

Forecasting Analysis Using Double Exponential Smoothing On The Indonesian Wholesale Trade Price Index

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ABSTRACT

The purpose of this study is to determine the forecast of Indonesian Wholesale Trade Price Index using the analytical method Double Exponential Smoothing based on the data from 2015 to 2020. This type of research is a quantitative research that uses a sample data from Statistics Indonesia (BPS) in the Export-Import Sector. The analyzing data used forecast analysis using Double Exponential Smoothing. Based on the results of data analysis, it can be concluded the Forecasting of Indonesia Wholesale Trade Price Index Export-Import Sector from January 2015 to December 2020. The limitation of this research is that the research only focuses on forecasting results from the export and import sectors, as well as the limitations of the variables used. The research is expected to be able to contribute to companies in knowing the rate forecast that affects the increase and decrease in the Indonesia export and import sectors in the coming year.

Keywords: Forecasting, Wholesale Trade Price Index, Export, Import

1. INTRODUCTION

Indonesia's reliance on international trade as a source of national economic growth is quite high. According to Salvatore (2007), capital flow activities at home and abroad are one of the economic activities that cannot be isolated from international trade. Because of the difference in the cost of international trade processing, factors of production can migrate from a country exporter to a country importer when international trade is done in the form of imports and exports. Exports fluctuate. Several factors strongly influence import and export nets. According to Mankiw (2006), there are factors in the economy that have an effect. Among them are: To begin with, consumers favor artificial products, both at home and abroad. Second, consider the cost of an outdoor product in both the country and the home market. The third factor is the exchange rate, which influences the amount of domestic currency required to purchase a specific amount of foreign currency. Consumers with a fourth opinion both inside and outside the country. Fifth, an item for cost transfer from one country to another. The sixth point is government policy in international trade. As a result, the strength of the oil and gas trade balances, as well as non-oil and gas trade balances, as well as the volatility of Indonesia's foreign exchange reserves, determine the best strategy for achieving sharia and macroeconomic stability in Indonesia.

When imports exceed exports, the trade balance will be in negative territory. A surplus in the trade balance, on the other hand, occurs when exports exceed imports. Exports are classified into two categories in international trade: oil and gas (oil and gas) and non-oil and gas (non-oil and gas). International trade is defined as "the activity of exchanging goods and services generated by a country to be sold elsewhere to meet needs." 2014 (Razak & Indra).

Indonesian entrepreneurs are very interested in this export. However, there are numerous barriers to exports. Because the cost of exporting raw materials is already high, many firms opt to export ingredients rather than

finished products. Almost every year, Indonesia has a surplus in exports. Indonesia's surplus is due to price rises for exports, not increased value. The activity of issuing or sending commodities in quantity abroad for commercial purposes is known as export. This includes selling property in a foreign country, demanding payment in a foreign currency, and communicating in a foreign language (Amir MS, 2000:1). The goal of export activities is to improve revenues for a firm or country, establish new markets outside of the country, and become accustomed to worldwide competition.

An import is defined as the acquisition of goods or services from another country for a country that has entered into a cooperative arrangement with two or more countries. Imported products can also be defined as a type of trade that involves bringing goods into Indonesia from other countries while adhering to all necessary restrictions (Hutabarat, 1996: 403). An import is the legal movement of products or goods from one country to another, usually through a trading transaction. Importation is the process of bringing items from another country into the country. Importing products in bulk frequently necessitates customs action in the country. Imports are a crucial component of international trade. Import activities are carried out in order to suit the needs of the general public. Imported goods are products that cannot be manufactured or countries that have acquired manufactured goods but are unable to meet public demand.

In general, the unit value index of exports and imports is a measure of how prices for exported and imported goods in Indonesia have changed over time. The unit value index of exports and imports is used to calculate: (a) GDP at constant prices, particularly for the export and import components in the expenditure GDP structure; and (b) trade exchange rates (terms of trade), by comparing the development of the export and import price indices (BPS, 2019). According to the CPI calculation reported by the Indonesia Statistics (BPS), the value of the export and import CPI tends to be stable, increasing and falling consistently every month.

The COVID-19 viral pandemic is currently affecting the entire world and is still spreading. Since January 30, 2021, the WHO has recognized this virus as an epidemic of worldwide concern (Guo et al., 2020). In 2021, it had even progressed to the second wave stage (Iftimie et al., 2021). This epidemic has had a significant influence on a variety of sectors, including the country's economy. A country's export and import activities are crucial. A country's income will come from its export and import activity. Lockdowns have been implemented in a number of countries, affecting both export and import activities. According to data released by the Indonesia Statistics (BPS) in 2020, the COVID-19 virus pandemic had an impact on oil and gas and non-oil and gas import activities in Indonesia from January to June 2020. Imports, particularly in the non-oil and gas sector, were subject to volatility at the time. Oil and gas account for over 60% of global energy production (Kong, Dong, Shao, Wan, Tang, & Liu, 2016). According to BPS 2020 data on the value of oil and gas and non-oil and gas imports, the number of imports from the oil and gas industry is less than that of imports from the non-oil and gas sector. This is due to the oil and gas industry's imports in the form of crude oil, oil products, and gas, all of which are natural resources in finite amounts, resulting in a tiny amount of imported crude oil, oil products, and gas. According to BPS 2020 data on the value of oil and gas and non-oil and gas imports, the number of imports from the oil and gas industry is less than that of imports from the non-oil and gas sector. This is due to the oil and gas industry's imports in the form of crude oil, oil products, and gas, all of which are natural resources in finite amounts, resulting in a tiny amount of imported crude oil, oil products, and gas. According to BPS 2020 data on the value of oil and gas and non-oil and gas imports, the number of imports from the oil and gas sector is smaller when compared to imports from the non-oil and gas sector. This is due to the oil and gas industry's imports in the form of crude oil, oil products, and gas, all of which are natural resources in finite amounts, resulting in a tiny amount of imported crude oil, oil products, and gas.

