The Turkish paper and paperboard industry: A study of the statistical assessment, analysis and forecast

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Abstract: Today, paper is one of the most needed products for its cultural and industrial use. As an indispensable component in our lives, paper has been improved by technology and developments and it's become more aesthetic and this leads to a gradual increase in the use of paper products per capita every year. In this study, forecasting was carried out in the paper and paperboard production, export and import amounts using a regression analysis method for the next twenty years based on the data for the years between 1982 and 2006. By analyzing the results, it can be seen that paper and cardboard production will increase by 58%, export will increase by 52% and import will increase by 17%.

Keywords: Paper foreign trade, production, export, import, analysis, forecast

Türk kağıt ve karton sanayi: İstatistiksel değerlendirme, analiz ve tahmin üzerine bir çalışma

Özet: Kağıt, kültürel ve sanayi alanındaki kullanımı ile günümüzün en önemli ihtiyaç maddelerinden birini teşkil etmektedir Hayatımızın vazgeçilmez unsurlarından biri olan kağıt gelişen teknoloji ve imkanlarla daha estetik bir hal almış olup, kişi başı kağıt tüketimi her yıl giderek artış göstermektedir. Bu çalışmada Türkiye'nin kağıt-karton endüstrisinin 1982-2006 yılları arasındaki 25 yıllık verilerinden yola çıkılarak gelecek 20 yıllık üretim, ithalat ve ihracat değerleri regresyon analizi yardımıyla tahmin edilmiştir. Sonuçlar incelendiğinde 2021 yılında kağıt-karton üretiminin yaklaşık %56, kağıt-karton ihracatının %49 ve kağıt-karton ithalatının ise %17'lik bir artış göstereceği görülmektedir.

Anahtar Kelimeler: Kağıt dış ticaret, üretim, ihracat, ithalat, analiz, tahmin

1. INTRODUCTION

The paper production in Turkey by modern methods began with a plant built in Izmit in 1936. Industrial and cultural paper products were only manufactured by SEKA only until the 1960s, when the domestic production did not meet the demands, paper products were imported. Between 1963 and 1979 was a breakthrough for a paper industry regarding expansion and development. During that period SEKA was a major manufacturer until 24 January 1980, then private sector in the paper industry as well as other industries became an important figure through liberalization politics. In 1936 annual capacity was around 10 thousand tons and in 2001, it reached to 1 million 627 thousand tons per year (TMMOB, 2003).

The Turkish paper industry turned its face to export for the last fifteen years, although it is very limited. Increased costs and low quality are the most important factors affecting export amounts negatively. With parallel to developments in packaging industry, industrial paper production is also increased by demand. Especially, SEKA Akdeniz plant, opened in 1984, had an important role in this increase. As of 2007, paper and paperboard export was achieved to 162 countries from Turkey. The countries that making most imports from Turkey for the last three years are Iraq, Bulgaria, Romania, United Kingdom, Israel and Greece (Hodul, 2010).

Apart from the domestic production, Turkish paper and paperboard demands was met by importing. Generally imported products are the types that domestic production can not meet the demand or luxurious types and when

exchange rates remain low making import more feasible. Newspaper, printing and writing papers, uncoated or impregnated paperboards, Kraft bag papers and oil-proof papers are imported items (IGEME, 2008).

It can be seen at Table 1 that Turkish paper-cardboard production between the years 1982-1991 was around 650,000 tons, it was gradually increased since 1991 and in 2006 it was 1,643,000 tons. The amount of export between 1982-1984 years is too low, it was 42,000 tons in 1985, and in 2001 it reached to 163,000 tons. Between 2002 and 2006, it was 174,000 tons. In the same way import, between1982 and 1986 it was around 70,000 tons, in 1987 it was 113,000 tons and in 1993 it reached to 640,000 tons. The import amounts demonstrated fluctuations since 1993 and in 2006; this quantity is approximately 2,000,000 tons.

