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Research on a number of applicable forecasting techniques in economic analysis, supporting enterprises to decide management

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ABSTRACT

Forecasting is an important tool, an indispensable part in the operation of businesses to help create a competitive advantage, thereby assisting corporate executives in proactively planning and necessary decisions for production, business, investment, promotion, production scale, product distribution channel, financial supply ... and preparation of sufficient facilities, Techniques for development in the future. In businesses, doing good forecasting will create conditions to improve competitiveness in the market. Thai Nguyen is one of the provinces in the Northern Midlands and Mountains region, with over 6000 businesses in operation. This is the locality which is assessed to have a fast growing market and many changes, accurate forecasting becomes more necessary for businesses to save costs and increase competitiveness. Forecasting will create important tools, support managers in setting up measures to adjust economic activities of their units in order to obtain the highest production and business efficiency, highly adapt to trend of integration and development.

Keywords: Forecasting, economic analysis tools, applied informatics in business, moving average, linear regression

1. THEORETICAL BASIS OF PREDICTION METHOD

1. 1. Forecast for short-term use

Short-term forecasts are often used to estimate future events with short time periods, from a few days to several months. Short-term forecasts provide managers with information to make decisions about production planning, stockpiling, raw material input and output as well as production and business plans. Business in fierce competition conditions today.

For the phenomena that need to be forecasted in the short term, the weighted average mobile method is often used. In this method, the role of historical data is the same. In some cases, these figures have different influences on the forecasted results, so forecasters prefer to use unequal weights for past figures. Weights or weights are numbers assigned to past data to indicate how important they affect the forecasted outcome. The large weight is assigned to the data closest to the forecast to refer to its effect as the largest. The choice of weight depends on the experience and sensitivity of the forecaster.

The forecast formula is applied as follows:

$$F_t = \frac{\sum_{i=1}^n A_{t-i}k_i}{\sum_{i=1}^n k_i}$$

In it: F_t : Forecast of period t

A_{t-i} : Actual data of the previous period ($i = 1, 2, \dots, n$)

K_i : Weight corresponding to period i

This method has the advantage, can level random fluctuations in the sequence. However, it also comes from flattening random variables, which will reduce sensitivity to real changes reflected in the sequence. On the other hand, the average mobile number has not yet given us the best development trend of the sequence. It only shows the movement in the past that cannot prolong that movement in the future.

Besides, it is also possible to use hat conditioning method for this type of data. Hat reconciliation provides forecasts for the previous period and in addition a number of adjustments to get the forecast for the next period. This adjustment is a certain proportion of the prediction error in the previous period and is calculated by multiplying the forecast number of the previous period by the elasticity factor between 0 and 1. This coefficient is called a factor peace.

The formula is defined as follows: $F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$

In it: F_t : Forecast for period t, the next stage.

F_{t-1} : Forecast for period t-1, previous period.

A_{t-1} : Actual data of period t-1.

In addition, we can also use trend-based hat conditioning. Because we often consider short-term plans, then seasons and trends are not important factors. When we move from short-term forecasts to medium-term forecasts, seasons and trends become more important. Combining the trend factor into hat conditioning prediction is called trend conditioning or trend regulation.

Since estimating for the mean and estimating the trend for the mean and the harmonic coefficient α are conditioned both. The conditioning factor for the trend used in this model is β .

The calculation formula is as follows:

- String leveling exponent or estimating current value: $F_t = \alpha A_t + (1-\alpha)(F_{t-1} + T_{t-1})$
- Estimating the trend: $T_t = \beta(F_t - F_{t-1}) + (1 - \beta)T_{t-1}$
- Forecast for the next phase m: $H_{t+m} = F_t + mT_t$

Inside:

F_t : new leveling value.

A: exponential coefficient ($0 < \alpha < 1$).

B: exponential coefficient to estimate trend ($0 < \beta < 1$).

A_t : real value at time t.

M: number of future forecast periods.

H_{t+m} : Predictive value for the next m stage.

1. 2. Forecasts apply in the long term

Long-term forecasts are a method of stopping to estimate in the long term, usually over a year. Long-term forecasts are essential in production management to assist managers in devising strategies for product planning, technological processes and as well as identifying production facilities for businesses.

