



Modelling the Philippines' Revenue Collection Performance: A Study Using Multiple Linear Regression Analysis

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ABSTRACT

This study uses Multiple Linear Regression (MLR) in predicting revenue collection of the Philippines. Data of revenue collection performance for the period January 2012 up to June 2022 was obtained from Bureau of Internal Revenue of the Philippines. Monthly revenue was used as a measure of revenue collection performance, and hence, is a dependent variable for the multiple linear regression. Five variables including inflation rate, forex rate, import value, export value and stock price index were used as an independent variable. This research used a Normal Estimation Equation using Matrices to create the model for Revenue Collection Performance and used α as 0.05. The researchers also used logarithm transformation to transform the data specifically the dependent variable (y) to satisfy all the assumptions on Multiple Linear Regression Analysis. SPSS was used to formulate a mathematical model. Experimental results from the different multiple linear regression model show that Forex Rate, Import Value and Stock Price Index having a p-value of 0.007, 0.004 and 0.006 respectively shows significant factors in determining revenue collection performance in the Philippines. This means that any increase or decrease in the said variables can cause revenue collection either to inflate or deflate. The mathematical model has a coefficient of determination of 0.745. This indicates that the factors included in the model can explain revenue collection by almost 75 percent. From the model, it can be concluded that a one increase in Forex Rate, Import Value and Stock Price Index can cause revenue collection to increase by 0.025, 0.000045, and 0.000069 respectively. Moreover, a one increase in inflation rate can deflate revenue collection by 0.023 correspondingly. The study concludes that Multiple Linear Regression is a powerful tool in predicting revenue collection performance in the Philippines. This paper would help the government to strengthen more the revenue collection performance in the Philippines.

Keywords: [SPSS, Logarithmic Transformations, Normal Estimation Equation using Matrices, Revenue Collection]

INTRODUCTION

According to Philippines Finance Secretary Carlos G. Dominguez, the Philippines expects to narrow its budget deficit, with the government having raised tax collections as of September 2021 amid a coronavirus pandemic. In the first three quarters of 2021, the tax collections were 9% above last year's level. Tax collections rose by 9.3% to P2.03 trillion from a year and the collection target was set to P3.106 trillion for 2022.

Based on the Philippine Institute for Development Studies, inflation is still regarded as a clear and present danger to macroeconomic stability. What complicates the analysis of the relation between inflation and economic growth are the exogenous supply shocks in the past decades and the manner in which economic managers responded to these shocks. In the study provided by Trading Economics, the annual inflation rate in the Philippines climbed to 7.7% in October 2022 from 6.9% in August 2022, topping market forecast of 7.1%. It was the highest print since December 2008, being near the top end of the central bank's target of between 7.1% to 7.9% for the month, with food prices rising the most in 4 years (9.4% vs 7.4% in September). According to the Manila Times, Global inflation breached 7.4 percent this year 2022. This is the highest since 1996 and even surpasses the 6.3 percent caused by the 2008 financial market crash. While the pandemic led to a drop to around 3.23 percent, factors such as supply chain issues, economic volatility, rising commodity prices, and the war between Russia and Ukraine have led to the current rise. While the Bangko Sentral ng Pilipinas is working to bring the percentage down, Filipino consumers are feeling the pinch. How will this current crisis affect Philippine taxation? To put it simply, the state enforces the principle of taxation to collect money from the people. The rate depends on what is being taxed. It can either be graduated, varying depending on the amount, or it can be fixed. While there are many types of taxes, one thing is common — taxes can only be paid in cash. During times of high inflation, the purchasing power of cash decreases. The value of money cannot keep up with the rising prices of products hence, more money is needed to pay for certain goods. Because of this situation, a large amount of money with lesser value circulates in the economy, giving a distorted view of increase in taxable income.

The exchange rate is the price of a unit foreign currency in terms of domestic currency. It serves as the basic link between the local and the overseas market for various goods, services and financial assets. Using the exchange rate, it will be able to compare prices of goods, services, and assets quoted in different currencies. According to Securities and Exchange Commission, companies whose

transactions are substantially denominated in a currency other than Philippines pesos have stated that the use of Philippine pesos results in foreign exchange gains (losses) which may distort the financial condition and performance. The currency that mainly influences sales prices for goods and services and whose competitive forces and regulations mainly determine the sales price of its goods and services. Based on the Philippine Star, the bulk of stiff price hikes notably come from imported refined crude oil products that in turn impinge upon transport costs of people and goods. It has also pushed up production costs of consumer goods and raw materials, the bulk of which were being imported from other countries. Coupled by the peso-dollar exchange rate that nearly breached P60 to \$1 a few weeks ago. Thankfully, monetary interventions – through raising interest rates – propped up the Philippine peso that has lately recovered and now range at P57 to \$1.

The country's total export sales in January 2022, amounting to USD 6.04 billion, increased at an annual rate of 8.9 percent, from an increment of 7.3 percent in the previous month. This was the 11th consecutive month of positive annual growth in exports value since March 2021. By commodity group, electronic products continued to be the country's top export in January 2022 with total earnings of USD 3.51 billion. By major type of goods, exports of manufactured goods shared the biggest to the total exports in January 2022 amounting to USD 5.06 billion (83.7%). Philippines trade data reports Philippines was 34th largest importer country in the world during 2020. Given the Philippine population of 108.9 million people, value of total imports in 2020 translated to roughly USD 1,050 in yearly product demand from every person in the Southeast Asian nation.