2. LITERATURE REVIEW

2.1 Wholesale Trade Price Index (IHPB)

The Wholesale Trade Price Index is an economic indicator that includes index data and depicts changes in wholesalers' purchasing prices from consumers. The bulk quantity of is determined. Wholesalers will find this data extremely useful in determining changes in good purchase prices as well as predicting future price conditions (BPS, 2009). The Wholesale Trade Price Index is a price index that tracks the average price change of a group of goods in the wholesale trade over time. This price index is one of the indicators used to track the economy's overall progress, as well as a source of data for market and monetary analysis. Agriculture, mining and quarrying, industry, imports

and exports are all covered by the Wholesale Trade Price Index in the form of general and sectoral indexes. Although it is difficult to define the boundaries of large quantities in a trade because they are typically viewed from two dimensions that are not always satisfied, large quantities do not always imply retail. The parameters of concern, according to the BPS website, are the number and value of Lenggogani (2012).

2.2 Forecasting Method

There are two types of forecasting methods: qualitative and quantitative. Quantitative forecasting is the method employed. There are two types of forecasting in the quantitative method: causal forecasting and time series forecasting. Data collected over time in the form of daily, weekly, monthly, and yearly time series to describe a certain event or condition is referred to as a time series (Makridakis et al. 1998). The term "time series analysis" refers to a collection of observations that occur at regular intervals over time (Wei, 2006). Forecasting is a vital part of planning that is both successful and efficient. According to Makridakis (1999), forecasting approaches are split into two categories: subjective forecasting and objective forecasting. A qualitative model is used in the subjective forecasting approach, while time series and causal models are used in the objective forecasting method. Qualitative models seek to incorporate subjective aspects into forecasting models; this model will be especially useful if reliable quantitative data is difficult to obtain.

2.3 Time Series Analysis

Time series analysis was introduced Box and Jenkins (1970). Since then, the time series has begun to develop a lot. A time series is a series of observational data that occurs based on a time index sequentially with fixed time intervals. Time series analysis is a statistical procedure that is applied to predict the probabilistic structure of conditions that will occur in the future in order to make decisions. A sequence of observations has a time series model if it fulfills two things: the time interval between time index t and t can be expressed at the same time (identical), and there is a dependency between observations separated by a time interval in multiples of as much as k times (expressed as lag). The purpose of time series analysis is to predict future conditions, determine the relationship between variables and control interests (to determine whether the process is under control or not) (Aswi and Sukarna, 2006).

2.4 Smoothing Method

According to Subagyo (2002), the smoothing method is a forecasting technique by taking the average of the values several periods ago to estimate the value in a future period. This smoothing method is divided into two, namely the average method and the exponential smoothing method.

2.5 Average Method

The average approach generates forecasts by averaging previous observations. Single moving averages and double moving averages are two common methods for averaging historical data (Hanke, Reitsch, and Wichern, 2003). When a new observation value arrives, a single moving average can be generated by eliminating the oldest observation values and replacing them with the most recent observation values (Makridakis, Wheelwright, and McGee, 2003). This strategy is more appropriate. used to foresee unforeseen events. The following are some of the method's limitations: Since each piece of data is given the same weight, it is not suitable for use when there are fluctuations; the data is not random (there are trends and seasonality); it is less sensitive to drastic changes; and determining the amount of data is subjective or impractical (Aritonang, 2002). The moving average of the moving average is referred to as the double moving average (DMA) (Makridakis, Wheelwright, and McGee, 2003). According to Subagyo (2002), the moving average is initially sought in this approach and placed in the last period. Then, using the first moving average as a starting point, look for the moving average again and construct a forecast. This approach works well for predicting data that is trending. Although the double moving average is simple to calculate, it has the drawback of assigning the same weight to all data. The exponential smoothing method can be applied to solve this problem. The moving average of the moving average is referred to as the double moving average (DMA) (Makridakis, Wheelwright, and McGee, 2003). According to Subagyo (2002), the moving average is initially sought in this approach and placed in the last period. Then, using the first moving average as a starting

point, look for the moving average again and construct a forecast. This strategy is appropriate for anticipating data that is trending. The double moving average is simple to calculate, but it has the drawback of giving each piece of data the same weight. The exponential smoothing method can be used to solve this problem. The moving average of the moving average is known as the double moving average (Makridakis, Wheelwright, and McGee, 2003). According to Subagyo (2002), the moving average is initially searched in this approach, and it is placed in the last period. Then, from the initial moving average, check for the moving average again and generate a forecast. This strategy is appropriate for anticipating data that is trending. The double moving average is simple to calculate, but it has the drawback of giving each piece of data the same weight. The exponential smoothing method might have been employed in the last period to solve this problem. Then, from the initial moving average, check for the moving average again and generate a forecast. This strategy is appropriate for anticipating data that is trending. The double moving average is simple to calculate, but it has the drawback of giving each piece of data the same weight. The exponential smoothing method can be used to solve this problem.

2.6 Exponential Smoothing

Exponential smoothing is a technique in which the weighting reduces exponentially as the number of observations increases. As a result, this approach is known as the exponential smoothing procedure. The exponential smoothing approach, like moving averages, consists of single, multiple, and more elaborate methods. They all share the same features, in that the newer value is given a higher weight than the older observation value (Makridakis, Wheelwright and McGee, 2003). Continuous revisions of forecasts based on more recent experience are performed using this exponential smoothing method, which involves averaging (smoothing) the values of previous data series by exponentially decreasing them.

2.7 Double Exponential Smoothing

Brown's Double Exponential Smoothing is a linear model introduced by Brown, according to Makridakis (2003). When the data exhibits a pattern, this method is used. A smoothed estimate of average growth at the conclusion of each period is called the trend. It is also possible to go from a double moving average (Double Moving Average) to a double exponential smoothing (Double Exponential Smoothing) using the same analogy used when going from a single moving average (Single Moving Average) to a single exponential smoothing (Single Exponential Smoothing). Because one of the restrictions of the Single Moving Average (i.e. the necessity to keep the last n data) is still present in the Double Moving Average, such a change could be intriguing. Only three data values and one value for can be used to calculate Double Exponential Smoothing. Past observations are likewise given less weight in this approach. For this reason Double Exponential Smoothing is preferred over Double Moving Average as a forecasting method in many major cases.