Methods of use:

Linear regression method

Linear regression is a predictive model to establish the relationship between two types of variables is a dependent variable with two or more independent variables. If the data is a time series, the usual independent variable will be the time t and the usual dependent variable will be assigned as sales or any other indicator that we want to determine the forecast value in future. Regression function is defined:

$$Y = ax + b.$$

Inside:

$$a = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2} \quad b = \frac{\sum x^2 \sum y - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

With: y is the dependent variable to be forecasted.

x is the independent variable.

a is the slope of the trend line.

b is the original degree.

n is the number of observations.

In the case of independent variables x are presented through each stage over time and they are evenly spaced, we can adjust so that the calculation becomes simple and easy to implement.

2. APPLICATION IN REVENUE FORECASTING

2. 1. The concept and importance of revenue forecasting for businesses

According to the accounting standard No. 14 "Revenue and other income" in the system of Vietnamese accounting standards: "Revenue is the total value of economic benefits earned by the enterprise in the accounting period, arising from the normal production and business activities of enterprises, contributing to the development of owners' equity. The above concept shows that revenue only includes the total value of economic benefits that businesses have obtained or will be obtained. Proceeds from third parties are not economic benefits, do not increase the equity of the enterprise will not be considered as revenue. Contribution of shareholders or owners increases equity but does not increase revenue. In a market economy, forecasting plays a very important role, because it provides the necessary information to detect and arrange the use of future resources in a practical and grounded way. With the forecasted information, it allows policy makers to make investment decisions, production decisions, savings and consumption, financial policies, and macroeconomic policies. No Forecasting not only creates a scientific basis for policy making, for developing a development strategy, for master plans, but also allows consideration of the ability to implement plans and adjust production plans, jointly suitable to each period and each stage of development.

For each business, revenue is considered an important economic indicator, reflecting the results of production and business activities in a certain period. Therefore, forecasting revenue is an important content in analyzing business activities for enterprises. The analysis of revenue forecasting results of enterprises aims to help enterprises realize and evaluate correctly, comprehensively and objectively their business situation. At the same time, through which businesses will see the level of photos fulfilling the revenue targets of enterprises. Since then, enterprises will find out conflicts and objective causes as well as subjective to set guidelines and measures to promote the process of consuming goods and increasing income for businesses.

2. 2. Steps to proceed

Step 1: Collect data

The source data here is defined as the turnover of the business from 2010 to 2017. After the source data is available, the study will conduct the forecasting methods.

Year	Revenue (billion VND)
2010	1670.23
2011	1890.27
2012	1920.23
2013	1896.23
2014	1956.13
2015	1990.75
2016	2100.89
2017	2356.87

Step 2. Select method:

Forecast revenue by moving average method
Projection process with AVERAGE function

- Enter the collected data into the spreadsheet.
- Use the AVERAGE function to calculate the forecast number.

Syntax

AVERAGE (number 1, [number 2], ...)

AVERAGE function syntax has the following arguments:

Number 1 Required. The first number, the cell reference, or the range you want to average.

Number 2, ... Optional. Additional numbers, cell references, or ranges that you want to average, up to 255.

In addition to the forecasting process of using the AVERAGE function, you can also use the Moving Average installer to make not only the forecast value but also the standard error and the forecast graph.

Add a tool to analyze Data Analysis data into Excel

+ Start Excel

+ Go to Tools menu, select Add-Ins. The Add - Ins dialog box appears in the Analysis ToolPak and Analysis ToolPak VBA section.

