Sugar Export Forecast Using Time Series

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ABSTRACT

The sales forecast exercises great influence in the company's results that work with flotation in the demand, but the utilization of an only technique cannot express the reality of your behavior. The several techniques utilization and the integration among them it allows a better forecast with mistakes reduction perspectives. This way, this work boards export forecast techniques of sugar using temporal series for executive auxiliar of the sector in the decision-making. The agribusiness relevance in the national economic context motivates the accomplishment of this work to analyze the performance of this segment exporter. Its importance it justifies by the paper that the segment exporter sugar cane performs in the trade balance and in the adjustment of the external accounts of the national economy. In particular, the analyses are done with the projections statistical models utilization of tendencies that can highlight the Regression models, Average Furniture, Simple Smoothing, Method of Holt and Winters the which ones project for the future, observations done in the past. The tests are presented and analyzed with the goal of showing the importance of a good forecast.

Keywords - Sugar cane, forecasting, sugar exports.

I. INTRODUCTION

The trade balance is of great relevance in the adjustment of the external accounts of the national economy and the analyses accomplishment allow a larger knowledge of the responsible mechanisms for the segment exporter performance of the national economy among the which ones meet the agricultural products and agribusiness. The importance of the sector sugar cane agribusiness in the national economic context and of your products and derivatives in the Brazilian trade balance, among them the sugar has great representativity, encourages the jobs conduction that care for the impact of this segment exporter of individualized. Study the variable conditional of the national exports can contribute to define strategies addressed to the dynamization of these markets. The export offer equation of sugar enables verify the incentive policies influence that enables elaborate analyses on the behavior of the external commerce, also assisting decision-making about production and commercialization. In Brazil the sugar cane stands out among main cultures regarding the planted area, volume and value differentiating from other countries producers for producing, in industrial scale, sugar and alcohol. In the external market, the exports participation of the national sugar grew significantly in the last years becoming the main country exporter. This way, it becomes important to study sugar cane agribusiness operation Brazilian so much in the domestic context as international [1].

The goal of this work is to analyze the technical Regression, Average Furniture, Simple Smoothing, Method of Holt and Winters in the sugar export forecast. The computational tests are presented and analyzed with the goal of showing the importance of a good forecast.

Beyond of this context of the sector sugar cane, this work presents more four other parts. It describes the importance of a good forecast for the companies. In the third, a characterization of the national sector sugar bowl is done. After they are shown the methodological procedures, data and obtained results and concluding with discussion and suggestion for possible jobs.

II. METHODOLOGY AND MATERIALS

Several authors study the participation behavior of Brazil in the trade international of sugar due to the country fact represent about 40% of the world exports. Some relation aspects of the Brazilian domestic market of this commodity with the international prices [2]. In this work, it is analyzed the sugar Brazilian production impact (potential of export of this commodity) about the price formation in the international market. The author uses the purse quotations of New York, Coffe, Suck & Cocoa Exchange Inc. (CSCE), belonging to the New York Board of Trade (NYBOT) in the Brazilian production influence analysis about the international prices, considering itself that this purse is the biggest reference for the sugar market and to what has larger liquidity. The

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prices impact of the future contract of brute sugar n°11 of Csce/Nybot, rate of commercial exchange, petroleum barrel WTI Spot (north American market) and Europe Brent Spot (European market) in the sugar crystal prices packed in sacks of 50 kg [3]. A Brazilian export offer function of sugar using the Auto-regression methodology Vetorial with identification by Bernanke's Process [1].

The present work aims analyze the sugar quantity behavior exported by Brazil using the forecast Regression methods, Average Furniture, Simple Smoothing, Method of Holt and Winters for executive auxiliary of the sector in the decision-making. To accomplish this work were used secondary data originating of the site database of UNICA (Sugar Cane Industry Union) with reference to year of 2004 and 2005.

In the middle academic is common to classify the researches in qualitative or quantitative depending on the type of used data and in its form of your treatment. Beyond of this, [4] is possible to classify the scientific researches in exploratory, explanatory and descriptive basing itself on your general goals. This context, the present work can be classified as quantitative and descriptive, characterizes for trying describe systematically an interest area or a phenomenon, being this description always detailed and objective.

Variable is an aspect or dimension of a phenomenon that in research given moment can take over different values, in other words, is any characteristic that can take over different numeric values [4]. These variable can be classified regarding the gender, species and categories. In this work the variable in study is the sugar quantity exported by Brazil in years of 2004 and 2005 and can be classified as quantitative variable and continues to take over any numeric value as well as enable measured. The periodicity chosen for the quantity forecast study of sugar exported by Brazil was the monthly. The utilization of monthly data it justifies for allowing the fast transmission among values involved at work, what to could not occur if the values went annual. The present work data correspond to the period between January 2004 and December 2005 and totalize 24 months.