Table 1. The production, export and import amounts of paper and paperboard in Turkey (tons) (FAO, 2008)

Years	Production	Export	Import
1982	537,000	900	69,200
1983	391,000	600	31,200
1984	488,000	1,000	69,800
1985	644,000	42,000	83,000
1986	710,000	41,000	82,600
1987	813,000	41,800	113,000
1988	681,000	38,000	135,500
1989	751,000	32,000	218,200
1990	891,000	26,000	246,300
1991	747,000	26,000	223,400
1992	1,012,200	41,268	312,109
1993	1,032,000	27,998	640,905
1994	1,102,000	88,800	256,900
1995	1,240,000	97,000	421,000
1996	1,105,000	37,400	700,000
1997	1,246,000	48,000	811,000
1998	1,357,000	57,000	775,000
1999	1,349,000	78,000	871,000
2000	1,567,000	65,000	1,005,540
2001	1,513,000	163,000	668,000
2002	1,643,000	174,627	1,020,000
2003	1,643,000	174,627	1,020,000
2004	1,643,000	174,627	1,020,000
2005	1,643,000	174,627	2,068,000
2006	1,643,000	174,627	2,068,000

The determination of short term and long term forest products manufacturing strategies and policies and preparation of future plans and programs is very important. For this reason, the first thing to do is to investigate and analyze the potential situation based on such criteria as current resources of forest industry, production power and problems etc. and to make projections in terms of production, export and import which will be used to prepare future plans.

In this study, models are established and projections are developed for production, import and export of Turkish paper-cardboard 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. Study results presented the current situation of paper and paperboard sector being one of the important industrial areas in Turkey, and it will provide a projection for future developments and changes in terms of production, export and import. Moreover, with additional updates, these models can be used in the calculations to make future projections for the production, export and import of forest products mentioned.

2. MATERIALS AND METHODS

2.1 Model Building and Regression Analysis

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

When set the model, the first stage is to determine the subject to be examined. After determination of the subject, the first thing to do is set forth magnitudes affecting each other in the structure. Given complex and detailed structure of real life, it turns out that a number of these variables are adequate. On the other hand, building a model by using variables more than required would cause the model less conceivable with the elimination of its usability characteristic. For this reason, while the model should represent the range in the main mass in the most effective way, it should also have such a structure that accommodates both time and cost factors. The solution to this situation is to seek the best model, basic, but also containing independent variables in the most appropriate number and composition to represent the existing structure with details as much as possible. Model containing variables in the most appropriate number and composition is not a single and independent one. In other words, more than one model may be built to represent the present structure. An essential objective is to seek a model with its selection process does not contain a great number of variables, but giving information about the subject as much as possible.

For establishment of the most appropriate regression models for the projection operations, while the paper and paperboard production, import and export were dealt with as dependent 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. Parameters of the econometric modeling rest on time series of past 25-years and projection was made for the next 15 years around on the basis of a variety of reasonable assumption and scenarios.

Making the study or building the most appropriate regression models were achieved by using the SPSS-15 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-dependent variable and selecting from them those that are not interrelated with each other and affect the dependent variable most. 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 a regression equation, statistical values F and t and table values of F and T statistical values at the significance level of $\alpha=0.05$ and the test was performed to find out whether the model is valid and the selected independent variables may be used satisfactorily or not.

2.2 Gathering Data on Variables Selected for Regression Models

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 the 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), Food and Agriculture 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.

Dependent variables to be used in the regression model were taken as Turkish paper and paperboard production, Turkish paper and paperboard import and Turkish paper and paperboard export. Not each of the independent variables used in the regression models built for projection of the paper and paperboard product in this study provided sufficient explanation, and, for this reason, the variables that may be possibly most effective were used depending on the characteristic of the product. These variables are consisted of: 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 and Producer Price Index 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) (Table 2-4).

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

Years	Population (000)	Per Capita TL	GNP $	Per Capita TL	GDP $
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 (TUIK, 2008; OGM, 2008).

Years	Log (000m³)	Industrial Wood (000m³)	Buildings Number of building	Permits Area	Annual Exchange Rates ($)
1982	4,066	5,821	*45,995	22,945,123	164.07
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 years increase on the number of buildings.
**The US$ and Turkish Lira exchange rates were ignored for 2005-2006 US$ rates.

3. RESULTS AND DISCUSSION

After building the most appropriate regression models for projection (3 distinct models for paper and paperboard 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 the basis of these figures.