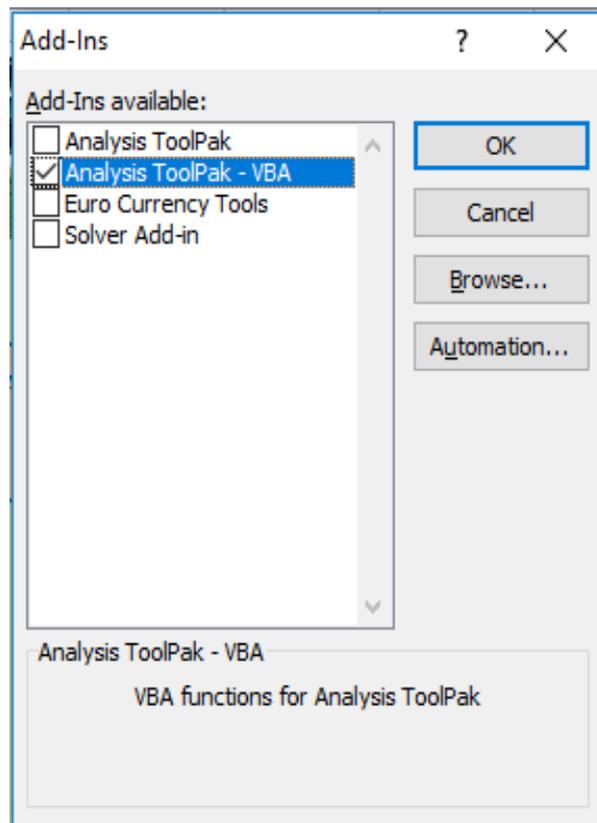


Figure 1. Select Data Analysis tool

+ Click OK to complete the installation. Now on the vertical menu bar The Tools menu has appeared Data Analysis.

Forecast by regression method

To predict linear regression, there are many ways such as using Excel functions and using the Regression installer.

Use TREND, FORECAST, SLOPE and INTERCEPT functions:

For forecasting by using a single linear regression model $y = ax + b$ (y is the dependent variable, x is an independent variable) when one of the two prices is known We can use TREND, FORECAST, SLOPE and INTERCEPT functions.

Use TREND function:

- Returns values along the regression line (by the square method smallest)
- Syntax: = TREND (known_y's, known_x's, new_x's, const)

Where: known_y's, known_x's, new_x's are values or geographic regions contains only the known value of x, y respectively and the new value of x. const is constant. By default if const = 1 (True) then regression according to the function $y = ax + b$, if const = 0 (False), the regression function $y = ax$.

Use FORECAST function:

- Calculate and estimate future values based on current values.
- Syntax: = FORECAST (x, known_y's, known_x's)
- In which: x is the value used for forecasting.

known_y's are the values or address ranges of the observed dependency dataset
known_x's are the values or address ranges of the observed independent dataset.

Use SLOPE and INTERCEPT functions:

In addition to using the above two functions to predict we can also use a combination of two SLOPE functions to calculate the angle coefficient and INTERCEPT function to calculate the free coefficient b of a single linear regression function $y = ax + b$. Replace these coefficients a and b into a function with a known value of x or y we will find the remaining value to be predicted.

- Syntax: = SLOPE (known_y's, known_x's)
= INTERCEPT (known_y's, known_x's)

Inside:

known_y's are the values or address ranges of the observed dependency dataset
known_x's are the values or address ranges of the observed independent dataset.

Use Regression installer for regression and forecasting

In addition to using functions to predict linear regression models as discussed above, we can use the Regression installer in the Data Analysis data analyzer.

Process of making a linear regression table in Excel

- Enter data into spreadsheet simultaneously in each column or simultaneously in each line.
- Select Tools Data Analysis Regression, OK. Dialog boxes appear in turn as follows:

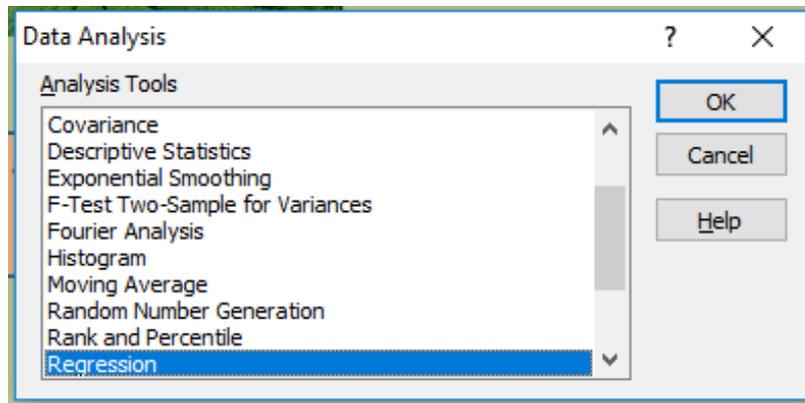


Figure 2. The dialog box contains the Regression analysis tool

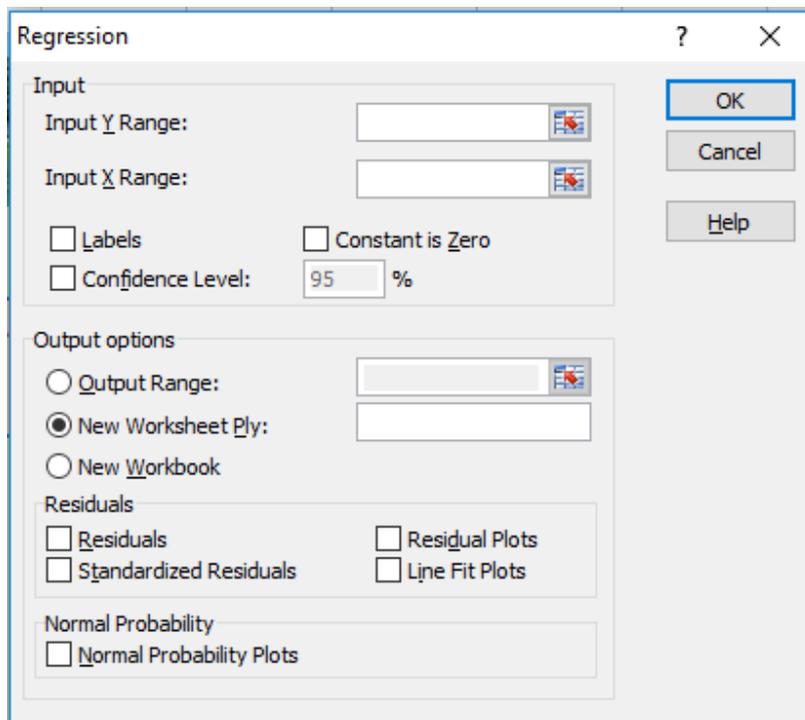


Figure 3. The dialog box to declare the parameters of the regression model

Explain the term:

Input options for input:

Input Y Range: The address field contains the dependent variable Y

Input X Range: Address space contains independent variables X
 Labels: Check this box to confirm that the first box (cells) does not contain regression data
 Constant is Zero: Check this to confirm the free coefficient of linear regression function $b = 0$
 Confidence Level: Reliability of regression (default is 95%) with $1-\alpha$
 with α is the level of significance or probability of error of type 1 rejecting H_0 while H_0 it's correct.
 Output option options Output Option:
 Output Range: The area or cell at the top left of the result area
 New Worksheet Ply: Print the results to another sheet
 New Workbook: Print the results to a new Excel file
 Other Options Residuals: Check these items for release
 Residuals: Random error
 Standardized Residuals: Standardize errors
 Residuals Plots: Error graph
 Line Fit Plots: Graph of linear regression functions
 Normal Probability distribution probability:
 Normal Probability Plots: Normal distribution probability graph
 - Click OK to give regression results.

Replacing the coefficients of the regression model calculated and the values given in the forecast period into the regression function will calculate the value to be predicted.

3. PREDICTION TOOL APPLICATION RESULTS IN BUSINESS PERFORMANCE ANALYSIS

3. 1. Forecast results by moving average method

Table 1. Revenue forecasting results by dynamic average method

Year	Revenue (billion VND)	Forecast	MA	Standard errors
2010	1588.79	–	#N/A	#N/A
2011	1667.72	–	#N/A	#N/A
2012	1799.24	1628.255	1628.26	#N/A
2013	1689.57	1685.25	1685.25	#N/A
2014	1986.97	1718.84333	1718.84	71.66620396
2015	2124.77	1825.26	1825.26	115.4711685
2016	2389.16	1933.77	1933.77	145.4739978
2017	2590.13	2166.96667	2166.97	193.2192205
2018		2368.02	2368.02	212.2763368