According to Philippines import statistics, Philippines major import commodities are electronics, machinery, mineral fuels & oils, vehicles and iron & steel. Philippines import data also shows China, Japan, United States and South Korea are the largest import partners of Philippines.

Taxes are crucial because governments collect this money and use it to finance social projects. According to Department of Finance of the Philippines, amid a coronavirus pandemic, the Philippines expects to narrow its budget deficit, with the government having raised tax collections. Most of the economists are confident that the elevated debt and deficit level is temporary condition and the country can quickly return to fiscal consolidation. The ability to collect taxes is central to a country's capacity to finance social services such as health and education, critical infrastructure such as electricity and roads, and other public goods. Considering the vast needs of poor countries, this low level of tax collection is putting economic development at risk.

Furthermore, taxes can affect the state of economic growth of a country. Taxes generally contribute to the gross domestic product (GDP) of a country. Because of this contribution, taxes help spur economic growth which in turn has a ripple effect on the country's economy; raising the standard of living, increasing job creation, etc. Taxes help raise the standard of living in a country. The higher the standard of living, the stronger and higher the level of consumption most likely is. Businesses flourish when there is a market for their product and services. With a higher standard of living, businesses would be assured of a higher domestic consumption as well.

Based on the 2021 BIR Report, the agency enabled to steadily improve its collection performance and broaden the taxpayer base.

Economic factors are connected with goods, services, and money. Despite directly affecting businesses, these variables refer to financial state of the economy on a greater level — whether that be local or global. The reason for this is that the state of the economy can decide many of the important details that come up in an operating company, including topics such as consumer demand, taxes and asset value.

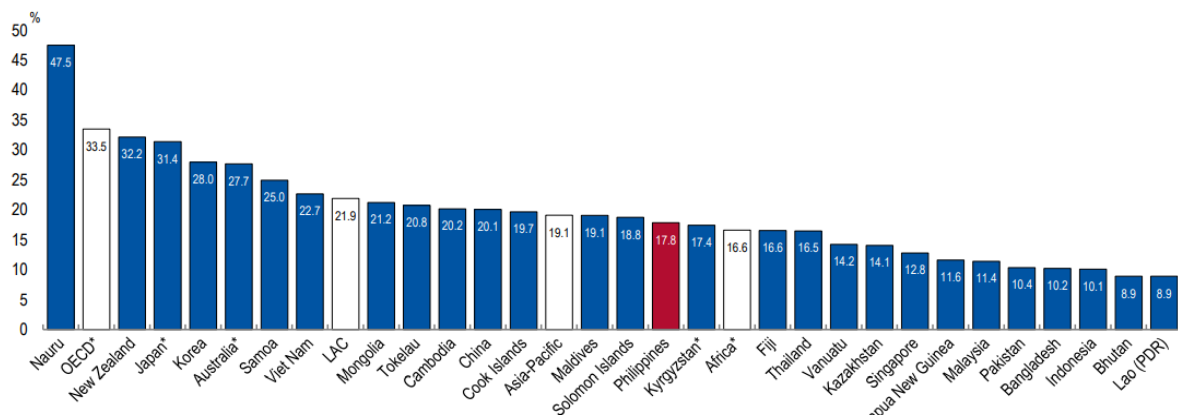


Fig 1: Revenue Statistics in Asia and Pacific 2022

According to Organization for Economic Co-operation and Development (OECD) as shown in Fig. 1, the Philippines' revenue/tax-to-GDP ratio was 17.8% in 2020, below the Asia and Pacific (28) average of 19.1% by 1.3 percentage points.

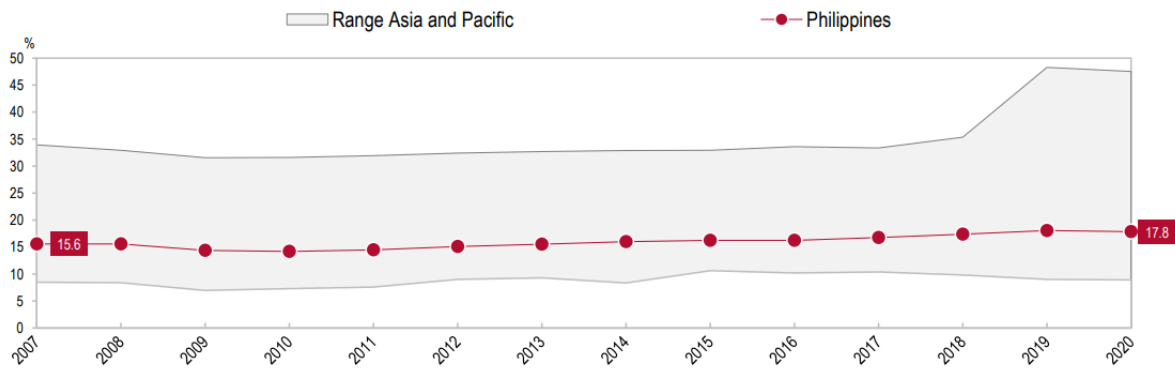


Fig 2: Philippines Revenue/Tax-To-GDP Ratio

Fig. 2 discusses the revenue/tax-to-GDP ratio in the Philippines decreased by 0.2 percentage points from 18.1% in 2019 to 17.8% in 2020. Based on the above graphs, it is clear that the total value of revenue collection in the Philippines is below the Asia and Pacific target. Thus, this study will be helpful for the policymakers and researchers in assessing the impact of some economic factors on revenue collection. Meanwhile, it helps them in understanding the link between different economic factors which play a critical role in improving revenue collection of the country.

