milyon m^3 olan liflevha üretiminin 2021 yılında yaklaşık 1,5 kat artarak 3,4 milyon m^3 olacağı, 2004-2006 yıllarında yaklaşık 200 bin m^3 olan liflevha ihracatının ise 330 bin m^3e, 500 bin m^3 olan ithalatın ise 2021 yılında 900 bin m^3e ulaşacağı görülmektedir.
Anahtar kelimeler: Liflevha ticaret, Üretim, İthalat, İhracat, Regresyon analizi

1. Introduction

The first fiberboard plant was established in Izmir, Turkey in 1968. After that Sumerbank Istanbul and Bolu plants and Artvin ORUS plants making the total production capacity of about 85,000 m^3/year. From the year of 1995, 4 new MDF plants were established and the total capacity reached to 550,000 m^3/year. In those years capacity usage ratio was 86%, the share of wood based panels in foreign trade of forest products was 5% in export and 5.8% in import (Tank et al. 1998).

According to 2011 reports, there were 40 plants in operation in terms of board production. And, 24 of them were particleboard and 16 of them were fiberboard manufacturing facilities. The total production capacity of both of these sectors is 9 million m^3 and production amount reached to 5.5 million m^3. Most of the fiberboard plants are operated by using dry system. Wet system plants are only producing high density fiberboards (HDF), but dry system plants produce both HDF and medium density fiberboards (MDF) (Sakarya and Canli 2011; TOBB 2012).

As it can be seen in Table 1, the average fiberboard production between the years of 1982 to 1991 was about 70,000 m^3, between 1992 and 1994 it was 100,000 m^3, between 1995 and 2001 it was 350,000 m^3, in 2002 it was 600,000 m^3, 2003-2004 it was 900,000 m^3 and between 2005 and 2006 it was 1,900,000 m^3. Between the years of 1982 and 1991 import and export values were zero, however it can be understood that foreign trade was started in 1992. The export was around 10,000 m^3 between 1992 and 2000, but it reached to 85,000 m^3 between 2001 and 2002, 175,000 m^3 between 2003 and 2005, and 343,000 m^3 in 2006. The import numbers were higher in comparison for the matching years. It was 40,000 m^3 until 2000 and it was 21,000 between 2000 and 2004, 727,000 m^3 in 2005 and it was down to 549,000 m^3 in 2006.

Table 1 and Fig. 1 shows that the lowest production level was seen between 1982 and 1991 and the highest level was seen in 2006. The production was 70,000 m^3 in 1991 and it was increased by 720% in 1997 reaching to 574,000 m^3. Similarly, the production level was 810,000 m^3 in 2003 and it was increased by 159.26% in 2006 reaching to 2,100,000 m^3.

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1415 m^3 export level was the starting point in 1992 when the export began and it was increased by 12,341% (125 times) reaching to 176,049 m^3 and it was increasing up till 2006 and reached to 343,000 m^3. At the same time the import amount was 20,413 m^3 in 1992 and it was increased by 1242% and reached to 274,000 m^3 in 2000. It was decreased to 88,000 m^3 in 2001. However it was increased again by 726% for the later years reaching 727,000 m^3 in 2005. In 2006 it was decreased by 24.5% down to 549,000 m^3.

2. Materials and methods

2.1. Materials

In the study, a 25-years data set between the years of 1982-2006 was used for the variables included in each product and model. The data in question were obtained either by direct access to or via websites of Turkish Statistics Institute (TUIK, 2008), Undersecretariat of Foreign Trade (DTM, 2008), State Planning Organization (DPT, 2008), Export Development Center, Ministry of Industry and Trade (IGEME, 2008), World Agricultural organization (FAO, 2008), Forest Certification Council (FSCC, 2008), and General Directorate of Forestry (OGM, 2008). Furthermore, some information and document of the organizations operating in the sector, the records of Turkish Association of Chambers and Exchanges (TOBB, 2007) and Chipboard Industrialists Society and websites of the organizations and enterprises having direct or indirect relation to the subject of the study were all used.

For establishment of the most appropriate regression models for the projection operations, while the fiberboard 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 (GNP), population, building area (m^2) as per occupancy permit, construction materials price index, economic growth, consumer price index (CPI), producer price index (PPI) 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. 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.