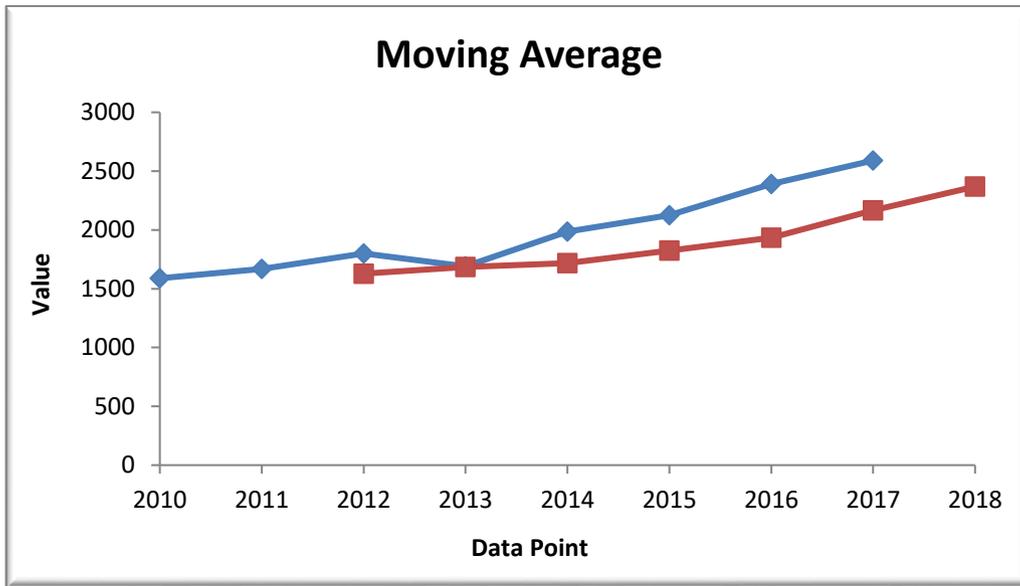


Figure 4. Graph of revenue forecast by moving average method

The forecasted results by the average method give us the value in Table 1.

Table 2. Revenue forecast results using TREND function

Year	Revenue (billion VND)
2010	1588.79
2011	1667.72
2012	1799.24
2013	1689.57
2014	1986.97
2015	2124.77
2016	2389.16
2017	2590.13
2018	2616.538571
2019	2758.092976
2020	2931.634974