The proposed approach for the execution of this research project, [5] follows the important steps:
• Problem definition;
• Information collection (data);
• Graphic analysis of the results.
• Models choice and adjustment;
• Forecast model use and evaluation.

III. LITERATURE REVIEW
3.1 DEMAND FORECAST

In the current economy, where the complexity and competitiveness increases continually, operational and financial earnings can be obtained using forecast good models to control

the production management (production aggregate planning development, materials stocks and management control), marketing (sales and propagandas strategies), finance (administration and managerial budget) and logistics (size and routing of fleet), having each functional their area special problems of forecast. The capacity levels, the financial needs and the general structure of the business are influenced by the demand levels. Seasonality in the demand-standard, growth or decline in sales rates and general flotation caused by infinity of controlled variables or cannot cause demand variation with time. Most forecast methods of short term read with this kind of temporal variation, frequently called series of time or temporal series [6].

The sales forecast exercises great influence in the company's results that work with great flotation in the demand for direct sales, being the sales departments and/or marketing the responsible persons for its execution. Their results is an input for the decision in the capacity planning and control, that usually is a production management responsibility. A demand forecast should be expresses in terms of useful to the capacity planning and control, could are translated in realistic expectations of demand, express at the same units that the capacity as hour-machine, man-hour, space etc. Moreover, should be as exact as possible, because while the dumb demand instantly, there is the phase displacement between decide to change the capacity and this change produce the desired result. Concluding, should give an indication of the relative uncertainty, in other words, of equal importance is an estimate of regarding real demand can differ of the average [7]. The forecast methods are classified in qualitative or based on trial, quantitative or mathematical and mixed of the two kinds [5]. The qualitative methods are not analytic methods, based on intuition, trial, interview with specialists, experience of the involved, market research, among others, used to create future scenarios. The quantitative methods use historical data to foresee the demand in future periods. The future forecast of the demand requires the construction of mathematical and statistical models that use the available data along time (time series). For the utilization of historical data in forecast models it owes still consider three basic terms:

• Existence of historical information;
• The historical information can be transformed in numeric data;
• Standards that occurred in the past will continue to occur in the future.

The consideration of historical data for forecast models addressed for present research for series study temporal and the application tool that do use of this concept. But should itself stress that

the qualitative and quantitative methods should not be treaties as "competitive", but as allied in intuit of obtaining best and more perfected forecasts. A model composite to foresee the demand of a company services provider in the computers technical assistance area people, more specifically, in the computer science equipment maintenance through the forecasts integration [8].

3.2 BRAZILIAN SUGARCANE INDUSTRY

The sugar cane, basic raw material for the sugar and alcohol production, has been occupying important position in the Brazilian agriculture along the two last decades.

This position is express by the volume of 569 million tons of cane, 27 million cubic meters of alcohol and 31 million tons of sugar [9]. The sugar cane volume, alcohol and sugar produced by the country, can be seen in the Table to follow.

Table 1: Sugar cane volume, alcohol and sugar produced by the country

Harvest	Sugar cane (tons)	Alcohol (m3)	Sugar (tons)
1990/1991	222.429.160	11.515.151	7.365.344
1991/1992	229.222.243	12.716.180	8.604.321
1992/1993	223.382.793	11.694.758	9.318.490
1993/1994	218.336.005	11.284.726	9.332.896
1994/1995	240.712.907	12.685.111	11.703.315
1995/1996	251.827.212	12.589.765	12.653.029
1996/1997	287.809.852	14.372.351	13.659.380
1997/1998	303.057.415	15.399.449	14.880.691
1998/1999	314.922.522	13.868.578	17.942.109
1999/2000	306.965.623	13.021.804	19.387.515
2000/2001	257.622.017	10.593.035	16.248.705
2001/2002	293.050.543	11.536.034	19.218.011
2002/2003	320.650.076	12.623.225	22.567.260
2003/2004	359.315.559	14.808.705	24.925.793
2004/2005	386.119.910	15.413.151	26.642.636
2005/2006	386.584.387	15.935.882	25.834.486
2006/2007	426.002.444	17.763.133	29.681.578
2007/2008	495.723.2	22.526.8	31.026.1
2008/2009	569.062.629	27.512.962	31.049.206

Source: UNICA – União da Agroindústria Canavieira de São Paulo (2010).