3.1 Regression Analysis Results of Paper and Paperboard Industry

3.1.1 Paper and paperboard production

As it can be seen from the summary table below (Table 5) the regression model with one independent variable (POPULATION) is valid and significant. Other ten independent variables included in the model for the regression analysis were not included in the regression equation as a result of the operation. The reason is that here stepwise method was applied in the multiple regression analysis. Consequently, it is seen that with the method eliminating the multiple linear connection (a condition deteriorating the model caused by high correlation among the independent variables), the other independent variables remain outside the model without the variable(s) affecting the paper and paperboard production most and overloading the model. As a result, the resulting coefficient of determination R^2 is quite high, and F statistical values show the models are valid and the relationship between the dependent variable and independent variables is significant at a significance level of

α=0.05. Here, R^2=0.962 is a very high coefficient of determination. This figure indicates that the selected independent variables express the paper and paperboard production around 96%, demonstrating that the structure of the linear model is appropriate. Below other results of the solution of the model (ANOVA and Coefficients) are given in Table 5.

As it may be seen from the coefficients (a) table, the regression equation in the paper and paperboard production shall be as follows (model 1)

Y= -1,920,097.846 + 50.050 POPULATION.

The hypothesis regarding the validation of selected independent variables and the model was tested by t and F statistics methods.

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	4,545,059.66	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 years 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, ANOVA and Coefficients for paper and paperboard production

MODEL SUMMARY (b)				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.981(a)	.962	.961	82,492.51424
a. Predictors: (Constant): POPULATION b. Dependent Variable: PAPERPRODUCT				

ANOVA (b)						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3,989,492,999,561.305	1	3,989,492,999,561.305	586.258	.000(a)
	Residual	156,515,342,838.695	23	6,805,014,906.030		
	Total	4,146,008,342,400.000	24			
a. Predictors: (Constant), POPULATION b. Dependent Variable: PAPERPRODUCT						

COEFFICIENTS (a)						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	-1,920,097.846	125,639.887		-15.283	.000
	POPULATION	50.050	2.067	.981	24.213	.000
a. Dependent Variable: PAPERPRODUCT						

3.1.2 Paper and Paperboard Import

As it may be seen in the summary table given below (Table 6), both regression models, one built with one independent variable (GNP), and the other with two independent variables (GNP, 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 both regression models and F statistical values are significant when the models are valid or when the relationship between the dependent variable and independent variable is significant at α=0.05. However, in this case of projection, the regression model with two independent variables (GNP, FOREIGN EXCHANGE) shall be used. Here, R^2=0.913 is a very high coefficient of determination. This figure indicates that the selected independent variables express the paper and paperboard import around 91%, demonstrating that the structure of the linear model is appropriate. Below other results of the solution of the model (ANOVA and Coefficients) are given in Table 6.

As it may be seen from the coefficients (a) table, the regression equation for the paper and paperboard import shall be as follows (Model 2) Y= -478,332.708 + 360.155 GNP$ + 0.317 EXCHANGE$. The hypothesis regarding the validation of selected the independent variables and the model from the same table was tested by t and F statistics methods.

3.1.3 Paper and Paperboard Export

As it may be seen in the summary table given below (Table 7), both regression models, one built with one independent variable (FOREIGN EXCHANGE), and the other with two independent variables (FOREIGN EXCHANGE, 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 regression models and F statistical values are significant when the models are valid or when the relationship between the dependent variable and the independent variable is significant at α=0.05. However, in this case of projection, the regression model with two independent variables (FOREIGN EXCHANGE, ECONOMIC GROWTH) shall be used. Here, R^2=0.907 is a very high coefficient of determination. This figure indicates that the selected independent variables express the paper and paperboard export around 91%, demonstrating that structure of the linear model is appropriate. Below other results of the solution of the model (ANOVA and Coefficients) are given in Table 7.