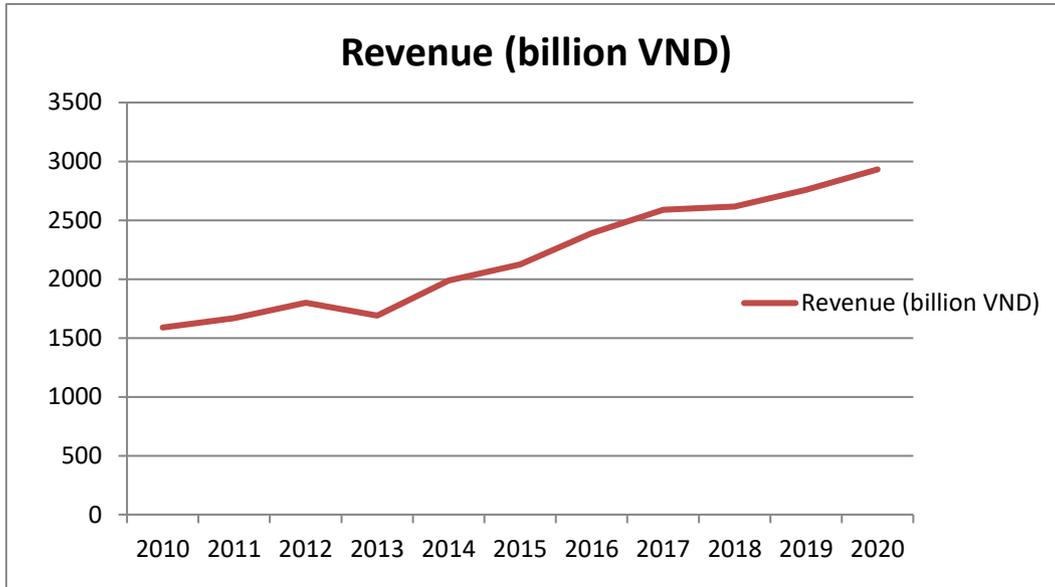


Figure 5. Sales forecast graph using TREND function

Use FORECAST function

Table 3. Revenue forecasting results by using FORECAST function

Year	Revenue (billion VND)
2010	1588.79
2011	1667.72
2012	1799.24
2013	1689.57
2014	1986.97
2015	2124.77
2016	2389.16
2017	2590.13
2018	2616.538571
2019	2758.092976
2020	2931.634974

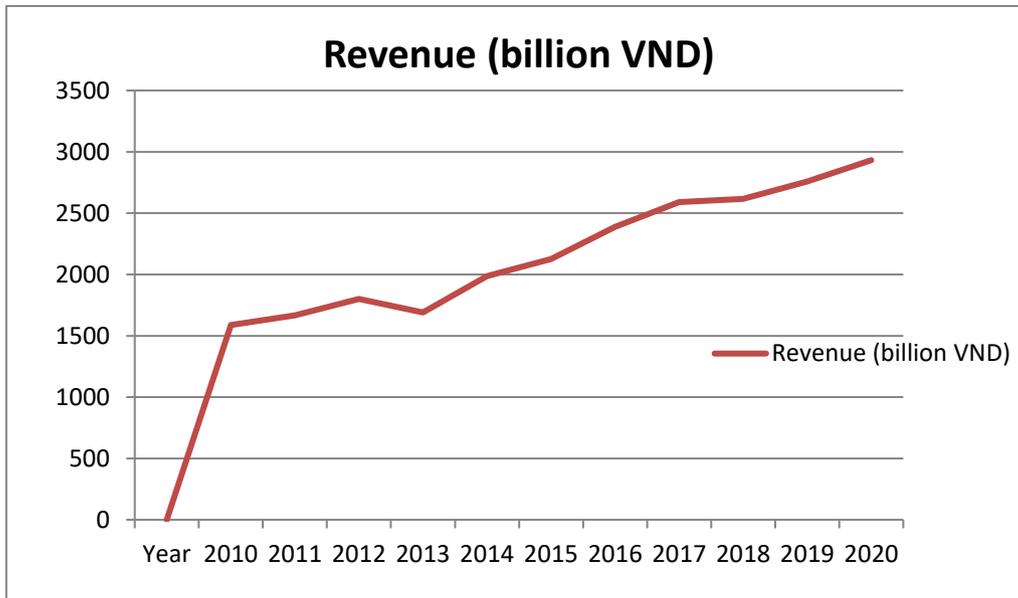


Figure 6. Graph of revenue forecast using the FORECAST function

Table 4. Revenue forecasting results using SLOPE and INTERCEPT functions

Year	Revenue (billion VND)	a	b		
2009	1430.63	135.682	-271210		
2010	1588.79	Regression: $y = 135.682x - 271210$			
2011	1667.72				
2012	1799.24				
2013	1689.57				
2014	1986.97	Forecast results		Year	Revenue (billion VND)
2015	2124.77			2018	2596.292333
2016	2389.16			2019	2731.974333
2017	2590.13			2020	2867.656333

