

Important Non-Wood Forest Products in Turkey: An Econometric Analysis

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Abstract—Wood resources obtained from forest and non-wood forest products (NWFP) have gained great importance recently as their economic values keeps increasing by the day. In this study, forecasting of Turkish Non-Wood Forest Products such as thyme, bay leaves, salvia and pine nut export amounts was carried out using a linear regression analysis method for the next fifteen years based on the data for the years between 1990 and 2009. Moreover, estimated import values and actual import values from the last years were compared and analyzed. Finally, predictions on future trends were made.

Keywords—Regression; Export; Thyme; Bay Leaves; Salvia; Pine Nut

I. INTRODUCTION

An important potential of forests is the non-wood forest products (NWFP). Since most of the non-wood forest products in Turkey are subject to traditional small scale utilizations and are called secondary forest products. Even in forests where wood is produced, non-wood forest products are seen as “auxiliary” or “secondary” products. Forests where wood is not produced are considered as low-value or unvaluable forests [1]. Non-wood forest products are defined as all kinds of plant or animal products which grow inside or around a forest, and from which human beings and other living things benefit to meet their needs or to generate income [2]. According to the World Health Organization (WHO) the number of plants used for various purposes around the world is 20,000. And of these plants, whilst 4,000 are widely used as herbal medicine, approximately 10% is traded [3]. As in all around the world, Non-Wood Herbal Forest Products (NWHFP) make up the most important part of non-wood forest products in Turkey. It is estimated that the number of NWHFP significant in world foreign trade is 150 and the annual foreign trade volume is around 1.1 billion dollars [4]. Today, NWHFP can be used in a wide range of industries such as medical, spices, food, tea, dyes, perfumery and textiles and the marketing of these products could provide significant benefits [5]. Bay leaves, thyme, salvia, pine nut, flower bulbs are among the main by-products for which Turkey has an export potential. Apart from these products, different faculties continue their research on the species that could be grown in forest bedding [6].

Ways are sought for increasing the contribution of NWFP to the economy, as their contribution is far below their potential. Our country’s revenue from NWFP export in the past

years is a lot higher than its revenue from wood products. In other words, NWFP make up the 98% of export revenue from wood products [7]. In the current study, based on the export data of thyme, bay leaves, salvia and pine nut, which have economic precedence, compared to other non-wood forest products in Turkey, for 1990-2009 years, the export numbers for 15 years covering the period between 2010-2024 are estimated with regression analysis.

II. MATERIALS AND METHODS

A. Materials

The material in this study is the export data of thyme, bay leaves, salvia and pine nut between 1990-2009 (Figure 1). The data for the aforementioned products were taken from the Turkish Statistical Institute (TurkStat) and the possible export numbers for 2010-2024 were calculated. The optimal regression models were formed using the SPSS statistical package.

B. Methods

The main econometric method used in this study is simple linear regression analysis. Regression analysis is a statistical procedure which uses the least squares approach in estimating the relationship between independent variable (s) and dependent variable in developing the estimation model [10]. If the regression analysis involves one dependent and one independent variable, then it is a simple linear regression. Simple linear regression model is solved with the following equation:

$$Y = \alpha + \beta_i X_i + \varepsilon_i$$

Where α_i and β_i represent the unknown parameters of the model, ε_i represents the error term, Y represents dependent and X represents independent variables [11]. In this study, the export numbers of thyme, bay leaves, salvia and pine nut, which are the dependent variables of the study, for 15 years were found based on time series (years) and projection values were calculated using this collected data. 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 $\alpha=0.05$ and test was

performed to find out whether the model is valid and the selected independent variable may be used satisfactorily or not.

III. FINDINGS

A. Regression Analysis Results and Projection Values relating to Thyme, Bay leaves, Salvia and Pine Nut Exports

The results of regression analysis on thyme, bay leaves, salvia and pine nut exports indicated that the r Square in the regression model is relatively high in non-wood forest products except pine nut. It was also seen that the F statistical values were valid for all the models or that the relationship between dependent and independent variables was significant at $\alpha=0.05$ significance level (Table I). It should be noted that $r^2=0.929$ value for thyme export is a high certainty coefficient. This number indicates that the independent variable explains thyme export almost around 93% and that the structure of the linear model is appropriate. Similarly, the certainty coefficient of the model set for bay leaves and salvia export (bay leaves: 0.920, salvia: 0.875) are high and provided the required explanation.