25-years (1982-2006) data on the aforementioned independent and dependant variables are organized in (Tables 2-3-4) 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 and import figures for the years 1982-1991 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 and export of Turkey was taken as zero as they are actually or very small or negligible level.

2.2. Methods

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.

Making the study or building the most appropriate regression models was achieved by using SPSS statistical package program. For this purpose, Stepwise Regression method was used. At first, different number of variables and period combinations as well as the most appropriate variable and period were determined and then different regression models (logarithmic, exponential, quadratic, linear, etc.) were also tried in the selection of the most accurate regression model used in the projection operation. This method was found to be the most appropriate one for the subject of the study in that theoretically it aims at determining the independent variables that may affect Y-dependant variable and selecting from them those that are not interrelated with each other and affect the dependant variable most.

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

Years	Production	Export	Import
1982	70,000	0	0
1983	85,000	0	0
1984	70,000	0	0
1985	70,000	0	0
1986	70,000	0	0
1987	70,000	0	0
1988	70,000	0	0
1989	70,000	0	0
1990	70,000	0	0
1991	70,000	0	0
1992	100,000	1,415	20,413
1993	95,000	1,767	16,174
1994	120,000	500	4,400
1995	131,000	2,100	16,900
1996	301,000	8,200	51,000
1997	574,000	7,000	49,000
1998	357,000	10,000	83,000
1999	348,000	14,000	45,000
2000	422,000	19,000	274,000
2001	386,000	82,000	88,000
2002	600,000	90,000	227,000
2003	810,000	176,049	247,261
2004	1,003,000	184,648	369,000
2005	1,742,000	183,267	727,355
2006	2,100,000	343,000	549,000

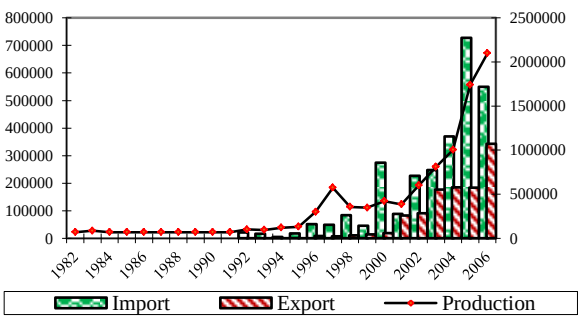

Fig. 1. The production, export and import amounts of fiberboard panels in Turkey

As independent variables with significant effect on Y are included in the model one by one starting from the strongest one, overloading of the model and waste of time shall be eliminated, making the projection calculation more practical.

Calculation results given in the variance table of the regression model were compared with the coefficients of regression equation, statistical values F and t and table values of F and T statistical values at the significance level of α=0.05 and test was performed to find out whether the model is valid and the selected independent variables may be used satisfactorily or not.

3. Results and Discussion

After building the most appropriate regression models for projection (3 distinct models for fiberboard production, import and export), forecast values of independent variables applicable for each model for the next 15 years were obtained (year) in relation to the time series and projection values were calculated on basis of these figures.

3.1. Regression analysis results of fiberboard industry (production-import- export)

3.1.1. Fiberboard production

As it may be seen from the summary table (Table 5), all regression models, with one independent variable (CPI), two independent variables (CPI, FOREIGN EXCHANGE $), three independent (CPI, FOREIGN EXCHANGE $, BUILDING AREA) and four independent variables (CPI, FOREIGN EXCHANGE $, BUILDING AREA, NUMBER OF BUILDINGS) 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 four regression models and F statistical values are significant when the models are valid or when the relationship between the dependant variables and independent variables is significant at $\alpha = 0.05$. However, in this case of projection, the regression model with three independent variables (CPI, FOREIGN EXCHANGE $, BUILDING AREA) shall be used. The reason is that the difference between the $r^2 = 0.972$ value of the model represented by four independent variables and $r^2 = 0.951$ value of the model represented by three independent variable is at a negligible level. Another reason is that, use of three independent variables in the projection makes the operation easy. Furthermore here, $r^2 = 0.951$ is a very high coefficient of determination. This figure indicates that the selected independent variables express the fiberboard production around 95%, demonstrating that structure of the linear model is appropriate. Below other results of the solution, ANOVA (Table 6), Coefficients (Table 7) and dispersion graphic (Fig. 2) of the model are given.