Using regression method

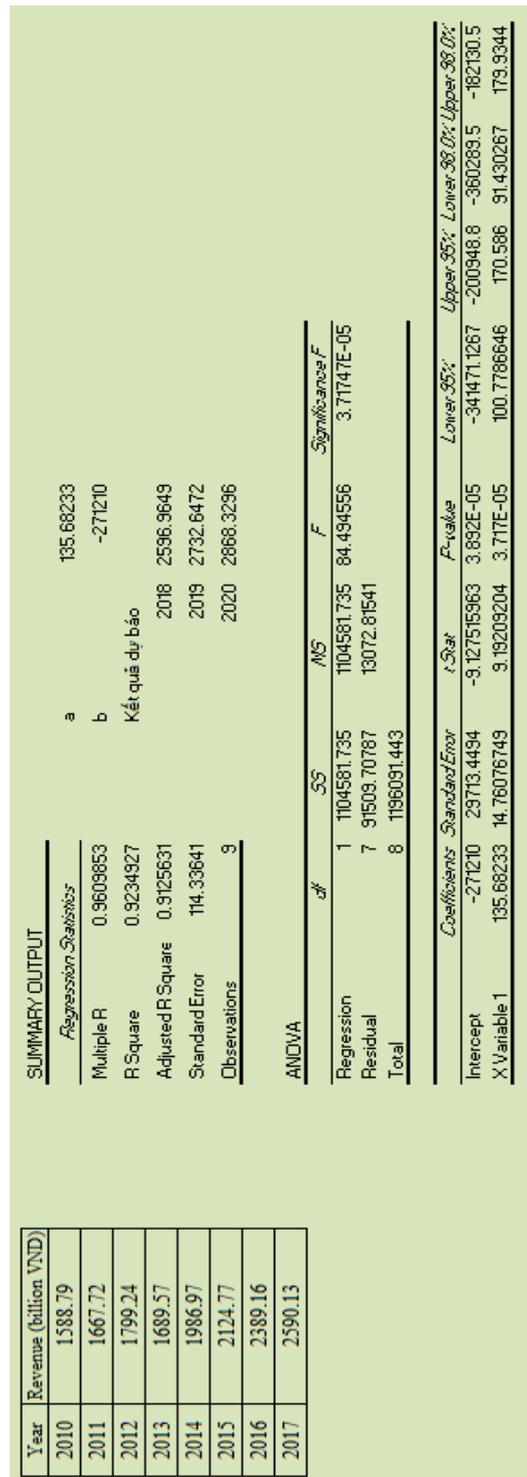


Figure 7. Graph of revenue forecast by regression and forecast method

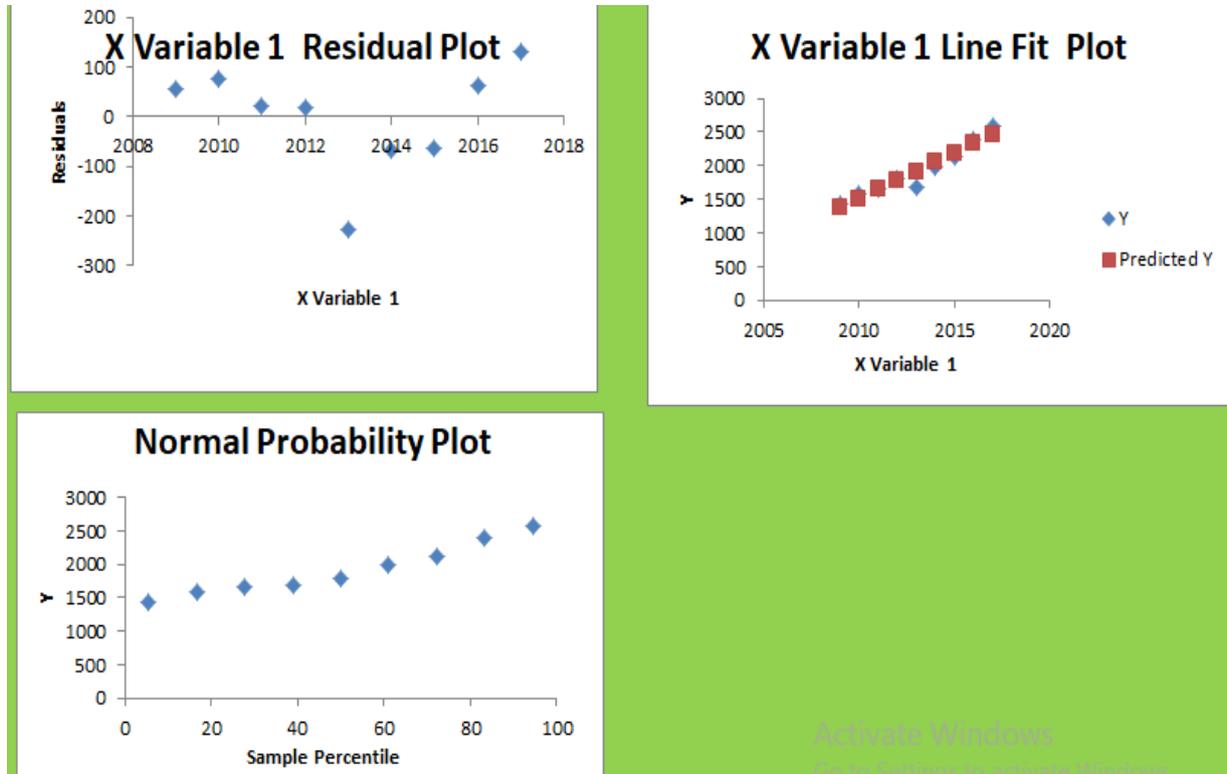


Figure 8. Graph of revenue forecast by regression method

3. 2. Compare and evaluate predictive results of dynamic averages and regression methods

After the forecast, we can summarize the results as follows:

Table 5. Summary table comparing the two prediction methods

Prediction method	Dynamic average method	Regression method
Forecast results	2368.02	2596.964899
Forecast errors	212.2763368	114.3364133

For dynamic average method: This method is implemented quickly, simply, easier to understand than regression method, can level the random variation of time. However, this method is completely based on past data, has not yet evaluated the difference between different period data, so the forecast error is greater than the regression method.

Regression method: As the prediction method gives us higher accuracy than the moving average method, the forecast error is less than the moving average method. However, this method is made more complex than the moving average method.

The results show that, when applying the above two methods to forecast the turnover of enterprises, the typical data collected at Ha Can Steel Private Enterprise in Thai Nguyen Province, the single regression method (linear regression) give a more approximate result than when using the moving average method. The error of single regression method is about 114 billion, this figure is nearly 1.9 times smaller than the error of the dynamic average method is about 212 billion. On the other hand, when predicting, the linear regression method gives us the correlation coefficient $\text{Multiple } R = 0.960985284 > 0.9$. Correlation coefficients show that the correlation level is considered to be tight. We have $r = 0.923$ that shows that for every 100% of the fluctuation of production demand, there is 92.3% because the remaining factor is due to random factors and other factors not in the model. From the comparison table, we see that the difference between the dynamic average method and the regression method is not too big. It can be predicted that business revenue in 2018 will be in the range of 2368.02 billion - 2596.96 billion.