Table 6. Model Summary, ANOVA and Coefficients for paper and paperboard import

MODEL SUMMARY (c)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.923(a)	.851	.845	223,020.85652
2	.956(b)	.913	.905	174,019.76702

a. Predictors: (Constant), GNP$ b. Predictors: (Constant), GNP$, EXCHANGE$ c. Dependent Variable: PAPERIMPORT

ANOVA (c)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6,544,073,469,977.620	1	6,544,073,469,977.620	131.570	.000(a)
	Residual	1,143,980,956,139.737	23	49,738,302,440.858		
	Total	7,688,054,426,117.350	24			
2	Regression	7,021,831,081,228.560	2	3,510,915,540,614.282	115.937	.000(b)
	Residual	666,223,344,888.794	22	30,282,879,313.127		
	Total	7,688,054,426,117.350	24			

a. Predictors: (Constant), GNP$ b. Predictors: (Constant), GNP$, EXCHANGE$ c. Dependent Variable: PAPERIMPORT

COEFFICIENTS (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	-650,986.660	117,603.729		-5.535	.000
	GNP$	474.670	41.382	.923	11.470	.000
2	(Constant)	-478,332.708	101,539.082		-4.711	.000
	GNP$	360.155	43.288	.700	8.320	.000
	EXCHANGE$	.317	.080	.334	3.972	.001

a. Dependent Variable: PAPERIMPORT

Table 7. Model Summary, ANOVA and Coefficients for paper and paperboard export

MODEL SUMMARY (c)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.938(a)	.880	.875	21,885.04659
2	.953(b)	.907	.899	19,655.45533

a. Predictors: (Constant), EXCHANGE$ b. Predictors: (Constant), EXCHANGE$, EGROWTH
c. Dependent Variable: PAPEREXPORT

ANOVA (c)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	80,725,941,919.629	1	80,725,941,919.629	168.546	.000(a)
	Residual	11,015,971,081.331	23	478,955,264.406		
	Total	91,741,913,000.960	24			
2	Regression	83,242,500,669.034	2	41,621,250,334.517	107.733	.000(b)
	Residual	8,499,412,331.926	22	386,336,924.178		
	Total	91,741,913,000.960	24			

a. Predictors: (Constant), EXCHANGE$ b. Predictors: (Constant), EXCHANGE$, EGROWTH
c. Dependent Variable: PAPEREXPORT

COEFFICIENTS (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	33,644.408	5,325.844		6.317	.000
	EXCHANGE$	.097	.007	.938	12.983	.000
2	(Constant)	500.663	13,839.084		.036	.971
	EXCHANGE$	.110	.008	1.062	13.099	.000
	EGROWTH	503.185	197.155	.207	2.552	.018

a. Dependent Variable: PAPEREXPORT

As it may be seen from the coefficients (a) table, regression equation for the paper and paperboard export shall be as follows (model 2) Y= 500.663 + 0.110 EXCHANGE$ + 503.185 EGROWTH. The hypothesis regarding the validation of selected independent variables and the model from the same table was tested by t and F statistics methods.

3.2 Calculation of the Estimated Value of the Independent Variables in the Projection Models

In the estimated values of the independent variables (Table 8) of POPULATION, FOREIGN EXCHANGE, GNP and ECONOMIC GROWTH are projected by years (x), using the data for the period of 1982-2006 with the help of regression analysis. In the said projection, the following regression equations were found and these equations were used for the calculations.

For POPULATION; $Y_{Population}$ = 45,900.440 + 1104.200.x

For GNP; Y_{GNP} = 957.470 + 128.622.x

For ECONOMIC GROWTH; $Y_{E.Growth}$ = 64.462 − 0.688.x

For FOREIGN EXCHANGE; $Y_{F.Exchange}$ = −475,638.310 + 67767.807.x

Table 8. The estimated values of the independent variables between the years of 2007-2021
(Population, GNP, Economic Growth, Foreign Exchange).