Of 1990 to the 2009 the sugar cane production passed of 222,4 million tons in the crop 1990/1991 to 569 million tons in the crop 2008/2009. With regard to the alcohol production, Brazil passed of 11,5 million cubic meters in the crop 1990/1991 to the 27 million cubic meters in the crop 2008/2009. The sugar production passed of 7,3 million tons in the crop 1990/1991 to 31 million tons in the crop 2008/2009. The country sugar and alcohol main regions producers are the region Center-south with May harvest to December and the Northern region with September harvest to March. The region Center-south is composed by the state: Espírito Santo, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina e São Paulo. The Northern region is composed by the state: Alagoas, Bahia, Ceará, Maranhão, Pará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, Sergipe e Tocantins. The existence of two sugar cane regions producers, alcohol and sugar allow in the country the sugar and alcohol supply occurs during whole year, since the periods among regions are different. The competition between activity of the sugar cane industry and Northern regions Center-south, the differences among production structures, in the administration and managerial terms the climate and the soil of a study of sugarcane economy in the country [10].

According to the authors, the strong presence of the State guaranteed sugar cane agribusiness maintenance, but it acted as a barrier to the growth stimulus before the market. Nowadays, the cane this expanding in the regions West and São Paulo's Northwest, in Goiás' State and Minas Gerais. But ahead of this advance of the agricultural area destined to the sugar cane culture, it argues in society several sectors a possible reduction of the agricultural area destined to the food production and her consequence as food and elevation production decrease of prices together with a deforestation increase of environmental reserves. The regional production of sugar cane, sugar and alcohol can be seen in the Table 2.

Table 2: Regional production of sugar cane, sugar and alcohol (million)

Harvest	North-northeast			Center-south		
	Sugar cane (tons)	Sugar (tons)	Alcohol (m3)	Sugar cane (tons)	Sugar (tons)	Alcohol (m3)
1990/1991	52,2	2,8	1,8	170,1	4,5	9,7
1991/1992	50,1	2,7	1,7	179,0	5,8	10,9
1992/1993	47,1	3,1	1,6	176,2	6,1	10,0
1993/1994	34,4	2,2	0,9	183,9	7,0	10,3
1994/1995	44,6	3,2	1,5	196,0	8,4	11,1
1995/1996	47,4	3,3	1,7	204,4	9,3	10,8
1996/1997	56,2	3,1	2,2	231,6	10,4	12,1
1997/1998	54,2	3,5	2,1	248,7	11,3	13,2
1998/1999	45,1	2,7	1,6	269,7	15,1	12,2
1999/2000	43,0	2,4	1,3	263,.4	16,9	11,6
2000/2001	50,5	3,6	1,5	207,0	12,6	9,0
2001/2002	48,8	3,2	1,3	244,2	15,9	10,1
2002/2003	50,2	3,7	1,4	270,4	18,7	11,1
2003/2004	60,1	4,5	1,7	299,1	20,4	13,0
2004/2005	57,3	4,5	1,8	328,7	22,1	13,5
2005/2006	49,7	3,8	1,5	336,8	22,0	14,3
2006/2007	53,2	4,0	1,1	372,7	25,5	16,0
2007/2008	64,6	4,8	2,1	431,1	26,2	20,3
2008/2009	64,0	4,2	2,4	504,9	26,7	25,1

Source: UNICA – União da Agroindústria Canavieira de São Paulo (2010).

According to the table of regional production, in the harvest 2008/2009, the sugar cane production of the region Center-south represented about 88% from the total produced in the Country, being São Paulo's State the responsible person for 63% of the national production. That state also is the main responsible person for the sugar and alcohol productions with 65% and 63%, respectively, of the national production. Note itself that there is a sugar cane production concentration tendency in the region Center-south. The region, in the crop 1990/1991, was responsible for 76% of the sugar cane, 61% of the sugar and 84% of the alcohol produced in Brazil. In the crop 2008/2009, it proceeded taking over the quantity of 88% of the sugar cane, 86% of the sugar and 90% of the alcohol produced in Brazil. The importance of the sugar and alcohol sector in Brazil justifies by the country fact be the biggest producer and world exporter of sugar becoming important to observe the variation of the exported quantity. The regional production of sugar cane, sugar and alcohol can be seen in the table to follow. The referring data to the sector show that in the period of 1999 to the 2005, it occurred a growth

of 0,8% a.a. in the sugar production. At the same period, the world exports grew to the a rate of 2% a.a., While the Brazilian exports grew in a rhythm of 9,9% a.a. Of this way, Brazil's Participation in the exports of world sugar grew of 27,23% in 1999 to 39,58% in the harvest of 2005, like observes itself in the Table 3.