4. CONCLUSIONS AND RECOMMENDATIONS

Revenue is considered an important economic indicator to reflect the business results of the enterprise. Therefore, revenue forecast is an important content in analyzing economic activities of enterprises. Applying predictive methods to revenue forecasts is a necessity. From the analysis of revenue forecasting results of enterprises, it aims to help enterprises realize and evaluate correctly, comprehensively and objectively the business situation of enterprises. At the same time, thereby seeing the level of accomplishing the targets of revenue plan of the enterprise. Revenue forecasting is the foundation for establishing and maintaining production. This will help managers to make decisions to determine the exact number of goods needed, time, manpower, resources, materials, machinery and supplies, etc. financial issues: how much money to borrow, how the cash flow will flow, ... From there, create the foundation of the business and make the marketing plan accordingly. Thereby helping to divide operational goals for all related groups. Thus, scientific forecasting helps enterprises stand firm in competition and win business. The market forecasts, rates, scientific and technological advances, changes in input sources, competitors ... are of vital importance for telecommunications enterprises. In addition, the forecast also provides information that allows coordination of actions between departments within the enterprise. From there, find out the contradictions exist and the objective reasons as well as subjective to set out guidelines and measures to promote the process of consuming goods and increasing income for businesses. Thereby, it helps enterprises to develop their development strategies in the short, medium and long-term periods to develop solutions suitable to each period and each stage of development, in order to create sustainable development in the current global integration trend.

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