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

	Population	Per Capita	GNP	Per Capita	GDP
Years	(1000)	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)

	Log	Industrial	Buildings	Permits	Annual
Years	1000m^3	Wood (1000m^3)	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
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 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	3,882
1983	539.00	165.68	1.7	28.1	5,441
1984	799.95	249.13	4.5	55.2	7,878
1985	1,159.63	356.79	1.7	55.5	12,525
1986	1,560.98	462.25	4.4	41.6	16,916
1987	2,167.51	610.40	7.5	43.4	23,075
1988	3,800.95	1,027.30	-0.7	68.5	38,744
1989	6,447.44	1,741.99	-0.6	74.5	62,699
1990	10,547.15	2,741.10	6.8	68.4	91,729
1991	17,503.32	4,260.36	-1.6	56.7	152,580
1992	30,052.64	7,051.58	4.4	70.7	246,594
1993	50,392.45	11,545.97	6.2	77.7	406,756
1994	106,102.03	25,212.55	-7.8	91.2	887,488
1995	206,323.49	47,528.46	6.1	98.5	1,511,717
1996	366,475.34	84,934.70	5.3	87.5	2,765,327
1997	672,724.15	153,300.04	8.7	96.9	5,104,892
1998	1,225,733.19	260,825.50	2.3	79.3	8,538,854
1999	1,943,577.71	398,121.90	-7.4	44.3	12,277,603
2000	2,960,721.26	600,952.65	1.4	53.0	18,851,834
2001	4545,059.66	998,582.63	-11.1	38.1	31,567,385
2002	6,733,431.01	1,510,984.00	6.4	53.6	45,494,981
2003	8,506,320.48	1,871,847.92	4.2	27.7	**56,359,182
2004	9,208,409.60	2,099,693.40	8.2	18.5	**63,218,094
2005	10,136,772.60	2,260,856.62	7.2	13.0	**68,066,921
2006	*11,657,288.49	*2,599,985.11	4.6	16.9	**78,276,959

*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,%15) respectively.

Table 5. Model summary(e)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.922(a)	0.850	0.843	209,437.59902
2	0.964(b)	0.929	0.923	147,035.01392
3	0.975(c)	0.951	0.944	125,420.63667
4	0.986(d)	0.972	0.966	97,294.804830

a Predictors: (Constant), CPI
b Predictors: (Constant), CPI, EXCHANGE$
c Predictors: (Constant), CPI, EXCHANGE$, BUILDAREA
d Predictors: (Constant), CPI, EXCHANGE$, BUILDAREA, NUMBERBUILD
e Dependent Variable: FIBERPRODUCT

Table 6. ANOVA(e)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5,710,682,878,696.730	1	5,710,682,878,696.730	130.190	0.000(a)
	Residual	1,008,874,481,303.265	23	43,864,107,882.751		
	Total	6,719,557,360,000.000	24			
2	Regression	6,243,932,863,024.130	2	3,121,966,431,512.065	144.406	0.000(b)
	Residual	475,624,496,975.871	22	216,19,295,317.085		
	Total	6,719,557,360,000.000	24			
3	Regression	6,389,220,301,841.730	3	2,129,740,100,613.912	135.391	0.000(c)
	Residual	330,337,058,158.267	21	15,730,336,102.775		
	Total	6,719,557,360,000.000	24			
4	Regression	6,530,231,779,051.290	4	1,632,557,944,762.824	172.460	0.000(d)
	Residual	189,325,580,948.705	20	9,466,279,047.435		
	Total	6,719,557,360,000.000	24			

a Predictors: (Constant), CPI
b Predictors: (Constant), CPI, EXCHANGE$
c Predictors: (Constant), CPI, EXCHANGE$, BUILDAREA
d Predictors: (Constant), CPI, EXCHANGE$, BUILDAREA, NUMBERBUILD
e Dependent Variable: FIBERPRODUCT

As it may be seen from the coefficients (a) (Table 7), regression equation for the fiberboard production shall be as follows (model 3) Y= 119,108.553 + 0.210 CONSUMER PRICE INDEX (CPI) – 0.593 FOREIGN EXCHANGE $ + 0,004 BUILDING AREA.