OBJECTIVES OF THE STUDY

The core purpose of this study is to determine the influencing factors that can significantly impact the revenue collection in the Philippines. The researchers will formulate a mathematical model of the revenue collection using Multiple Linear Regression. Variables that are considered in this study are inflation rate (x_1), forex rate (x_2), import value (x_3), export value (x_4) and stock price index (x_5), which are considered as independent variables. The revenue collection (y) is identified as dependent variable. The relationships and effects of these variables in the revenue collection will be further elaborated and discussed in the Review of Related Literature and Studies.

STATEMENT OF THE PROBLEM

This study is conducted to formulate a mathematical model through regression analysis to estimate the future revenue collection in the Philippines. This research also wants to answer the following questions:

1. What is the behavior of the graph of the following variables?
 - a. Revenue Collected (y)
 - b. Inflation Rate (x_1)
 - c. Forex Rate (x_2)
 - d. Import Value (x_3)
 - e. Export Value (x_4)
 - f. Stock Price Index (x_5)
2. What could be the mathematical model that can be formulated through regression analysis that could estimate the future revenue collection of the Philippines country?
3. What are the significant factors that can actually predict the revenue collection of the Philippines?

CONCEPTUAL FRAMEWORK

The variables are expressed in conceptual framework section of the study. Conceptual framework is a group of concepts that are broadly defined and systematically organized to provide a focus, a rationale, and a tool for the integration and interpretation of information, usually expressed abstractly through word models Kothari (2004). Conceptual framework of this study also explains relationship between independent variables and dependent variable.

Below is the research paradigm of the multiple regression study showing the relationships between the independent and dependent variables. This study will be based on the theoretical framework and review of related literatures. As shown in the below conceptual framework, the study illustrates the relationship between the different economic factors and the revenue collected in the Philippines. It is reflected on the paradigm that the economic factors (independent variables) are factors in determining revenue collected in the Philippines (dependent variable). In addition, there were five (5) identified economic factors that may help determine revenue collected in the Philippines. These factors, namely: (a) Inflation Rate (x_1) (b) Forex Rate (x_2) (c) Import Value (x_3) (d) Export Value (x_4) (e) Stock Price (x_5)

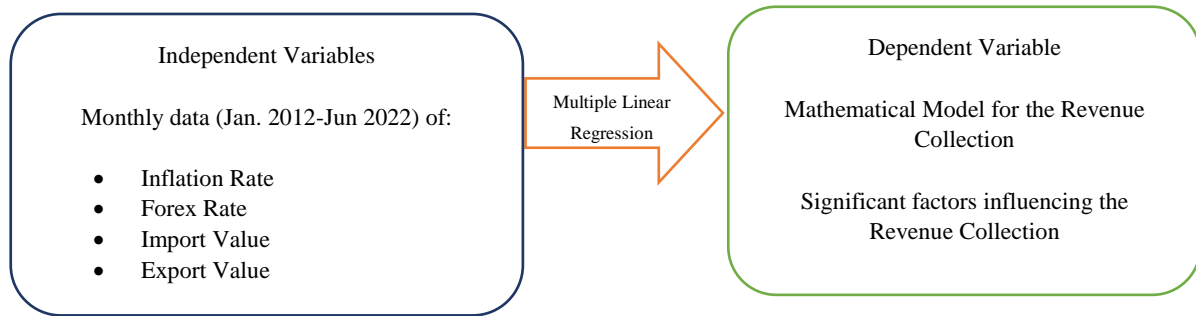


Fig. 3: Research Paradigm

The researchers followed this research paradigm. A multiple linear regression is to be applied to the data in order to come up with the expected output as indicated in the diagram.

SCOPE AND LIMITATIONS OF THE STUDY

The scope of this research is from January of 2012 up to June of 2022. The data were gathered and collected from Philippine Statistics Authority (PSA) and Bureau of Internal Revenue (BIR) of the Philippines. The researchers formulate regression models by using the following independent variables such as inflation rate (x_1), forex rate (x_2), import value (x_3), export value (x_4) and stock price index (x_5).

LITERATURE REVIEW

This section of the paper will provide an overview of the current knowledge of the topic and allowing to identify relevant theories, methods and gaps that would help to determine the nature of the research by studying a previous work and findings to create a full understanding of the developments in this field. This will also discuss the relationship of the independent variables to the dependent variable as presented in the research paradigm.

According to Washington State University Government Relations Report (2022), revenues continued to exceed expectations and the influx of revenue collected is in part due to a considerable increase in inflation.

As per Department of Finance, the good tax reform which needed to boost the country's revenue is crucial to the financial viability of the administration's higher public spending policy because it aims to correct the tax systems "inherent flaws, such as non-indexation to inflation rates" to consistently meet annual revenue targets.

In Breaching the Mark: Train Law ad Surging Inflation (2018), Inflation is defined as a sustained increase in the general level of prices of commodities in a jurisdiction and is measured as an annual percentage change. Under the circumstances of inflation, the prices of goods and services increase over time.