3. RESEARCH METHODOLOGY

Secondary data in the form of time series in the form of monthly data from January 2015 to December 2020 was used in this investigation. The annual results of the Wholesale Trade Price Index (IHPB) including commodity sectors, imports, and exports are the source of data for the Indonesia Statistics (BPS) report. Robert G Brown's Double Exponential Smoothing method was used to analyze it (1950). Brown's Double Exponential Smoothing is a linear model created by Brown that uses only one parameter and adds double smoothing values to single smoothing values. When the data reveals a trend but does not include the seasonal component, this method is used. Brown's double exponential smoothing is implemented using the following formula:

- Calculating single smoothing value

$$S^1_t = \alpha X_t + (1 - \alpha) S^1_{t-1}$$

- Calculating the value of double smoothing (double smoothing)

$$S''_t = \alpha S^1_t + (1 - \alpha) S''_{t-1}$$

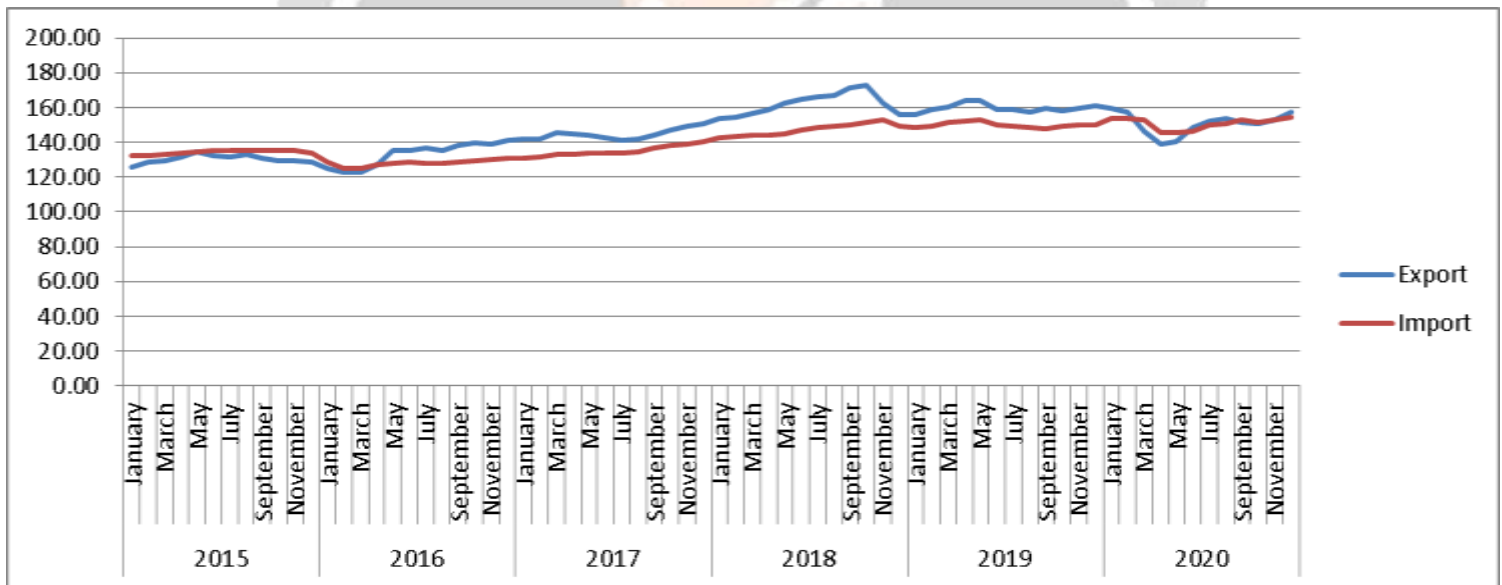
- Determining the smoothing constant
 $\alpha_t = 2S^1_t - S^{II}_t$
- Doing forecasting
 $F_{t+m} = \alpha_t + b_t(m)$

Where :

- S^1_t : Single smoothing value
- S^{II}_t : Double smoothing value
- α_t : Smoothing constant value in period t
- b_t : Coefficient value *trend* in period t
- α : Smoothing parameter where $0 < \alpha < 1$
- m : The number of future periods that will be predicted
- F_{t+m} : Forecasting m period

4. RESULTS AND DISCUSSION

In this section, we will discuss forecasting using the Double Exponential Smoothing method generated using Excel. The data used in this study is data from the Pusan Statistics Agency (BPS) for 2015-2020, with a lot of 72 data, starting from January in 2015 to December in 2020, regarding the Indonesian Wholesale Trade Price Index for Export Commodity Groups. and Import.



Graph. 1: Export and Import Sector Chart

Based on the Graph 1 above, the export and import sectors from 2015 to 2018 experienced an increase in October 2018 from 172.82 to imports in November to 153.10. From 2018 to 2020 in April there was a decline because in 2020 there was a Covid-19 pandemic which showed a decline in prices in the import sector by 145.77 and in the export sector of 139.01. This shows that there is an increase and decrease in the price of the wholesale trade index for the export and import sectors as shown in the graph.