3.1.2. Fiberboard import

As it may be seen in the summary table (Table 8), both regression models, one built with one independent variable (CPI), and the other with two independent variables (CPI, GNP$) are valid and significant, that is, usable for projection. However, in this case of projection, the regression model with two independent variables (CPI, GNP$) shall be used. Here, r^2 =0.880 is a very high coefficient of determination. This figure indicates that the selected independent variables express the fiberboard import around 88%, demonstrating that structure of the linear model is appropriate. Below other results of the solution, ANOVA (Table 9), Coefficients (Table 10) and dispersion graphic (Fig. 3) of the model are given.

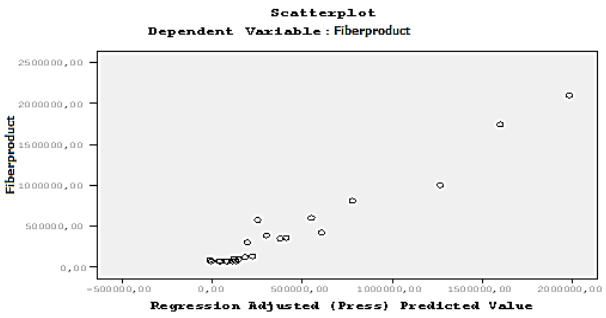

Fig.2. The scatter diagram of fiberboard production

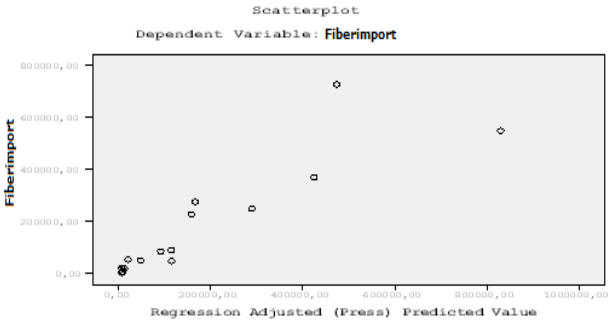

Fig. 3. The scatter diagram of fiberboard import

Table 7. Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	89,484.217	49,580.708		1.805	0.084
	CPI	0.130	0.011	0.922	11.410	.000
2	(Constant)	133,123.273	35,899.908		3.708	0.001
	CPI	0.258	0.027	1.836	9.534	.000
	EXCHANGE$	-0.848	0.171	-0.956	-4.966	.000
3	(Constant)	-119,108.553	88,464.706		-1.346	0.193
	CPI	0.210	0.028	1.495	7.521	.000
	EXCHANGE$	-0.593	0.168	-0.669	-3.529	0.002
	BUILDAREA	0.004	0.001	0.182	3.039	0.006
4	(Constant)	87,188.921	86,986.132		1.002	0.328
	CPI	0.162	0.025	1.153	6.483	.000
	EXCHANGE$	-0.559	0.131	-0.63	-4.275	.000
	BUILDAREA	0.014	0.003	0.619	5.058	.000
	NUMBERBUILD	-7.081	1.835	-0.452	-3.860	0.001

[a]Dependent Variable: FIBER PRODUCT.

Table 8. Model summary(c)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.891(a)	0.795	0.779	102,601.59496
2	0.938(b)	0.880	0.860	81,604.73207

a Predictors: (Constant), CPI,
b Predictors: (Constant), CPI, GNP$
c Dependent Variable: FIBERIMPORT

Table 9. ANOVA (c)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	529,536,565,249.674	1	529,536,565,249.674	50.302	0.000(a)
	Residual	136,852,134,740.726	13	10,527,087,287.748		
	Total	666,388,699,990.400	14			
2	Regression	586,476,712,430.898	2	293,238,356,215.449	44.034	0.000(b)
	Residual	79,911,987,559.502	12	6,659,332,296.625		
	Total	666,388,699,990.400	14			

[a]Predictors: (Constant), CPI., [b]Predictors: (Constant), CPI, GNP$., [c]Dependent Variable: FIBERIMPORT.

As it may be seen from the coefficients (a) (Table 10), regression equation for the fiberboard import shall be as follows (model 2) Y = - 259,153.982 + 0.028 CONSUMER PRICE INDEX (CPI) + 102.962 GNP$.

3.1.3. Fiberboard export

As it may be seen in the summary Table 11, both regression models, one built with one independent variable (PPI), and the other with two independent variables (PPI, BUILDING AREA) 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 α=0.05. Here, r^2 =0.946 is a very high coefficient of determination. This figure indicates that the selected independent variables express the fiberboard export around 95%, demonstrating that structure of the linear model is appropriate. Below other results of the solution, ANOVA (Table 12), Coefficients (Table 13) and dispersion graphic (Fig. 4) of the model are given.