Ofori, Obeng, Armah (2018), generation of enough revenue for development is becoming increasingly crucial in this era of slow growth, growing unemployment and high debt. Tax revenue over the years reveals an unstable pattern. According to them, one key factor ne key factor that has been overlooked in the literature in terms of the determinants of tax revenue is exchange rate volatility. The results of the study suggest that exchange rate volatility has a deleterious effect on tax revenue both in the short-run and long-run but the effect is more pronounced in the long-run than the short-run.

Illievski (2015) used panel data set of 96 countries over the period 1990-2008 to examine relationship between stock price and tax revenue. When the stock market increases relative to GDP it means that more financial resources for investments are available. He showed that the effect of total stock market value traded to tax revenue is positive and statistically significant. In general, the stock market positively influences the government's ability to raise tax revenue.

Colombage, Maslyuk and Taha, stock market and revenue are considered as determinants of economic growth. They cited few economic theories explaining the stock market and revenue collection as joint determinants using Endogenous Growth Models (EGM), which suggests that economic growth is strongly influenced by the stock price market and tax policy, and the Laffer-Khaldum Curve, which demonstrates that investment income would stimulate economic growth which in turn generate more tax revenue. They also employed panel unit root tests and panel Granger Causality Tests to estimate both short and long run casual relationships between stock price, revenue and economic growth.

In WCO News: Deutsche Post DHL Group, they cited that many countries have seen a significant and rapid growth in the volume of low-value imports of physical goods on which duties and taxes are not collected. There are growing concerns about matters related to potential revenue loss, fraud, and the disadvantages experienced by domestic retailers. Therefore, it is appropriate to provide an overview of the traditional collection model, current developments aimed at improving it, and new, alternate models for collecting duties and taxes on these consignments.

De Vera (2022), With importation recovery and the return to economic growth last year, the Bureau of Customs (BOC) not only exceeded its 2021 collection goal but also surpassed its tax take in 2019 before the pandemic. international trade trends and sustained enforcement activities will allow the country's second biggest tax-collection agency to hit its collection target this year. The DBCC had projected imports to grow 10 percent this year, alongside faster GDP growth of 7 to 9 percent. The Philippines is a net importer as it sources for domestic consumption more products overseas than the locally made goods it sells abroad.

According to Economic Complexity Index, in 2020, Philippines was the number 39 in total exports. Also, based on Philippine Statistical Authority (PSA), In January 2022, the country's total external trade in goods amounted to USD 16.78 billion which indicates an annual growth rate of 20.1 percent. The total external trade marked its 12th consecutive month of positive annual growth which is critical in measuring revenue collection.

MATERIALS & METHODS

This chapter presents the methods used by the researchers in this study. The study used descriptive design method to identify factors that were really affecting revenue collection performance in the Philippines and suggested possible solution based on the findings of the study. For the accomplishment of this research, the researchers used secondary data that was collected from different sources such as government websites and publications.

Data for chosen variables were selected, calculated and transferred into an Excel spreadsheet. Then, the researchers uploaded this in SPSS.

Identification of dependent and independent variables, as well as their measurement, is really needed when constructing an empirical model. As a result, the current study's dependent variable is the revenue collection. In addition, the empirical model includes dependent factors such as inflation rate, fore rate, import value, export value and stock price index. Then, the researcher employed multiple linear regression analysis and tested the five assumptions to satisfy the multiple linear regression.

STATISTICAL TOOL

SPSS was used by the researchers to come up with more accurate and reliable results. SPSS is short for Statistical Package for the Social Sciences, and it's used by various kinds of researchers for complex statistical data analysis.

STATISTICAL TREATMENT

1. Multiple Linear Regression Model

The researchers used Multiple Linear Regression (MLR). Multiple linear regression analysis is a technique for modelling the linear relationship between two or more variables. It is one of the most widely used of all statistical methods. To conduct the Multiple Linear Regression Analysis, there are five assumptions that are needed to be satisfied which includes the following:

1. Linear Relationships
2. Normality
3. No multicollinearity
4. No auto-correlation
5. Homoscedasticity

The underlying assumptions must be satisfied in order to get a more valid model. Diagnostics for the underlying assumptions must be done and remedial measures can then be taken accordingly. If the assumptions of the multiple linear regressions are met, then the regression model can be conducted using this model:

$$y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki} + \mu_i$$

where y is the dependent variable, x is the independent variable, β is the predicted value of the dependent variable when the independent variables are zero, and μ is the zero.

2. Normal Estimation Equation

To construct a model, the researchers used a normal estimation equation. The normal equation is a closed-form solution used to find the value of θ that minimizes the cost function. Another way to describe the normal equation is as a one-step algorithm used to analytically find the coefficients that minimize the loss function. The whole sample of n observations can be expressed in the matrix notation

$$y = x\beta + u$$

where y is the n -dimensional column vector, x is a $n(k+1)$ matrix, β is a $(k+1)$ -dimensional column vector of parameters, and u is a n -dimensional column vector of error terms.