In this study, perform calculations with Brown's Double Exponential Smoothing using the parameter α is $\alpha = 0.60$ then perform the calculation of Brown's Double Exponential Smoothing as follows:

- Determining the First Smoothing (S^1_t)

To determine the smoothing value (S^I_t) there are 2 data, namely exports and imports can use the following equation:

$$S^I_t = \alpha X_t + (1 - \alpha)S^I_{t-1}$$

- For t=1
Because at t=1 the value S^I_t is not yet available, then to overcome this problem it can be done by setting a value S^I_t equal to the value of the first period data (X_1) for exports of 126.07 while imports of 132.15.
- For t=4
Export

$$S^I_t = \alpha X_t + (1 - \alpha)S^I_{t-1}$$

$$= (0,60 \times 131,35) + (1 - 0,60)129,24$$

$$= 130,51$$
 Import

$$S^I_t = \alpha X_t + (1 - \alpha)S^I_{t-1}$$

$$= (0,60 \times 133,56) + (1 - 0,60)133,00$$

$$= 133,34$$

And so on until the calculation S^I_t for t = 72 as follows:

- For t=72
Export

$$S^I_{72} = \alpha X_t + (1 - \alpha)S^I_{72-1}$$

$$= (0,60 \times 157,20) + (1 - 0,60)152,13$$

$$= 155,17$$
 Import

$$S^I_{72} = \alpha X_t + (1 - \alpha)S^I_{72-1}$$

$$= (0,60 \times 154,35) + (1 - 0,60)152,57$$

$$= 153,64$$

b. Determining the Second Smoothing Value (S^{II}_t)

To determine the second smoothing (S^{II}_t) on export and import data, you can use the following equation:

$$S^{II}_t = \alpha S^I_t + (1 - \alpha)S^{II}_{t-1}$$

- For t=1
Because at t=1 the value S^{II}_t is not yet available, then to overcome this problem it can be done by setting a value S^{II}_t equal to the value of the first period data (X_1) of 126.07 for exports and 132.15 for imports.
- For t=4
Export

$$S^{II}_t = \alpha S^I_t + (1 - \alpha)S^{II}_{t-1}$$

$$= (0,60 \times 130,51) + (1 - 0,60)129,24$$

$$= 130,00$$
 Import

$$S^{II}_t = \alpha S^I_t + (1 - \alpha)S^{II}_{t-1}$$

$$= (0,60 \times 133,34) + (1 - 0,60)133,0$$

$$= 133,20$$

And so on until the calculation S''_t for $t = 72$ is as follows:

- For $t=72$
Export

$$S''_t = \alpha S'_t + (1 - \alpha)S''_{t-1}$$

$$= (0,60 \times 155,17) + (1 - 0,60)151,74$$

$$= 153,80$$
 Import

$$S''_t = \alpha S'_t + (1 - \alpha)S''_{t-1}$$

$$= (0,60 \times 153,64) + (1 - 0,60)152,01$$

$$= 152,99$$

c. Determining the Size of the Constant (α_t)

To determine the value α_t of export and import data, you can use the following equation:

$$\alpha_t = 2S'_t - S''_t$$

- For $t=1$
Export

$$\alpha_1 = 2S'_1 - S''_1 = 2(126,07) - 126,07$$

$$= 126,07$$
 Import

$$\alpha_1 = 2S'_1 - S''_1 = 2(132,15) - 132,15$$

$$= 132,15$$
- For $t=2$
Export

$$\alpha_2 = 2S'_2 - S''_2 = 2(130,51) - 130,00$$

$$= 131,01$$
 Import

$$\alpha_2 = 2S'_2 - S''_2 = 2(133,34) - 133,20$$

$$= 133,47$$
 and so on until the calculation α_t for $t = 72$ is as follows:
- For $t=72$
Export

$$\alpha_2 = 2S'_2 - S''_2 = 2(155,17) - 153,80$$

$$= 156,54$$
 Import

$$\alpha_2 = 2S'_2 - S''_2 = 2(153,64) - 152,99$$

$$= 154,29$$

d. Determining the Slope (b_t) Value

To determine the value b_t of export and import data, you can use the following equation:

$$b_t = \frac{\alpha}{1 - \alpha}(S'_t - S''_t)$$

- For $t=1$
Export

$$b_t = \frac{\alpha}{1 - \alpha}(S'_t - S''_t)$$

$$= \frac{0,60}{1 - 0,60}(126,07 - 126,07)$$

$$= 0$$
 Import

$$b_t = \frac{\alpha}{1 - \alpha}(S'_t - S''_t)$$

$$= \frac{0,60}{1 - 0,60} (132,15 - 132,15)$$

$$= 0$$

- For t=4
Export

$$b_t = \frac{\alpha}{1 - \alpha} (S'_t - S''_t)$$

$$= \frac{0,60}{1 - 0,60} (130,51 - 130,00)$$

$$= 0,76$$

Import

$$b_t = \frac{\alpha}{1 - \alpha} (S'_t - S''_t)$$

$$= \frac{0,60}{1 - 0,60} (133,34 - 133,20)$$

$$= 0,20$$

and so on until the calculation b_t for t = 72 is as follows:

- For t=72
Export

$$b_t = \frac{\alpha}{1 - \alpha} (S'_t - S''_t)$$

$$= \frac{0,60}{1 - 0,60} (155,17 - 153,80)$$

$$= 2,06$$

Import

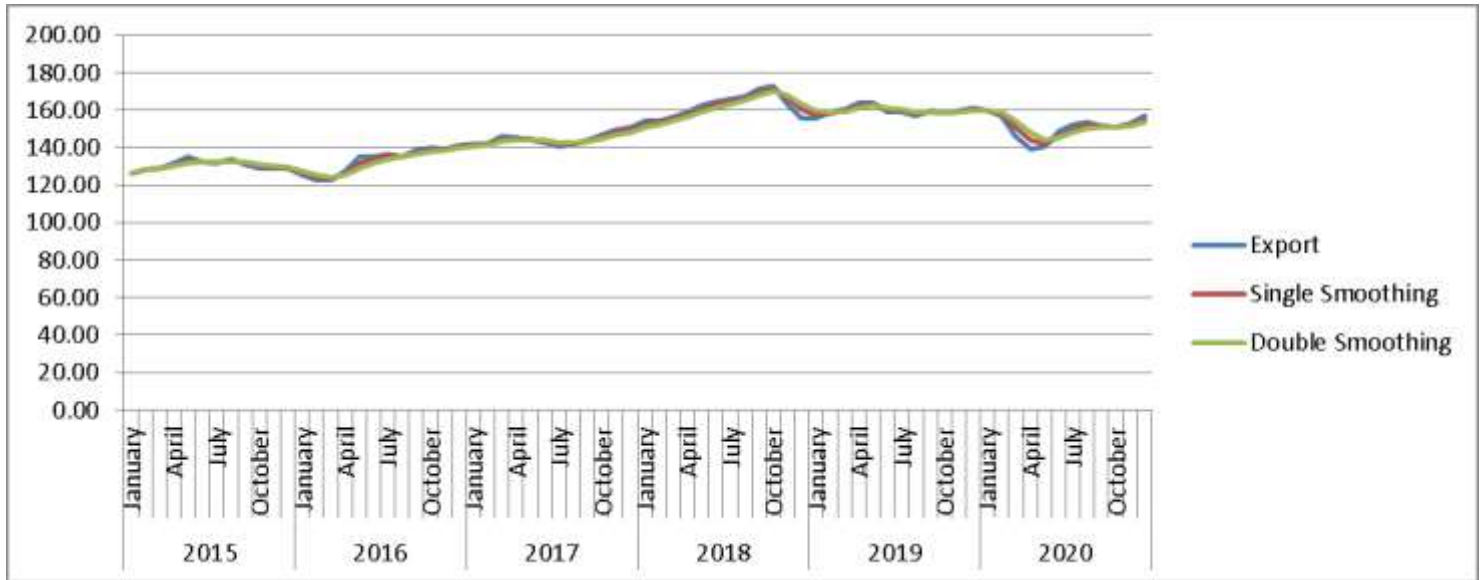
$$b_t = \frac{\alpha}{1 - \alpha} (S'_t - S''_t)$$

$$= \frac{0,60}{1 - 0,60} (153,64 - 152,99)$$

$$= 0,98$$

e. Forecasting the Price Index for Wholesale of Export and Import Commodities

After calculating the first smoothing value, the second smoothing value, the a_t value and the b_t value using the parameter value $\alpha = 0,6$.



Graph 2: Graph of First Smoothing Value and Second Smoothing Value of Export Commodities

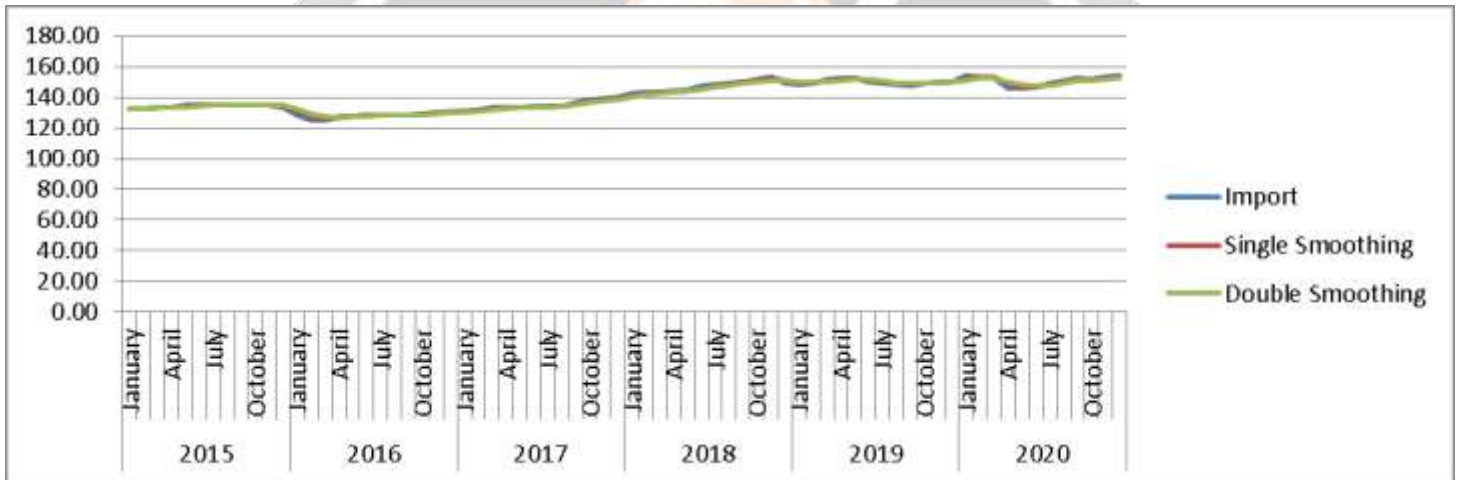
Based on Graph 2, which shows the movement of data patterns in the Export Commodity, the first smoothing value and the second smoothing value. And it can be concluded that the first smoothing value and the second smoothing value lag behind the actual data.

Table 1: First Smoothing Value, Second Smoothing Value, a_t and b_t Values on Export Commodities

t	X_t	S^I_t	S^{II}_t	a_t	b_t
1	126.07	126.07	126.07	126.07	0.00
2	128.53	128.53	128.53	128.53	0.00
3	129.24	129.24	129.24	129.24	0.00
4	131.35	130.51	130.00	131.01	0.76
5	134.89	133.14	131.88	134.39	1.88
6	132.28	132.62	132.33	132.92	0.44
7	131.78	132.12	132.20	132.03	-0.13
8	133.38	132.87	132.61	133.14	0.40
9	131.19	131.86	132.16	131.57	-0.44
10	129.05	130.18	130.97	129.38	-1.19
11	129.09	129.52	130.10	128.95	-0.87
12	128.73	129.05	129.47	128.63	-0.63
13	125.29	126.79	127.86	125.72	-1.61
14	122.93	124.48	125.83	123.12	-2.03
15	122.76	123.45	124.40	122.49	-1.43
16	127.54	125.90	125.30	126.50	0.90
17	135.17	131.46	129.00	133.93	3.70