As it may be seen from the coefficients (a) Table 13, regression equation for the fiberboard export shall be as follows (model 2) Y= -84,828.788 + 0.100 PPI + 0.001 BUILDING AREA.

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

In the estimated values of the independent variables (Tables 14-17), 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 equations were found and these equations were used for the calculations (Table 18).

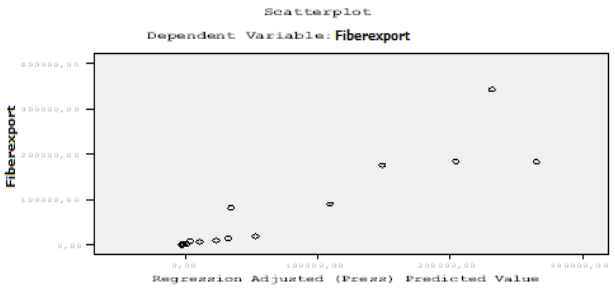

Fig. 4. The scatter diagram of fiberboard export

Table 10. Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	5,295.19	36,609.217		0.145	0.887
	CPI	0.046	0.006	0.891	7.092	.000
2	(Constant)	-259,153.98	95,009.21		-2.728	0.018
	CPI	0.028	0.008	0.550	3.58	0.004
	GNP$	102.962	35.211	0.449	2.924	0.013

[a]Dependent Variable: FIBERIMPORT.

Table 11. Model Summary(c)

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.951(a)	0.904	0.897	33,015.51093
2	0.973(b)	0.946	0.937	25,730.61147

a Predictors: (Constant), PPI., b Predictors: (Constant), PPI, BUILDAREA., c Dependent Variable: FIBEREXPORT.,

Table 12. ANOVA(c)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	133,693,459,344.881	1	133,693,459,344.881	122.652	0.000(a)
	Residual	14,170,311,502.052	13	1,090,023,961.696		
	Total	147,863,770,846.933	14			
2	Regression	139,918,998,446.938	2	69,959,499,223.469	105.669	0.000(b)
	Residual	7,944,772,399.995	12	662,064,366.666		
	Total	147,863,770,846.933	14			

[a]Predictors: (Constant), PPI., [b]Predictors: (Constant), PPI, BUILDAREA., [c]Dependent Variable: FIBEREXPORT.

Table 13. Coefficients(a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	-14,160.376	11,716.802		-1.209	0.248
	PPI	0.103	0.009	0.951	11.075	0.000
2	(Constant)	-84,828.788	24,788.727		-3.422	0.005
	PPI	0.100	0.007	0.921	13.616	0.000
	BUILDAREA	0.001	0.000	0.207	3.066	0.010

[a]Dependent Variable: FIBER EXPORT.

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

Years	Population (000)person	OGM Wood Sales (m^3)	Foreign Exchange (USD$)
2007	74,609.64	7,970.756	1,286,324.672
2008	75,713.84	8,021.802	1,354,092.479
2009	76,818.04	8,072.848	1,421,860.286
2010	77,922.24	8,123.894	1,489,628.093
2011	79,026.44	8,174.940	1,557,395.900
2012	80,130.64	8,225.986	1,625,163.707
2013	81,234.84	8,277.032	1,692,931.514
2014	82,339.04	8,328.078	1,760,699.321
2015	83,443.24	8,379.124	1,828,467.128
2016	84,547.44	8,430.170	1,896,234.935
2017	85,651.64	8,481.216	1,964,002.742
2018	86,755.84	8,532.262	2,031,770.549
2019	87,860.04	8,583.308	2,099,538.356
2020	88,964.24	8,634.354	2,167,306.163
2021	90,068.44	8,685.400	2,235,073.970