Years	Population (000)person	GNP	Economic Growth (%)	Foreign Exchange (USD$)
2007	74,609.64	4,301.642	46.574	1,286,324.672
2008	75,713.84	4,430.264	45.886	1,354,092.479
2009	76,818.04	4,558.886	45.198	1,421,860.286
2010	77,922.24	4,687.508	44.510	1,489,628.093
2011	79,026.44	4,816.130	43.822	1,557,395.900
2012	80,130.64	4,944.752	43.134	1,625,163.707
2013	81,234.84	5,073.374	42.446	1,692,931.514
2014	82,339.04	5,201.996	41.758	1,760,699.321
2015	83,443.24	5,330.618	41.070	1,828,467.128
2016	84,547.44	5,459.240	40.382	1,896,234.935
2017	85,651.64	5,587.862	39.694	1,964,002.742
2018	86,755.84	5,716.484	39.006	2,031,770.549
2019	87,860.04	5,845.106	38.318	2,099,538.356
2020	88,964.24	5,973.728	37.630	2,167,306.163
2021	90,068.44	6,102.350	36.942	2,235,073.970

3.3 Paper and Paperboard Production, Export and Import Projection Values in Turkey

In Table 9, Turkish paper and paperboard 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 and 2021 in the equation found as a result of regression analysis conducted for the paper and paperboard 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 paper and paperboard production; Y= −1,920,097,846 + 50,050 POPULATION

For paper and paperboard import; Y= − 478,332,708 + 360,155 GNP$ + 0,317 EXCHANGE$

For paper and paperboard export; Y= 500,663 + 0,110 EXCHANGE$ + 503,185 EGROWTH,

Table 9. Paper and paperboard production, export and import projection values in Turkey (tons)

Years	Production	Export	Import
2007	1,814,115	165,431	1,478,690
2008	1,869,380	172,540	1,546,496
2009	1,924,645	179,648	1,614,303
2010	1,979,910	186,757	1,682,109
2011	2,035,175	193,865	1,749,916
2012	2,090,441	200,973	1,817,721
2013	2,145,706	208,081	1,885,527
2014	2,200,971	215,190	1,953,334
2015	2,256,236	222,298	2,021,140
2016	2,311,502	229,407	2,088,947
2017	2,366,767	236,514	2,156,753
2018	2,422,032	243,622	2,224,559
2019	2,477,297	250,731	2,292,365
2020	2,532,562	257,839	2,360,221
2021	2,587,828	264,948	2,427,977

3.4 Observed and Projected Values of Paper and Paperboard Production, Export and Import in Turkey

In Figure-1, the projected and observed values of paper production of Turkey between the years of 2007-2012 were presented. The projected and observed values are very close, especially in the 2007-2009 it can be seen that they were very close to real values.

Figure 1. 2007-2012 Observed and projected values of paper and paperboard production in Turkey
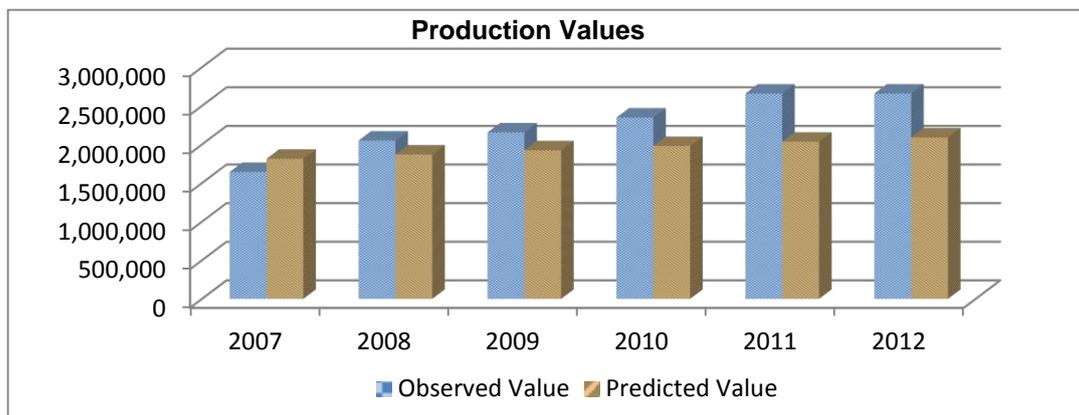
Turkey's projected and observed export figures between the years of 2007-2012 are given in Figure 2. The real values were determined a little higher than the projected values, and the predicted values is almost the same with values realized in 2007 and 2012.