Table 3 - Production and world and national export of sugar (million)

Harvest	World Production (Tons)	World Export (Tons)	Brazilian Export (Tons)	% Exposed by Brazil
1999/2000	136,4	41,5	11,3	27,23
2000/2001	130,6	37,6	7,7	20,42
2001/2002	134,3	41,1	11,6	28,17
2002/2003	148,8	45,8	14,0	30,55
2003/2004	141,7	45,5	15,2	33,42
2004/2005	141,6	45,7	18,1	39,58
Growth Rate	0,8%	2,0%	9,9%	-

Source: UNICA – União da Indústria de Cana-de-Açúcar (2007)

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The prices impact of the future contract of brute sugar n°11 of Csce/Nybot, rate of commercial exchange, petroleum barrel WTI Spot (north American market) and Europe Brent Spot (European market) in the sugar crystal prices packed in sacks of 50 kg [3]. A Brazilian export offer function of sugar using the Auto-regression methodology Vetorial with identification by Bernanke's Process [1].

The operational performance of the sector sugar cane Brazilian, that allows this participation in the international commercialization of sugar, is due to the clear competitive advantages in the sugar cane comparison with other cultures as beet, used by other countries.

Specifically in the region Center-south, the production had in the last significant years evolution with the new varieties development adapted most to the climate, soil and more resistant

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the plagues; Use of modern materials; Transportation and mechanization system improvement of the farming; Planning best processes, production management and control; Smaller use of chemical products in the industrial process; Innovations in the process of productive and co-generation of electric power [11].

IV. RESULTS AND DISCUSSION

The analyze sugar quantity behavior exported by Brazil using the forecast Regression methods, Average Furniture, Simple Smoothing, Method of Holt and Winters for executive auxiliary of the sector in the decision-making was used the computational application Excel for the generation of the graphic results. The present work data correspond to the period between January 2004 and December 2005 and totalize 24 months and can are visas in the illustration 01.
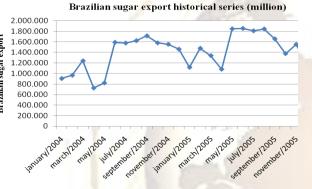

Illustration 01: Brazilian sugar Export historical series

To compare the several techniques of used forecast in this article, they were calculated 4 measured: Mean Error (ME), Mean Square Error (MSE), Absolute Average Deviation (MAD) and standard deviation (σ). In the Table 4, they are presented these measured for the 5 technical of forecast. An important verification that can be accomplished is that the technique of simple smoothing was to what it presented it the minor's mistakes being therefore the one of best accuracy.

Table 4: Measured of mistake for sugar national export forecast

Error	Regression Method	Average Furniture	Simple Smoothing	Holt Method	Winters Method
ME	-796.420	-28.271	-8.631	-61.193	169.548
MSE	758.491,047	76.530,467	59.397,388	91.677,066	87.450,034
MAD	699.297	108.092	163.377	220.157	189.158
σ	870.914	276.641	243.716	302.782	295.720

V. CONCLUSIONS

In the context of the Brazilian, several industrial reality they The sales forecast

accomplishment exercises great influence in the companies results, could show tendencies contributing for the strategic planning of the organizations. The sales forecast is important for materials replacement at the moment and right quantity, and so that all the other necessary activities to the industrial process be adequately programed. Despite forecasts are important for all the company, they present mistakes in their estimate, should itself be careful so much in the data collection as in the model choice to decrease the mistakes [12].

The present work had as goal analyze the sugar quantity behavior exported by Brazil using the Regression methods, Average Furniture, Simple Smoothing, Method of Holt and Winters, for executive auxiliary of the sector in the decision-making. In the demand forecast accomplishment, it is necessary the forecast mistakes evaluation. Comparing the mistake measures Mean Error (ME), Mean Square Error (MSE), Absolute Average Deviation (MAD) and standard deviation (σ), it verified that it Simple Smoothing obtained larger accuracy that the Regression methods, Average Furniture, Method of Holt and Winters.

Like the forecasts are affected by several factors, each technical can contribute to capture information that influences these factors. As proposed for future jobs, it suggests the integration and combination among forecast techniques. A way to agree the forecasts is where objective and subjective techniques are agreed [13]. It initially generates a model with a historical database; Soon after an objective forecast and at the same time a subjective analysis of the historical information is done obtaining a subjective forecast. These forecasts are agreed generating a forecast agreement. In the characterization of the sector agriculture-industrial sugar bowl, accomplished at the beginning of this article, Brazil presents a participation elevated in international market of sugar, about 40% of the world exports are national, what justifies the studies accomplishment of this nature [2]. Through the obtained results, it concludes that the methods used to solve the export forecast problem of sugar is an useful tool to an decision-making. Its importance it owes to the fact that the sugar export by Brazil great impact being in the balance of her commercial accounts.

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