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	13,886,464	1,719,991	52,165,111.15
2008	14,302,418	1,812,472	54,965,534.91
2009	14,718,373	1,904,954	57,765,958.68
2010	15,134,328	1,997,436	60,566,382.44
2011	15,550,283	2,089,918	63,366,806.20
2012	15,966,238	2,182,400	66,167,229.96
2013	16,382,192	2,274,882	68,967,653.72
2014	16,798,147	2,367,363	71,768,077.49
2015	17,214,102	2,459,845	74,568,501.25
2016	17,630,057	2,552,327	77,368,925.01
2017	18,046,011	2,644,809	801,693,48.77
2018	18,461,966	2,737,291	82,969,772.53
2019	18,877,921	2,829,773	85,770,196.30
2020	19,293,876	2,922,255	88,570,620.06
2021	19,709,831	3,014,736	91,371,043.82

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	89,153,950.80	102,594.396	4,301.642
2008	91,026,081.78	102,510.882	4,430.264
2009	92,898,212.77	102,427.368	4,558.886
2010	94,770,343.75	102,343.854	4,687.508
2011	96,642,474.73	102,260.340	4,816.130
2012	98,514,605.71	102,176.826	4,944.752
2013	100,386,736.7	102,093.312	5,073.374
2014	102,258,867.7	102,009.798	5,201.996
2015	104,130,998.7	101,926.284	5,330.618
2016	106,003,129.6	101,842.770	5,459.240
2017	107,875,260.6	101,759.256	5,587.862
2018	109,747,391.6	101,675.742	5,716.484
2019	111,619,522.6	101,592.228	5,845.106
2020	113,491,653.6	101,508.714	5,973.728
2021	115,363,784.6	101,425.200	6,102.350

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

3.3. Fiberboard production, export and import projection values in Turkey

In Table 19, Turkish fiberboard 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 2007-2021 in the equation found as a result of regression analysis conducted for the fiberboard 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 fiberboard production; Y= 119,108.553 + 0.210 CPI − 0.593 FORIGN EXCH.$ + 0.004 BUILD. AREA

For fiberboard import; Y= −259,153.982 + 0.028 CPI + 102.962 GNP$

For fiberboard export; Y= −84,828.788 + 0.100 PPI + 0.001 BUILDING AREA,

3.4. Observed and projected values of fiberboard production, export and import in Turkey

In Figure-5, the projected and observed values of fiberboard production of Turkey between the years of 2007-2013 were presented. The projected and observed values are very close, especially in the 2007-2010 it can be seen that they were very close to real values.

Turkey's projected and observed import figures between the years of 2007-2013 are given in Figure 6. The projected values were determined a little higher than the real values, and the predicted values is almost the same with values realized in 2012 and 2013.

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

$Y_{Population}$	= 45,900.440 + 1,104.200.*x*	Y_{CPI}	= 3,071,639.325 + 415,954.780.*x*
Y_{OGM}	= 6,643.560 + 51.046.*x*	Y_{PPI}	= −684,537.362 + 92,481.844.*x*
$Y_{Pricet\ Indx}$	= −2E+007 + 2,800,423.762.*x*	$Y_{E.Growth}$	= 64.462 − 0.688.*x*
$Y_{B.Area}$	= 40,478,545.270+ 1,872,130.982.*x*	Y_{GNP}	= 957.470 + 128.622.*x*
$Y_{Number\ Build.}$	= 104,765.760 − 83.514.*x*	$Y_{Foreign\ Exch.}$	= −475,638.310 + 67,767.807.*x*

Table 19. Fiberboard production, export and import projection values in Turkey (m^3)

Years	Production	Export	Import
2007	2,629,091	176,324	572,573
2008	2,683,744	187,445	597,463
2009	2,738,397	198,565	622,353
2010	2,793,049	209,685	647,242
2011	2,847,702	220,806	672,132
2012	2,902,355	231,926	697,022
2013	2,957,007	243,046	721,912
2014	3,011,660	254,166	746,802
2015	3,066,313	265,287	771,692
2016	3,120,966	276,407	796,582
2017	3,175,618	287,528	821,472
2018	3,230,271	298,648	846,362
2019	3,284,924	309,768	871,252
2020	3,339,577	320,888	896,142
2021	3,394,229	332,009	921,031

According to Turkey's projected and observed export values between the years of 2007-2013 (Figure-7), the observed values were found higher than projected values. This situation proves that Turkey's fiberboard export values have been improved beyond expectations.

4. 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 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.

Investments through production of fiberboard production being one of the most important inputs in furniture industry have been growing rapidly in Turkey along with foreign trade (Koç ve Aksu,1999).