And for pine nut, $r^2 = 0.49$ value is an acceptable certainty coefficient. Because, coefficient of correlation, 0.70 (R), linear relationship between the variables, is about the level 0.60-0.70 recognized in the literature. The results of t and F statistical tests of the hypotheses obtained from ANOVA and coefficient tables are given in Table II. The regression models built with thyme, bay leaves, salvia, pine nut are valid and significant. Table III shows the export projection values for thyme, bay leaves, salvia and pine nut. These values are found by putting the independent variable (year) in the regression equation (Table I) formed for each product. In the table, it is estimated that the thyme export which was 11474 tons in 2009 is expected to be 17735 in 2024 with an increase of 54.5% (1.54 times). And similarly the bay leaves export is expected to see a 38.7% increase (1.38 times) and reach 12570 tons and salvia exports which was 1544.7 tons is expected to see 100.4% increase (2 times) and reach 3096 tons. Also, pine nut export is estimated to have a 4% increase compared to 2009 and realize as 2300 tons in 2024.

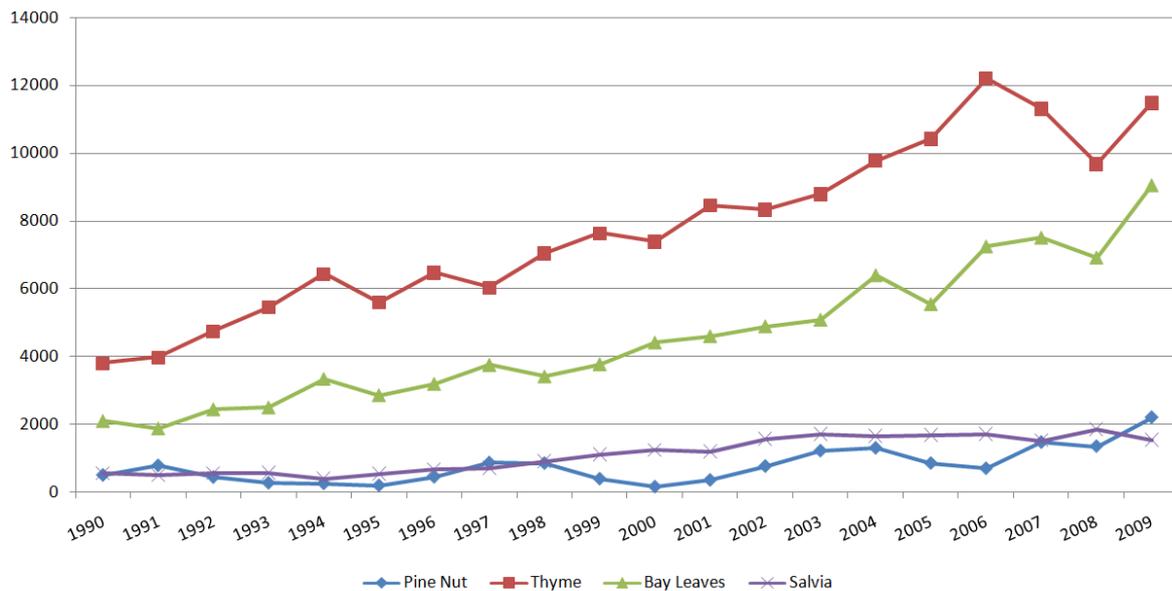


Fig. 1. Export amounts of thyme, bay leaves, salvia and pine nut (in Tonnes).

TABLE I. THE REGRESSION ANALYSIS RESULTS OF NON-WOOD FOREST PRODUCTS

Products	R	r ²	Regression model	Regression equation	Significance
Thyme	0.964	0.929	Linear	Y = -806834.211+407.396x	p<0.05
Bay leaves	0.959	0.920	Linear	Y = -649413.2+327.067x	p<0.05
Salvia	0.936	0.875	Linear	Y = -160560.158+80.858x	p<0.05
Pine nut	0.70	0.49	Linear	Y = -123531.883+62.170x	p<0.05

TABLE II. T AND F TEST RESULTS OF NON-WOOD FOREST PRODUCTS.

Products	T calculation	T table	Result	H0	F calculation	F table	Result	H0	Significance
Thyme	15.313	2.101	T calculation > T table	reject	234.492	4.41	F calculation > F table	reject	Significant
Bay leaves	14.414	2.101	T calculation > T table	reject	207.758	4.41	F calculation > F table	reject	Significant
Salvia	11.243	2.101	T calculation > T table	reject	126.401	4.41	F calculation > F table	reject	Significant
Pine nut	4.187	2.101	T calculation > T table	reject	17.534	4.41	F calculation > F table	reject	Significant

TABLE 3. EXPORT PROJECTIONS FOR THYME, BAY LEAVES, SALVIA AND PINE NUT (IN TONS).