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ \vdots \\ y_n \end{bmatrix} = \begin{bmatrix} 1 & x_1 & \cdots & x_{1k} \\ 1 & x_2 & \cdots & x_{2k} \\ 1 & x_3 & \cdots & x_{3k} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{n1} & \cdots & x_{nk} \end{bmatrix} \times \begin{bmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_k \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ u_3 \\ \vdots \\ u_n \end{bmatrix}$$

Ordinary least squares (OLS) minimizes the squared distances between the observed and predicted value y

$$S(\beta) = \sum_{i=1}^n (y_i - x_i' \beta)^2 = (y - x\beta)'(y - x\beta) \rightarrow \min \beta$$

The resulting OLS estimator of β is written as:

$$\beta' = (x'x)^{-1}x'y$$

Its matrix nature is written in the form of:

$$\begin{bmatrix} n & \sum_{i=1}^n x_{1i} & \cdots & \sum_{i=1}^n x_{2i} & \sum_{i=1}^n x_{ki} \\ \sum_{i=1}^n x_{1i} & \sum_{i=1}^n x_{1i}^2 & \cdots & \sum_{i=1}^n x_{1i} x_{2i} & \sum_{i=1}^n x_{1i} x_{ki} \\ \vdots & \vdots & \cdots & \vdots & \vdots \\ \sum_{i=1}^n x_{ki} & \sum_{i=1}^n x_{ki} x_{1i} & \cdots & \sum_{i=1}^n x_{ki} x_{2i} & \sum_{i=1}^n x_{ki}^2 \end{bmatrix} \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix} = \begin{bmatrix} \sum_{i=1}^n y_i \\ \sum_{i=1}^n x_{1i} y_i \\ \vdots \\ \sum_{i=1}^n x_{ki} y_i \end{bmatrix}$$

This can be used to predict the dependent variable, and the error term called as residual.

RESULTS AND DISCUSSIONS

This section will explain the behavior of the graph of the following independent variables and the dependent variables within the span of ten (10) years from 2012 up to the first semester of 2022.

1. BEHAVIOR OF THE GRAPH

The first graph on the figure refers to the behavior of the revenue collection from 2012-2022. As observed in the graph, there is an increasing trend from 2012 to 2019 but a drastic decrease happened during 2020 due to the pandemic. Minor fluctuations were also noticed within the succeeding years.

As shown in the figure, fluctuation on the graph of the inflation rate was recorded. For the whole span, the highest growth was recorded during 2018. During the Covid-19 pandemic that started in 2019, a decrease during the 4th Quarter of 2019 have greatly affected the inflation rate. Gradually, it is ascending again after two years at the end of 2021. By examining the quarterly increase, it is concluded that inflation rate grew the highest during the 1st Quarter of 2019 having an increase of 7% due to economic growth.

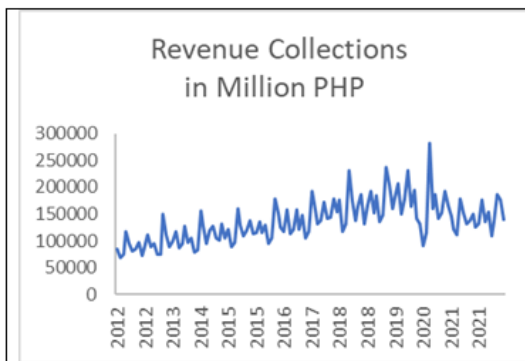


Fig. 4

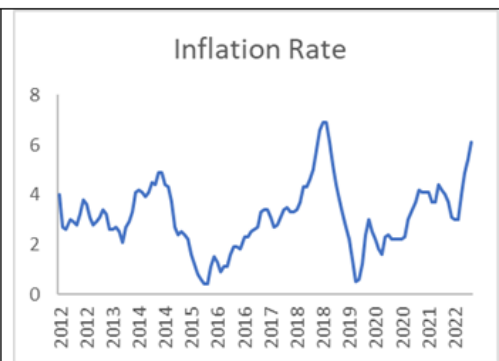
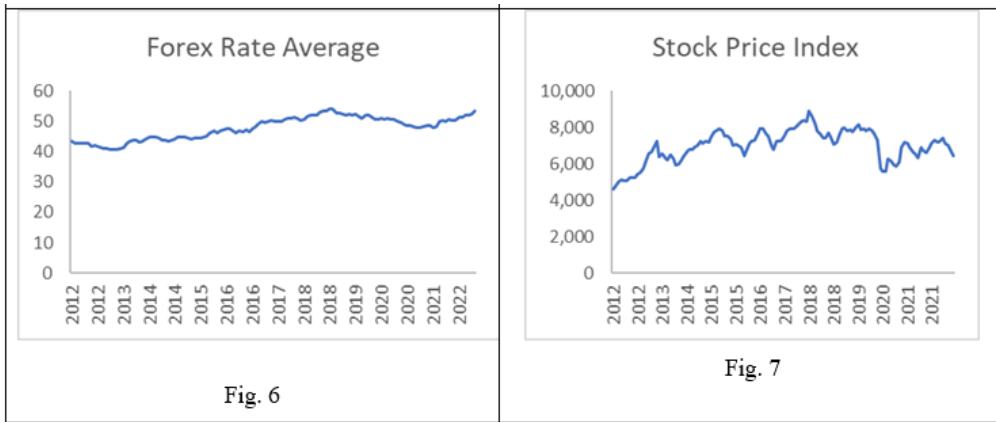