18	135.33	133.78	131.87	135.70	2.87
19	136.65	135.50	134.05	136.96	2.18
20	135.36	135.42	134.87	135.96	0.82
21	138.45	137.24	136.29	138.18	1.42
22	139.62	138.67	137.72	139.62	1.43
23	139.29	139.04	138.51	139.57	0.79
24	141.33	140.41	139.65	141.18	1.14
25	141.99	141.36	140.68	142.04	1.02
26	141.88	141.67	141.27	142.07	0.60
27	145.76	144.12	142.98	145.27	1.71
28	145.22	144.78	144.06	145.50	1.08
29	144.04	144.34	144.23	144.45	0.16
30	142.91	143.48	143.78	143.18	-0.45
31	140.85	141.90	142.65	141.15	-1.13
32	142.17	142.06	142.30	141.83	-0.35
33	144.29	143.40	142.96	143.84	0.66
34	146.90	145.50	144.48	146.52	1.52
35	149.49	147.89	146.53	149.26	2.05
36	150.83	149.66	148.41	150.91	1.88
37	153.92	152.21	150.69	153.74	2.29
38	154.46	153.56	152.41	154.71	1.72
39	156.64	155.41	154.21	156.61	1.80
40	159.12	157.64	156.27	159.01	2.05
41	162.77	160.72	158.94	162.50	2.67
42	164.43	162.94	161.34	164.55	2.41
43	166.04	164.80	163.42	166.19	2.08
44	167.11	166.19	165.08	167.29	1.66
45	171.36	169.29	167.61	170.98	2.53
46	172.82	171.41	169.89	172.93	2.28
47	162.86	166.28	167.72	164.84	-2.16
48	155.93	160.07	163.13	157.01	-4.59
49	155.59	157.38	159.68	155.08	-3.45
50	159.05	158.38	158.90	157.86	-0.78
51	160.57	159.70	159.38	160.01	0.48
52	163.77	162.14	161.04	163.24	1.66
53	163.96	163.23	162.35	164.11	1.32
54	158.92	160.64	161.33	159.96	-1.03
55	158.96	159.63	160.31	158.96	-1.02
56	157.07	158.10	158.98	157.21	-1.33
57	159.46	158.91	158.94	158.89	-0.04
58	158.26	158.52	158.69	158.35	-0.25

59	159.92	159.36	159.09	159.63	0.40
60	161.14	160.43	159.89	160.96	0.80
61	159.65	159.96	159.93	159.99	0.04
62	157.06	158.22	158.91	157.54	-1.03
63	146.27	151.05	154.19	147.91	-4.71
64	139.01	143.83	147.97	139.68	-6.22
65	140.33	141.73	144.23	139.23	-3.75
66	148.47	145.77	145.15	146.39	0.93
67	152.31	149.70	147.88	151.51	2.72
68	153.76	152.13	150.43	153.84	2.55
69	151.32	151.65	151.16	152.13	0.73
70	150.84	151.16	151.16	151.16	0.00
71	152.78	152.13	151.74	152.52	0.58
72	157.20	155.17	153.80	156.54	2.06



Graph 3: Graph of First Smoothing Value and Second Smoothing Value of Imported Commodities

Based on Graph 3, which shows the movement of data patterns in Import Commodities, the first smoothing value and the second smoothing value. And it can be concluded that the first smoothing value and the second smoothing value are slightly parallel to the actual data.

Table 2: First Smoothing Value, Second Smoothing Value, a_t and b_t Values on Imported Commodities

t	X_t	S^I_t	S^{II}_t	a_t	b_t
1	132.15	132.15	132.15	132.15	0.00
2	132.14	132.14	132.14	132.14	0.00
3	133.00	133.00	133.00	133.00	0.00
4	133.56	133.34	133.20	133.47	0.20
5	134.75	134.18	133.79	134.58	0.59
6	134.97	134.66	134.31	135.00	0.52

7	135.00	134.86	134.64	135.08	0.33
8	135.10	135.00	134.86	135.15	0.22
9	135.40	135.24	135.09	135.39	0.23
10	135.29	135.27	135.20	135.34	0.11
11	135.39	135.34	135.28	135.40	0.09
12	133.52	134.25	134.66	133.83	-0.62
13	128.36	130.72	132.29	129.14	-2.37
14	125.17	127.39	129.35	125.43	-2.94
15	125.01	125.96	127.32	124.61	-2.03
16	127.23	126.72	126.96	126.48	-0.36
17	127.65	127.28	127.15	127.41	0.19
18	128.62	128.08	127.71	128.46	0.56
19	128.23	128.17	127.99	128.36	0.28
20	128.13	128.15	128.08	128.21	0.10
21	128.73	128.50	128.33	128.66	0.25
22	129.34	129.00	128.73	129.27	0.40
23	130.11	129.67	129.29	130.04	0.56
24	130.66	130.26	129.88	130.65	0.58
25	131.09	130.76	130.41	131.11	0.53
26	131.88	131.43	131.02	131.84	0.62
27	133.36	132.59	131.96	133.22	0.94
28	133.41	133.08	132.63	133.53	0.67
29	133.76	133.49	133.15	133.83	0.51
30	133.90	133.74	133.50	133.97	0.35
31	133.89	133.83	133.70	133.96	0.20
32	134.34	134.14	133.96	134.31	0.26
33	136.65	135.64	134.97	136.32	1.01
34	138.26	137.21	136.32	138.11	1.35
35	139.01	138.29	137.50	139.08	1.19
36	140.45	139.59	138.75	140.42	1.25
37	142.35	141.24	140.25	142.24	1.50
38	143.18	142.41	141.54	143.27	1.29
39	143.78	143.23	142.56	143.91	1.01
40	143.98	143.68	143.23	144.13	0.67
41	145.11	144.54	144.01	145.06	0.78
42	147.32	146.21	145.33	147.08	1.32
43	148.64	147.67	146.73	148.60	1.40
44	149.30	148.65	147.88	149.41	1.15
45	150.36	149.67	148.96	150.39	1.08
46	151.51	150.78	150.05	151.50	1.09
47	153.10	152.17	151.32	153.02	1.27

