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Factors Affecting Money Supply (M0) in the Economy

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Abstract:

This paper provides factors affecting the Money Supply (M0) in the economy. The data were obtained from the site tradingeconomics.com and estimated using the E-views. The researchers conduct tests such as the test on Normality, Regression, Durbin-Watson Test, Multicollinearity, Heteroskedasticity, Ramsey RESET test, and Chow Breakpoint. These lead to a conclusion that factors affecting the Money Supply (M0) that have significance are the Consumer Price Index (CPI), External Debt and Gross Domestic Product (GDP).

Key words: factors affecting Money Supply (MO), economy, *Consumer Price Index (CPI), External Debt and Gross Domestic Product (GDP).*

1. Introduction

Money Supply matters when it comes to situations happening in an economy. The money here is defined as the narrow money

which is the currency or coins in the circulation.[1] This may affect the growth in the economy since this serves as the aid in controlling inflation in the country. To regulate such, there are also other factors affecting the money supply. The Central Bank or Bangko Sentral ng Pilipinas is the one responsible for regulating money in the economy. They use some variables to control inflation.

In economics, the money supply or money stock is the total amount of monetary assets available in an economy at a specific time.[2] There are several ways to define "money," but standard measures usually include currency in circulation and demand deposits (depositors' easily accessed assets on the books of financial institutions) which is the M0. Money supply data are recorded and published usually by the government or the Central Bank of the country. In our country, we have the Bangko Sentral ng Pilipinas. Aside from maintaining the records on data, they are also responsible on controlling certain circumstances in an economy.

In studying such, we are able to manifest ways to avoid situations that hinders economic growth. The researchers look into the best model in order to determine whether those explanatory variables have its significant relationship with the money supply M0. The researchers aim for the further understanding of the topic. With this, they will be able to know those factors affecting the money supply specifically money in a narrow sense or M0. It is important to perceive ideas on how to control or manipulate unexpected circumstances happening in an economy. For this to be realized, there are some variables affecting the money supply M0 which may actually be the cause to prevent problems regarding the status of an economy. So, the raison d'être of this paper is to know if those factors affecting the money supply M0 which is the dependent variable has its significant relationship with those explanatory factors (CPI,

[1] http://lexicon.ft.com/Term?term=m0,-m1,-m2,-m3,-m4
[2] http://en.wikipedia.org/wiki/Money_supply

GDP, Government Debt, External Debt, Inflation Rate, Employment Rate, Interest Rate, Bank Lending Rate, Import and Export annual Growth , Government Expenditure and Stock Market). The researchers would like also to find out the trends or behavior of the corresponding data.

This chapter reveals the status of knowledgeability of the researcher. The knowledge investigator presents sufficient background for the problem in the form of well-tied pertinent fact. According to Ahmed, to explore the short-run direction of causality between GDP, MS and CPI, Granger Causality test has been applied and in order to investigate the existence of long-run relationship, co-integration analysis has been employed which is actually discussed on "The Long-run Relationship Between Money Supply, Real GDP, and Price Level: Empirical Evidence from Sudan".

Other studies also have explained the hinted hiked in interest rates following the US Federal Reserve's decision of the Bangko Sentral ng Pilipinas. Montecillo posted it at the business.inquirer.net. According to this, the Philippine central bank has hinted at a hike in benchmark interest rates following the US Federal Reserve's decision to further reduce its monetary stimulus for the world's largest economy.

The article discuss about the hinted hiked in interest rates following the US Federal Reserve's decision of the Bangko Sentral ng Pilipinas in accordance to the world's largest economy. The Governor of the Bangko Sentral ng Pilipinas, Amando M. Tetangco Jr. said that the adjustment in the current policy will help businesses plan better. This will give external developments including heightened geopolitical risks that could result in volatility in international commodity price, even though the existence in domestic inflation. The possible interest rate adjustment will be decided by the monetary board, for it must be mindful of the consumer's price movements to remain with the target for the rest of the year. He noted that

the recovery of the US economy would help lift the global growth benefiting countries like the Philippines.

There is also a study on how fixed interest rate affects money supply and the demand. It is said that interest rates are an important part of the economic market; monetary policy is usually the driving force behind interest rates. A nation's central bank or Federal Reserve System may set fixed interest rates. Monetary policy determines how much money should be in the economic market by setting or adjusting national interest rates. In this article, the author discusses how the interest rate affects the Money Supply and Demand. The fixed interest rate is a key piece of a nation's monetary policy. The goal is to reach the equilibrium point where individuals and businesses are willing to borrow money from banks offering a set interest rate. Setting the fixed rate too high may reduce demand for bank loans, since consumers are unwilling to pay a large interest amount on loans.

The methodology used to determine the significant relationship between the selected explanatory variables is regression analysis such as the ordinary least squares (OLS) regression and other tests assumptions.