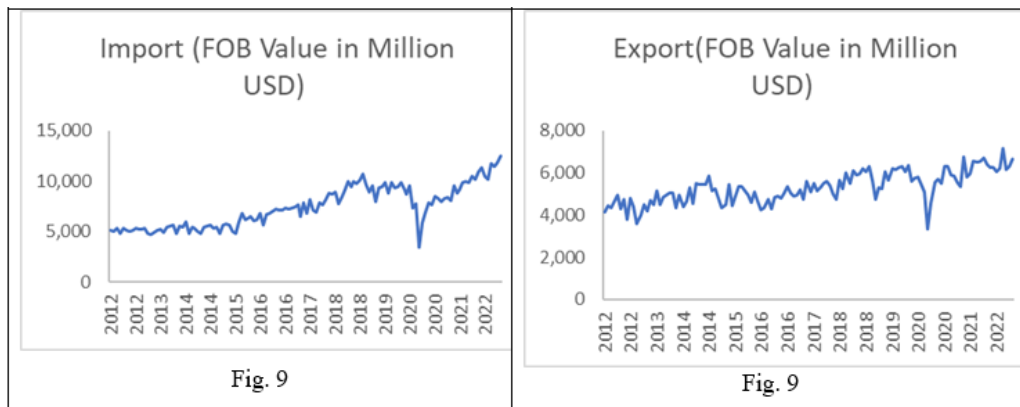
Fig. 5

Forex rate reveals a stationary pattern having its maximum and minimum value of 54.01 and 40.670 respectively on the 4th Quarter of year 2018 and 1st Quarter of 2013 correspondingly. In 2016, forex rate eased due to reflecting decelerating inflation, improving fiscal performance, and ample liquidity in the financial system. On the annual analysis of the forex rate of the Philippines, it can be seen that from 2013 to 2018, there was an escalation of forex rate but dropped off of at the end of 2019 as the pandemic starts.



In past ten year’s total trade (exports and imports) shows an increasing trend with some fluctuations. Trade in services with the Philippines (exports and imports) have an increasing trend before the Covid-19 pandemic but disrupted at the end of 2019 due to the strike of the virus. Import and export services ascend as the virus began to deteriorate.

Similar to import and output value, the graph of stock price index reveals an elevating trend with some fluctuations having its lowest record during 2012, and highest during 2018. From the past two decades, stock price index reached its peak during the first quarter of 2018. It then dives down as time elapses, and even reached its lowest value last 2020. During the 1st Quarter of 2021, it showed a sudden trend and continues to show progress as the pandemic flattened at the end 2021 and the start of 2022.



2. MATHEMATICAL MODEL USING NORMAL EQUATION MATRICES

To be able to formulate the estimating model for revenue collection, the regression analysis using the matrix theory was applied to this research. The least squares estimating equations $(X'X) b = X'y$

$$\begin{bmatrix}
 126 & 390.90 & 6022.16 & 935772.37 & 668343.32 & 880134.64 \\
 390.90 & 1434.47 & 18830.70 & 3013977.45 & 2112752.13 & 2724627.71 \\
 6022.16 & 18830.70 & 289589.05 & 45528498.19 & 32168998.85 & 42296898.96 \\
 935772.37 & 3013977.45 & 45528498.19 & 7468080097.24 & 5119695600.89 & 6636377027.73 \\
 668343.32 & 2112752.13 & 32168998.85 & 5119695600.89 & 3614267454.50 & 4701174032.09 \\
 880134.64 & 2724627.71 & 42296898.96 & 6636377027.73 & 4701174032.08 & 6245986466.53
 \end{bmatrix}
 \begin{bmatrix}
 b_0 \\
 b_1 \\
 b_2 \\
 b_3 \\
 b_4 \\
 b_5
 \end{bmatrix}
 =
 \begin{bmatrix}
 1484.26 \\
 4607.84 \\
 71032.50 \\
 11070770.08 \\
 7886810.00 \\
 10385034.82
 \end{bmatrix}$$

The following coefficients were obtained.

$$\begin{aligned}
 b_0 &= 9.86, & b_1 &= -0.023, & b_2 &= 0.025, & b_3 &= 0.000047, \\
 b_4 &= -0.000005, & b_5 &= 0.00007
 \end{aligned}$$

After the data analysis, the following model was obtained and can be written as:

$$\ln y = 9.86 - 0.023x_1 + 0.025x_2 + 0.000047x_3 - 0.000005x_4 + 0.00007x_5$$

With a coefficient of determination of 0.745, this model is actually good enough in predicting the dependent variable. But since one of the independent variables is found out to be insignificant predictors of revenue collection after performing a regression analysis, the researchers omit that variable from the equation.