48	149.59	150.62	150.90	150.34	-0.42
49	148.45	149.32	149.95	148.69	-0.95
50	149.56	149.46	149.66	149.27	-0.29
51	151.55	150.72	150.29	151.14	0.63
52	152.20	151.61	151.08	152.13	0.79
53	152.92	152.39	151.87	152.92	0.79
54	150.36	151.17	151.45	150.90	-0.42
55	149.34	150.07	150.62	149.52	-0.83
56	148.19	148.94	149.62	148.27	-1.01
57	147.91	148.32	148.84	147.81	-0.78
58	149.45	149.00	148.94	149.06	0.10
59	149.80	149.48	149.26	149.70	0.33
60	150.24	149.94	149.67	150.21	0.40
61	154.02	152.39	151.30	153.47	1.63
62	153.81	153.24	152.46	154.02	1.17
63	152.91	153.04	152.81	153.27	0.35
64	145.77	148.68	150.33	147.03	-2.48
65	145.62	146.84	148.24	145.45	-2.09
66	146.44	146.60	147.26	145.95	-0.98
67	149.65	148.43	147.96	148.90	0.70
68	150.85	149.88	149.11	150.65	1.15
69	152.60	151.51	150.55	152.47	1.44
70	151.62	151.58	151.17	151.99	0.61
71	153.23	152.57	152.01	153.13	0.84
72	154.35	153.64	152.99	154.29	0.98

Based on the results of the calculations in table 1 and table 2, it is possible to forecast the Wholesale Trade Price Index for export and import commodities for the next 2 years. To calculate the forecast value can use the following equation:

$$\bar{F}_{t+m} = a_t + b_t m$$

- Forecast $t=4$ ($m=1$) is for April 2015

Export:

$$\bar{F}_{t+m} = a_t + b_t m$$

$$F_{4+1}=129,24+0,00$$

$$F_4=129,24$$

Import:

$$\bar{F}_{t+m} = a_t + b_t m$$

$$F_{4+1}=133,00+0,00$$

$$F_4=133,00$$

- Forecast t=73 in January 2021

Export:

$$F_{t+m} = a_t + b_t m$$

$$F_{73+1}=156,54+2,06$$

$$F_{73}=158,60$$

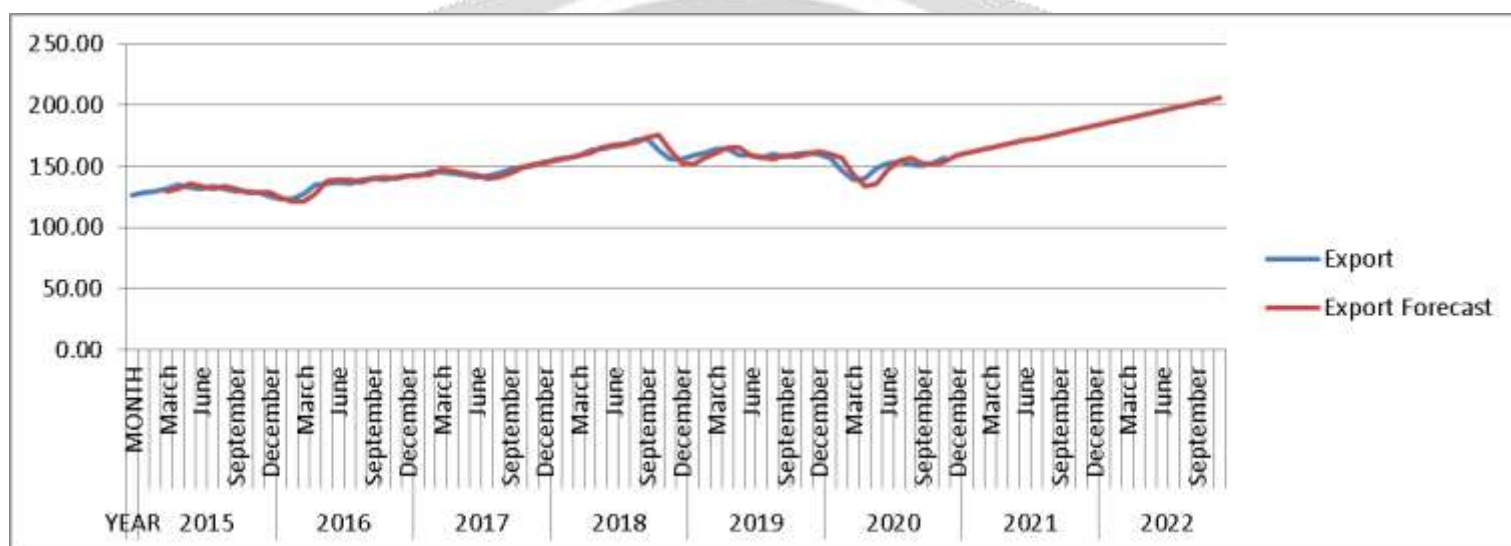
Import:

$$F_{t+m} = a_t + b_t m$$

$$F_{73+1}=154,29+0,98$$

$$F_{73}=155,27$$

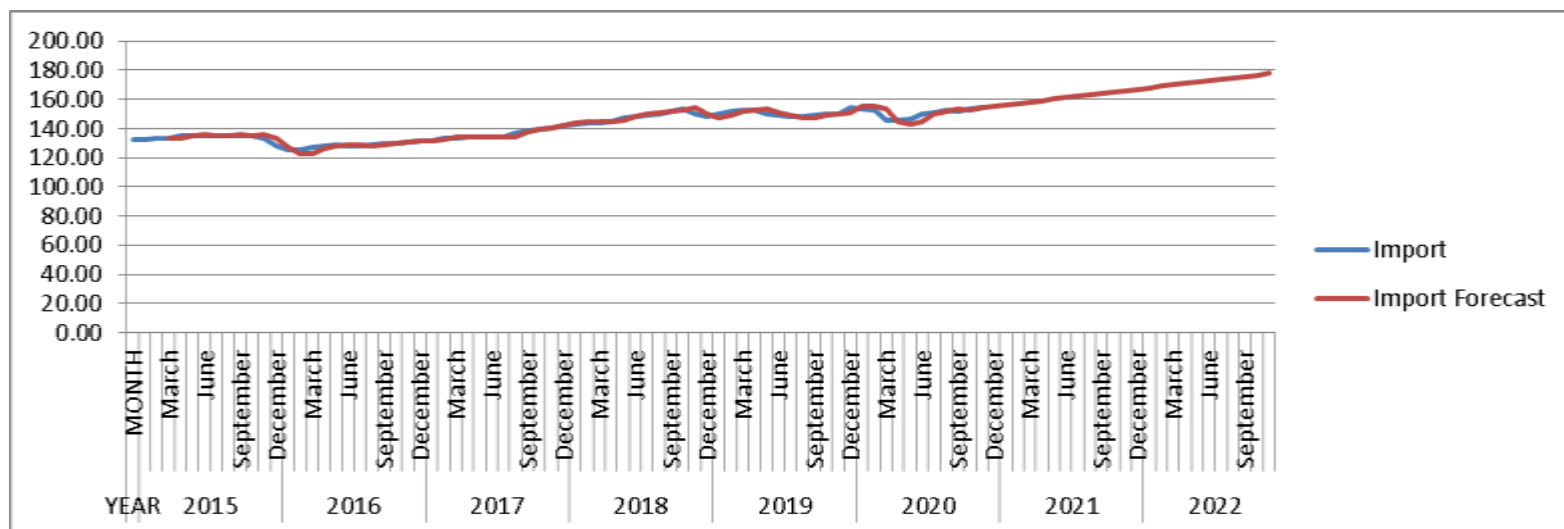
- f. The Result of Forecasting the Consumer Price Index of Indonesian Export and Import Commodities
 After obtaining the results of the forecasting calculations, the forecasting results can also be presented in the following graphic form:



Graph 4: Forecasting Graph of Export Commodities

The Export Commodity CPI in August 2018 declined as a result of the 25% DMO policy for coal, according to the forecasting results. Since we stopped coal traders from exporting, and now we're creating export allowances, the DMO provision is no longer an obligation, and I believe we'll be able to compensate next month," said Trade Minister Enggartiasto Lukita in the Kelapa Gading region of Jakarta North on Monday (17/9). Due to the start of the lockdown against the Covid-19 pandemic in March 2020, the price decreased by 139.01, however on the Forecast chart, it decreased in April, with a price value of 133.46. "Oil and gas exports declined 16.29 percent in March, but non-oil and gas exports rose 1.24 percent," stated BPS Head Suhariyanto in a virtual conference in Jakarta on Wednesday, March 15 2020. In March of this year, export values were lower than in March of the previous year. Exports fell 0.20 percent to \$14.12 billion in March 2020. Oil and gas exports decreased by 40.91 percent, while non-oil and gas exports increased by only 3.38 percent. Both experienced a large growth in the months following until December. Due to the start of the lockdown against the Covid-19 pandemic in March 2020, the price fell to 139.01, but the Forecast chart fell to 133.46 in April. "Oil and gas exports declined 16.29 percent in March, but non-oil and gas exports rose 1.24 percent," stated BPS Head Suhariyanto in a virtual conference in Jakarta on Wednesday, March 15 2020. In March of this year, export values were lower than in March of the previous year. Exports fell 0.20 percent to \$14.12 billion in March 2020. Oil and gas exports decreased by 40.91 percent, while non-oil and gas exports increased by only 3.38 percent. Both experienced a large growth in the months following until December. Exports fell in value in March 2019 compared to March 2019. Exports declined 0.20 percent to \$14.12 billion in March 2020. Oil and gas exports decreased by 40.91

percent, while non-oil and gas exports increased by only 3.38 percent. Both experienced a large growth in the months following until December.



Graph 5: Forecasting Graph of Import Commodities

Because the Ministry of Finance released a Regulation of the Minister of Finance (PMK) addressing the increase in income tax (PPh) article 22 related to imports, the CPI of Imported Commodities in December 2018 dropped, according to the forecasting findings. According to Heru, the average daily import realization for the finished consumer products group increased to 7.5 percent, while import activity decreased by 12.3 percent (finance.detik.com). In June of this year, the drop occurred again. According to Suhariyanto, the reduction in imports in June 2019 was driven by a drop in oil and gas imports as well as non-oil and gas imports. The drop in imports owing to the holiday commerce is attributable to the period of leave and holidays associated with the 2019 Eid al-Fitri. "The 9-day sabbatical in June 2019 had a significant impact on the pace of imports in Indonesia," Suhariyanto stated in a press conference at the BPS Headquarters in Jakarta on July 15, 2019. Oil and gas imports declined by 21.50 percent in June 2019, from USD 2.18 billion in May to USD 1.71 billion. Then, from USD 12.42 billion in May 2019 to USD 9.87 billion in June 2019, non-oil and gas imports dropped 20.55 percent. Due to the early lockdown of the Covid-19 epidemic in March 2020, the price value decreased to 145.77, however on the Forecast chart, it decreased to 143.36 in May. Both experienced a large growth in the months following until December.

5. CONCLUSION

Based on the results of the basic analysis and discussion in the previous presentation, conclusions are obtained as answers to research problems, namely, Parameter α namely = 0.60 for the forecasting of the Export and Import Commodity Trade Price Index, the results of the forecasting of the Export and Import Commodity Trading Price Index in January 2021 and in November 2022 using α Parameter α namely the Double Exponential Smoothing method from Brown showing an increase every month, namely in Exports and Imports in January 2021 and in December. Based on the results of the analysis and conclusions, the limitations of this study are that this research only focuses on forecasting results from the export and import sectors, as well as the limitations of the variables used, determining the accuracy of forecasting results in 2021 with actual data and considering the factors that influence it in the following year. from the external and internal environment.

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