Figure 2. 2007-2012 Observed and projected values of paper and paperboard export in Turkey
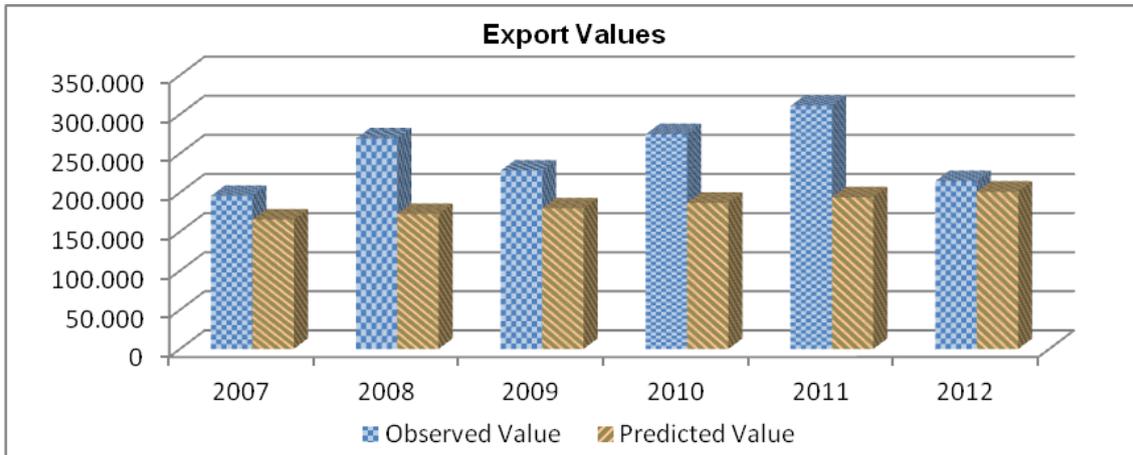
According to Turkey's projected and observed import values between the years of 2007-2012 (Figure-3) , the observed values were found higher than projected values. Since actual import figures were fluctuated for some years, the gap between the estimated and observed values was increased. Fluctuations of import values showed that external paper trade is affected by not only model variables but also affected by many different variables. Turkey a developing country obtains large part of the raw materials needed from abroad, and the consumption of paper per person increases each year. This has been a primary reason for being an importer country in terms of paper and paper products.

Figure 3. 2007-2012 Observed and projected values of paper and paperboard import in Turkey
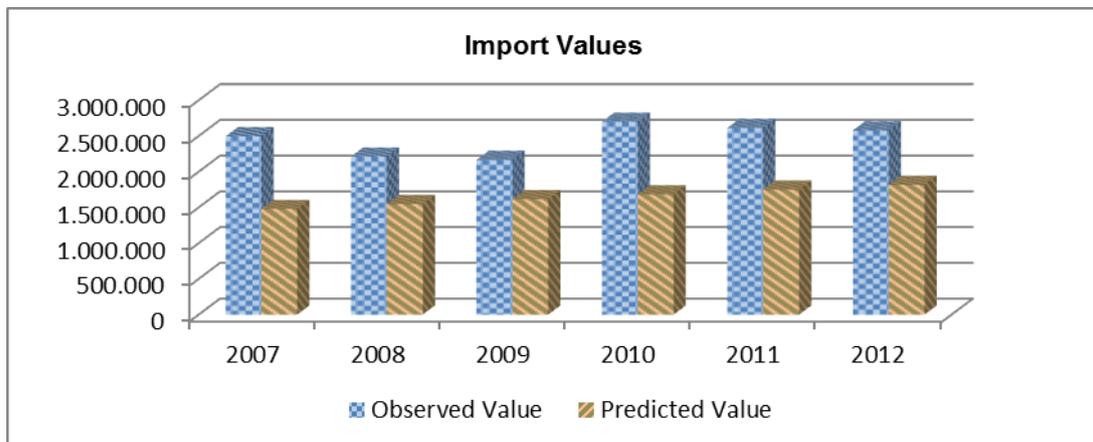
4. CONCLUSION AND RECOMMENDATIONS

In Turkey paper sector began its journey with the capacity of 10 thousand tons in 1936, it has been showing a continuous improvement in the intervening 70 years and in 2006 it has reached to 1 million 643 thousand tons, while the consumption capacity reached to 3.9 million tons. Because of this growth in Paper, cardboard and corrugated cardboard consumption the need for new knowledge and technology from abroad also increased rapidly. In other countries, especially in Western Europe, the growth of the industry went under recession. Cardboard consumption shows also downward trend. The consumption of paper and cardboard in Turkey is still increasing. Annual corrugated cardboard production in Turkey is 921,000 tons, making it 6th biggest in Europa. Turkey is one of the essential corrugated manufacturers in Europe at the moment as ranked sixth in the annual consumption of 261,000 tons (IGEME, 2008).