Years	Thyme	Bay Leaves	Salvia	Pine Nut
2010	12031.749	7991.47	1964.422	1429.817
2011	12439.145	8318.537	2045.28	1491.987
2012	12846.541	8645.604	2126.138	1554.157
2013	13253.937	8972.671	2206.996	1616.327
2014	13661.333	9299.738	2287.854	1678.497
2015	14068.729	9626.805	2368.712	1740.667
2016	14476.125	9953.872	2449.57	1802.837
2017	14883.521	10280.94	2530.428	1865.007
2018	15290.917	10608.01	2611.286	1927.177
2019	15698.313	10935.07	2692.144	1989.347
2020	16105.709	11262.14	2773.002	2051.517
2021	16513.105	11589.21	2853.86	2113.687
2022	16920.501	11916.27	2934.718	2175.857
2023	17327.897	12243.34	3015.576	2238.027
2024	17735.293	12570.41	3096.434	2300.197

B. Comparison of projection values and actual values

Figure 2 shows the comparison of projected and actual export values of non-wood forest products between 2010-2014. In the figure, it is seen that the projected thyme and bay leaves numbers are very close to the projected numbers. It is also seen that the projected salvia values are within acceptable limits. However, it is seen that the actual pine nut numbers are far from the projections and that the export has shown significant decrease. The main factor behind this is the huge crop fall in Bergama district of İzmir province particularly as of 2009 which provides 80% of Turkey's pine nut production [12]. A disease that occurred in pine nut trees as of 2009 caused to a significant decrease in production and as a result of that, the pines dried out and pine nut crop fell by a significant ratio of 60%. As a result of this, the amount of product exported and the inflow of currency decreased significantly [13-14].

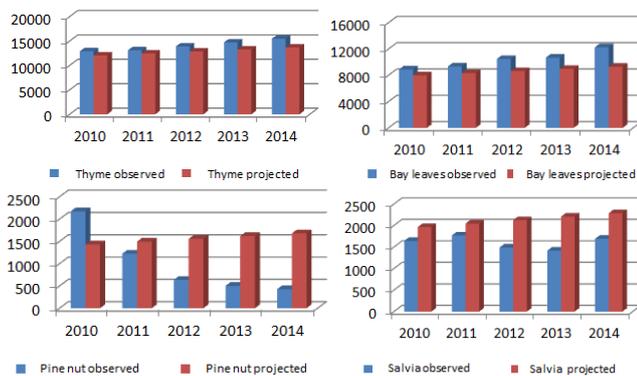


Fig. 1. Projected and actual export numbers between 2010-2014

IV. RESULTS AND CONCLUSION

When the 15-year export projections (covering 2010-2024) for thyme, bay leaves, salvia and pine nut, which have a significant share in Turkey's non-wood forest product export, was examined, it was seen that the certainty coefficient of the regression model set for thyme, bay leaves and salvia export (r^2) had such high values as 0.929-0.920-0.875, respectively

and that the linear model set for the projections was appropriate. And certainty coefficient of the model set for pine nut (0.49) had an acceptable correlation based on the literature (0.60-0.70).

In general, it was projected that thyme export which was 11474 tons in 2009 is expected to increase 1.54 times, whilst bay leaves export which was 9063 tons in 2009 is expected to increase 1.38 times and salvia exports which was 1544.7 tons is expected to increase 2 times. Also, pine nut export is expected to have a small increase of 1.04 times compared to 2009 and reach 2300 tons in 2024. When the last 5 years comparison for projected and actual export numbers are analysed, it is seen that the projections for thyme and bay leaves are very close to actual numbers. Also, the projections for salvia could be considered acceptable. However, the projections and actual numbers for pine nut have significant differences. When the reasons of this is examined, it is seen that the reason behind it is not the structure of the model but the huge crop fall in Bergama district of İzmir province which provides 80% of Turkey's pine nut production. Due to a disease seen in pines in this area as of 2009, there has been a significant fall in productivity and a 60% fall in pine nut crops. In addition to their contribution to development and economy, the use of non-wood forest products in medicine and pharmaceutical industry in today's world in which GM (genetically modified organism) foods are discussed, are highly important in terms of food safety due to their organic structure and their small interaction with chemicals. And these NWFPs are becoming more and more prominent. Turkey ranks the 21st in the export of non-wood forest products, however, the country ranks at the top of the list in the export of some NWFPs. Still it is obvious that non-wood forest products, which have a rich source in terms of plant diversity, wild life resources and endemic species, are not given due consideration and do not deserve its current condition.

In order to increase the export of non-wood forest products in Turkey the inventory and expansion of prominent products should be determined and the best time to harvest those products should be determined to ensure maximum

productivity. Considering that although there has been an increase in the export numbers of thyme and bay leaves in recent years, the fact that their unit prices fell necessitates that pricing decisions during the marketing phase should be taken in a healthier manner as soon as possible.

In addition, during secondary wood raw material production and forestation, necessary measures shall be taken in order not to damage these resources. Besides, in order to harvest these products in the following years, they should be harvested without damaging and the factories where they are processed should be equipped with the necessary technology. As stated in earlier research, by attaching the deserved importance to non-wood forest products, more contribution will be provided by these products to the economy of the country compared to the wood raw material and with efficient management, damage to the forests in the country will be prevented.

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