Using the least square estimation

$$\begin{bmatrix} 126 & 390.90 & 6022.16 & 935772.37 & 880134.64 \\ 390.90 & 1434.47 & 18830.70 & 3013977.45 & 2724627.71 \\ 6022.16 & 18830.70 & 289589.05 & 45528498.19 & 42296898.96 \\ 935772.37 & 3013977.45 & 45528498.19 & 7468080097.24 & 6636377027.73 \\ 880134.64 & 2724627.71 & 42296898.96 & 6636377027.73 & 6245986466.53 \end{bmatrix} \begin{bmatrix} b_0 \\ b_1 \\ b_2 \\ b_3 \\ b_5 \end{bmatrix} = \begin{bmatrix} 1484.26 \\ 4607.84 \\ 71032.50 \\ 11070770.08 \\ 10385034.82 \end{bmatrix}$$

The following coefficients were obtained.

$$b_0 = 9.836, \quad b_1 = -0.023, \quad b_2 = 0.025, \quad b_3 = 0.000045, \\ b_5 = 0.000069$$

Thus, formulating a new estimation equation written in the form of:

$$\hat{y} = e^{(9.836 - 0.023x_1 + 0.025x_2 + 0.000045x_3 + 0.000069x_5)}$$

This mathematical model has a coefficient of determination of 0.745. This indicates that the factors included in the model can explain revenue collection by almost 75 percent. From the model, it can be concluded that a one increase in Forex Rate, Import Value and Stock Price Index can cause revenue collection to increase by 0.025, 0.000045, and 0.000069 respectively. Moreover, a one increase in Inflation Rate can deflate revenue collection by 0.023 correspondingly.

3. SIGNIFICANT FACTORS

In determining the predictors of revenue collection, the researchers conducted a multiplier linear regression. A logarithmic transformation has taken place to the dependent variable in order to satisfy all the required assumptions before conducting such a regression analysis. The level of significance used in order to determine the significant factors is considered to be 0.05. Those factors which has a p-value of less than the level of significance after applying a multiple linear regression is therefore concluded to be a significant predictor of revenue collection.

Table 1: Regression Analysis

	p-value
Inflation Rate	0.099
Forex rate	0.007
Stock Price Index	0.004
Import Value	0.006

As shown in Table 1, three out of five independent variables were found out to be a predictor of revenue collection namely Forex Rate, Import Value and Stock Price Index having a p-value of 0.007, 0.004 and 0.006 respectively. This means that any increase or decrease in the said variables can cause revenue collection either to inflate or deflate. The other variable: Inflation Rate was found to be insignificant predictor due to its p-values being greater than 0.01 in the values of 0.099 correspondingly.

CONCLUSION

This study concludes that Forex Rate, Import Value and Stock Price Index having a p-value of 0.007, 0.004 and 0.006 respectively shows significant factors in determining revenue collection performance in the Philippines. It means that any increase or decrease in the said variables can cause revenue collection either to inflate or deflate. The mathematical model has a coefficient of determination of 0.745. This indicates that the factors included in the model can explain revenue collection by almost 75 percent. From the model, it can be concluded that a one increase in Forex Rate, Import Value and Stock Price Index can cause revenue collection to increase by 0.025, 0.000045, and 0.000069 respectively. Moreover, a one increase in inflation rate can deflate revenue collection by 0.023 correspondingly.

RECOMMENDATION

Both national and local governments should improve revenue generation to make the country's fiscal resources developed. The BIR should consider on their roadmap the improvements of forex rate, import and stock price as these factors are significant in the revenue

collection performance in the Philippines. The government should create a program to boost these economic factors so as to improve the collection performance of the revenue. All attached agencies should scale up their measures and improve existing policies related to forex rate, import value and stock prices.

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Appendix B: Test of Normality

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LN_Revenue_Collection	.042	126	.200 [*]	.993	126	.756

a. Lilliefors Significance Correction

H₀: The data are normally distributed

H_a: The data are not normally distributed

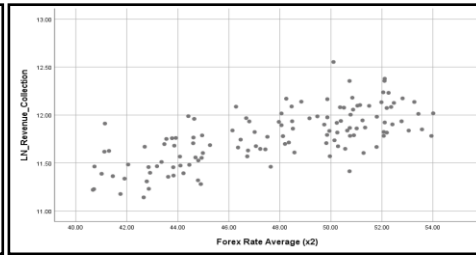
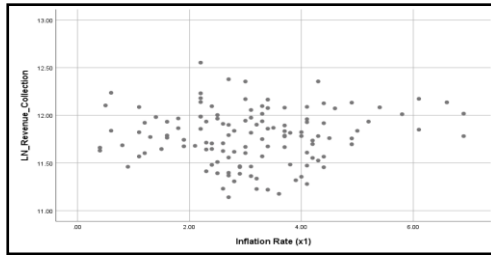
Rejection rule: If P-value is greater than 0.05, then fail to reject the null hypothesis.

Conclusion: The Shapiro-Wilk tests the normality of the data. The test fails to reject the hypothesis of normality since the p-value is 0.756 which is greater than to 0.05. Satisfying the normality test allows to state that with 95% confidence the data fits the normal distribution. Moreover, passing the normality test states that no significant departure from normality was found.