The paper-cardboard production was around 650,000 tons in 1991. There was an increase of the production in 1992 as 88.5% compared to 1982 and it reached to 1,012,200 tons. The production amount in 2006 compared to 1993, increased by 62.3% (1.62 times) with 1,643,000 tons.

In 1983, the exports realized as 600 tons. But in 1994, it was an increased with a 14,700% (148 times) as 88,800 tons. In 1996, exports decreased by 137.4% as 37,400 tons. Then again and it started to show an increase in the quantity and the increase of 367% in 2006, compared to 1996 as 174,627 tons. The average import was 70,000 tons between the years 1982-1986 in 1983 and it increased significantly in the year 2000 by % 3122 as 1,005,540 tons. It decreased in 2001 by 50.5%, as 668,000 tons. In 2006, import was increased by 3.09 times (% 209.5) again as 2,068,000 tons.

Ten independent variables were selected for the regression analysis for estimation of paper and cardboard products as the Forest Directorate General timber and industrial lumber sales (m^3), the per capita gross domestic product, the population (thousand people), total area of construction spaces (m^2) according to occupancy permits, number of the buildings, the paper consumption (kg) per capita, the inflation rate, currency rates, economic growth and building materials price index.

All models and their combinations for the projections of paper-cardboard production, import and export were investigated and the most appropriate regression models were found by trials and regression models created. Because selected major paper-cardboard products and quantities of production, import and export target for the period up to the year 2021 projection, regression analysis was carried out in a separate process for estimated values of the meaningful and valid independent variables used in established models and then forecasting was performed or realized.

For paper production projection, population ($R^2 = 0.962$), for paper import projection GNP and currency rates ($R^2 = 0.913$) and for exports, while the currency rates and economic growth ($R^2 = 0.907$) variables provided sufficient explanation found out from the regression analysis results and it was determined that they can be used as a tool for forecasting.

The following are about estimated results of paper-cardboard production, export and import figures. The cardboard and paper production was 1.6 million tons as of 2006 and it is forecasted that it will reach to about 2.5 million tons with a 58% increase; similarly export which is 174 thousand tons as of 2006 and it will increase by 52% and reach to about 260 thousand tons. The import is 2 million tons as of 2006 and it is forecasted that will reach about 2.4 million tons with a 17% increase. It can be said that the differences occurred between projected and observed values between the years of 2007 and 2012 were acceptable. Based on higher differences occurred for some years, the growth of the Turkish paper sector is realized higher than expected and this causes high-foreign trade changes every year.

Paper sector is extremely sensitive to economic growth in recent years and it has gained a dynamic structure. Per capita paper production and consumption increased rapidly in world markets, especially in developed countries, as well as in Turkey. But despite this, the world is still yet to reach the boundaries of producers. The paper-cardboard sector is also a capital intensive sector, and it is obliged to be encouraged by national policies, also is exposed to many different effects of terms of free competition in the globalized world economy nowadays.

In these circumstances, it is suggested that, the development of know-how, evaluation of research activities effectively and efficiently to carry out R&D work, for the modernization of private and government sector organizations to increase their capacity and renovations necessary funds and credits are required to be given by the government.

In order to compete in the production of paper with EU countries, Turkey must increase the capacity, make investments that will upgrade the quality and productivity, and to decrease the costs. Moreover, Turkey must use raw materials, labor and energy entries more efficiently. In order to reach the EU production averages, additional investments should be made established to existing organizations in paper industry, and new enterprises should be established using domestic and foreign capital and there should be sought joint venture opportunities between paper companies in the EU and domestic firms (KTO, 2007).

In addition, the new plantation facilities for fast growing species that is currently being applied in the world should be established in Turkey. Coppice areas should be converted to productive forests appropriate for paper production and highly qualified personnel should be educated for these purposes.

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