In the regression analyses performed for projection of fiberboard production, import and export, the nine 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 fiberboard production, import and export projections and their combinations were tried and the most appropriate regression models were searched and thus regression models were formed.

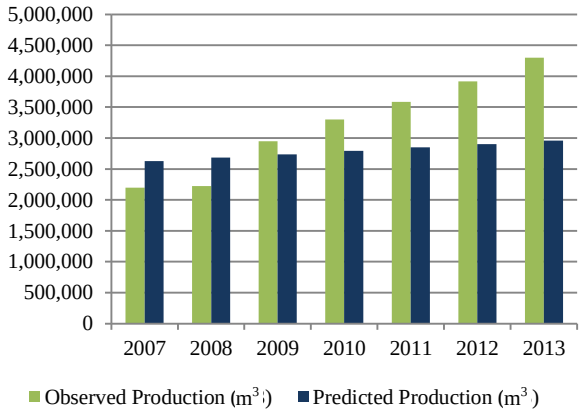

Fig.5. 2007-2013 Observed and projected values of fiberboard production in Turkey

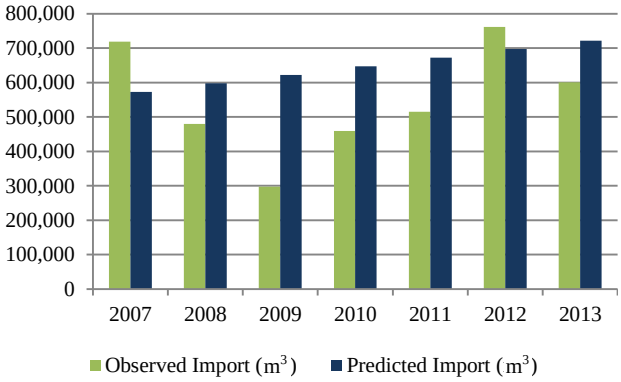

Fig.6. 2007-2013 Observed and projected values of fiberboard import in Turkey

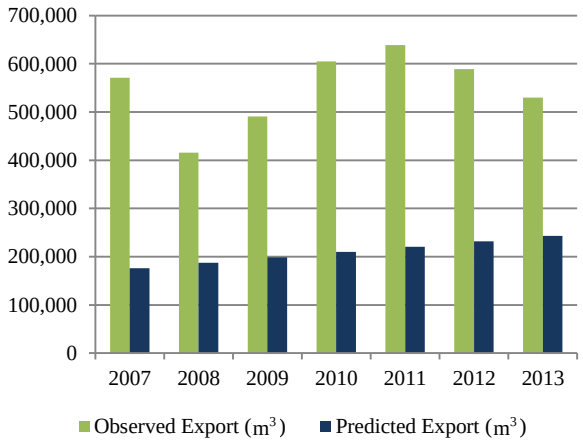

Fig.7. 2007-2013 Observed and projected values of fiberboard export in Turkey

As period up to the year 2021 was target in the projection of fiberboard 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.

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

As a result of different regression model trials, the independent variables of CPI, Foreign Exchange and Building Area As Per The Occupancy Permit (m^2), have provided sufficient explanation (r^2 = 0.951) for the fiberboard production and used as estimation tool for the projection of fiberboard production.

Similar operations in the fiberboard import projection were performed by using same data and changes in the period. It is seen from the results of the regression analysis that CPI and GNP as significant and independent variables provides explanation (r^2 = 0.880), and that the variables PPI and Building Area As Per The Occupancy Permit (m^2) in the fiberboard export projection provide explanation as significant variable (r^2 = 0.946) and can be used as projection tool.

When examining the fiberboard export and import estimated figures, the following results appear:

As a result of regression analysis performed, it is seen that fiberboard production of 2 million m^3 in 2006 shall increase 1.5 times in the year 2021, reaching to 3.4 million m^3; and the fiberboard export around 200 thousands m^3 in 2004-2006 shall reach to 330 thousands m^3 and import of 500 thousands m^3 to 900 m^3 in 2021.

Comparing the actual values and predicted ones belonging to 2013, it can be said that especially production and import values are very close to estimated values. It can be seen that the difference between realized values of production and estimates has gone down to 7.2% for some of the years and for import it was 8.5%. However, the difference in export values was found as 54% as it is very high (FAO 2014). In order to improve the export projections new variables can be determined and different models can be established.

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

Acknowledgement

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