Appendix C : Test of Linearity

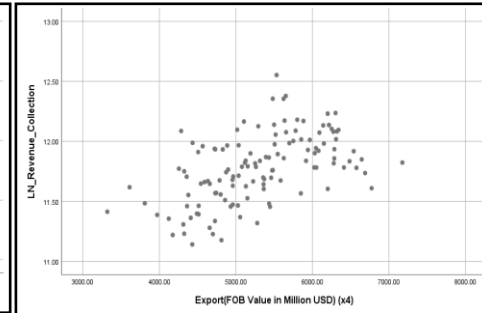
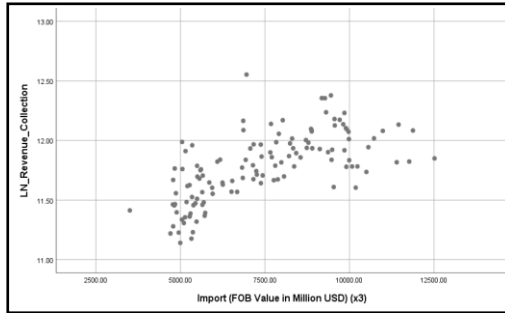
Graph 1 – Inflation Rate (x₁)

Graph 2 – Forex Rate Average (x₂)

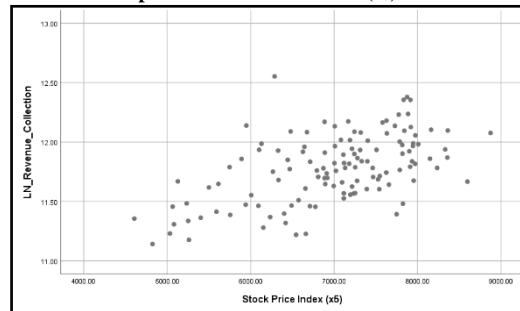


Graph 3 – Import (x₃)

Graph 4 – Export (x₄)



Graph 5 – Stock Price Index (x₅)



Multiple linear regression requires the relationship between the independent and dependent variables to be linear. The scatterplot was used in testing the linearity assumption. The pattern of dots on a scatterplot determines whether a relationship or correlation exists between two continuous variables. If a relationship exists, the scatterplot indicates its direction and whether it is a linear or curved relationship. By

looking at the plotted data, linear pattern can be seen which indicates linearity among between the independent and dependent variables.

Appendix D: Test of Multicollinearity

Multiple linear regression assumes that there is no multicollinearity in the data. Multicollinearity occurs when the independent variables are too highly correlated with each other. In this study,

multicollinearity was tested using the variance inflation factor (VIF). It can be seen from the table that all of the computed VIFs at the last

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	9.860	.361		27.287	.000		
	Inflation Rate (x1)	-.023	.014	-.108	-1.630	.106	.840	1.190
	Forex Rate Average (x2)	.025	.009	.329	2.662	.009	.242	4.137
	Import (FOB Value in Million USD) (x3)	4.669E-5	.000	.336	2.159	.033	.153	6.526
	Export(FOB Value in Million USD) (x4)	-5.837E-6	.000	-.015	-1.139	.890	.304	3.288
	Stock Price Index (x5)	6.961E-5	.000	.218	2.874	.005	.645	1.550

a. Dependent Variable: LN_Revenue_Collection

column are lesser than 10 which indicates that there is no multicollinearity exist between and among the independent variables.

Appendix E: Test of Independence

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.745 ^a	.556	.537	.19268	1.850

a. Predictors: (Constant), Stock Price Index (x5), Inflation Rate (x1), Export(FOB Value in Million USD) (x4), Forex Rate Average (x2), Import (FOB Value in Million USD) (x3)

b. Dependent Variable: LN_Revenue_Collection

The Durbin Watson (DW) statistic was used for autocorrelation in the residuals from a statistical model or regression analysis. The Durbin-Watson statistic has a value ranging between 0 and 4. A value of 2.0 indicates there is no autocorrelation detected in the sample. Values from 0 to less than 2 points to positive autocorrelation and values from 2 to 4 means negative autocorrelation. Since the computed Durbin Watson (DW) statistic is equal to 1.85, it is concluded that there is a positive autocorrelation.

Appendix F: Homoscedasticity- The Breusch-Pagan Test

Test Equation:

Dependent Variable: Residual^2

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.153268376							
R Square	0.023491195							
Adjusted R Square	-0.017196672							
Standard Error	0.062766571							
Observations	126							
ANOVA								
	df	SS	MS	F	Significance F	Lagrange's Multiplier	Significance LM	
Regression	5	0.01137279	0.002275	0.577351	0.717248388	2.959890571	0.706169643	
Residual	120	0.472757097	0.00394					
Total	125	0.484129887						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.110867673	0.117714097	-0.94184	0.348168	-0.343933393	0.122198046	-0.343933393	0.122198046
Inflation Rate	-0.002088662	0.004597604	-0.45429	0.650438	-0.011191597	0.007014274	-0.011191597	0.007014274
Forex Rate Average	0.004540944	0.003042963	1.492277	0.138251	-0.001483912	0.0105658	-0.001483912	0.0105658
Import (FOB Value in Milli	-9.31752E-06	7.04328E-06	-1.32289	0.188386	-2.32627E-05	4.62769E-06	-2.32627E-05	4.62769E-06
Export(FOB Value in Millio	1.15272E-05	1.3686E-05	0.842261	0.401317	-1.55702E-05	3.86246E-05	-1.55702E-05	3.86246E-05
Stock Price Index	-8.03583E-06	7.89189E-06	-1.01824	0.310613	-2.36612E-05	7.58957E-06	-2.36612E-05	7.58957E-06

H₀: Homoscedasticity is present

H_a: Heteroscedasticity is present

Rejection rule: If P-value is greater than 0.05, then fail to reject the null hypothesis.

Conclusion: Since the result of the Breusch-Pagan test for homoscedasticity is 0.706169643 then, **fails to reject the null hypothesis.** Hence, homoscedasticity exists.

Appendix G: Bar Graph of the Variables