2. Methodology

This chapter describes the data and methods used in this study to come up with the factors affecting the money supply (M0) and estimate the probability that the given independent variables have its significant relationship to the dependent variable which is the money supply (M0).

Ordinary Least Squares (OLS Regression)

In statistics, ordinary least squares (OLS) or linear least squares is a method for estimating the unknown parameters in a linear regression model, with the goal of minimizing the differences between the observed responses in some

arbitrary dataset and the responses predicted by the linear approximation of the data (visually this is seen as the sum of the vertical distances between each data point in the set and the corresponding point on the regression line - the smaller the differences, the better the model fits the data). The resulting estimator can be expressed by a simple formula, especially in the case of a single regressor on the right-hand side.[3]

2.1 Data Gathering Procedure

In this study, all of the data needed by the researchers were obtained from the site www.tradingeconomics.com and IECONOMICS. The data collected are from the data about Philippines from 1987 to 2012. These consist of the CPI, GDP, Interest Rate, Bank Lending Rate, Employment Rate, Import and Export annual growth, Government Debt, External Debt, Inflation Rate and Government expenditure which are the factors of the Money Supply (M0).

To know if there is a significant relationship between the given independent variables and dependent variable, the behavior or trends of each must be observed. Thereafter, the data must be organized to fit in the statistical package used which is the EViews or Econometric Views. This tool provides sophisticated data analysis, regression, and forecasting tools on computers which can quickly develop a statistical relation from the data and then use the relation to forecast future values of the data.

2.*2 Normality Test*

Normality tests are used to determine if a data set is well-modelled by a normal distribution and to compute how likely it is for a random variable underlying the data set to be normally distributed.[4] The assumptions of this test are:

[3] http://en.wikipedia.org/wiki/Ordinary_least_squares
[4] http://en.wikipedia.org/wiki/Normality_test

1. Data is continuous.
2. Variables are normally distributed.
3. With multivariate statistics, the assumption is that the combination of variables follows a multivariate normal distribution.
4. When a variable is not normally distributed, we can create a transformed variable and test it for normality. If the transformed variable is normally distributed, we can substitute it in our analysis. Three common transformations are: the logarithmic transformation, the square root transformation, and the inverse transformation.

2.2.1 Jarque-Bera Test. The Jarque-Bera test is used to check hypothesis about the fact that a given sample xs is a sample of normal random variable with unknown mean and dispersion. As a rule, this test is applied before using methods of parametric statistics which require distribution normality. Skewness and kurtosis is used for constructing this test statistic. JB (1981) tests whether the coefficients of skewness and excess kurtosis are jointly 0.[5]

$$\beta_1 = \frac{E\left(a_t^3\right)}{\left[E\left(a_t^2\right)\right]^{3/2}} = skewness$$

$$\beta_2 = \frac{E\left(a_t^4\right)}{\left[E\left(a_t^2\right)\right]^2} = kurtosis$$

2.3 Regression

In statistics, regression analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables.[6] The following are assumptions:

1. Variables are normally distributed.

[5] http://www.alglib.net/hypothesistesting/jarqueberatest.php
[6] http://en.wikipedia.org/wiki/Regression_analysis

2. A linear relationship between the independent variables and dependent variable.
3. Variables are measured without error.
4. Assumption of Homoskedasticity if errors have constant variance and Heteroskedasticity if non-constant variance.

2.3.1 Heteroscedasticity/Heteroskedasticity.

This refers to the circumstance in which the variability of a variable is unequal across the range of values of a second variable that predicts it. It is a violation of the constant error variance assumption. It occurs if different observations' errors have different variances. The MODEL procedure now provides two tests for heteroscedasticity of the errors: White's test and the modified Breusch-Pagan test. Both White's test and the Breusch-Pagan are based on the residuals of the fitted model. For systems of equations, these tests are computed separately for the residuals of each equation. The residuals of estimation are used to investigate the heteroscedasticity of the true disturbances.

WHITE option tests the null hypothesis:

$$H_0 : \sigma_i^2 = \sigma^2 \quad \text{for all i}$$

2.4 Durbin-Watson Test

It is a test that the residuals from a linear regression or multiple regression are independent. Because most regression problems involving time series data exhibit positive autocorrelation, the hypotheses usually considered in the Durbin-Watson test are:[7]

$$H0 : \rho = 0 \; H1 : \rho > 0; \; H0 : \rho = 0 \; H1 : \rho > 0$$

[7]http://www.math.nsysu.edu.tw/~lomn/homepage/class/92/DurbinWatsonTest.pdf

2.5 Ramsey RESET Test

In statistics, the Ramsey Regression Equation Specification Error Test (RESET) test is a general specification test for the linear regression model. More specifically, it tests whether non-linear combinations of the fitted values help explain the response variable. The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, the model is mis-specified.[8]

2.6 Multicollinearity Test

In statistics, multicollinearity (also collinearity) is a phenomenon in which two or more predictor variables in a multiple regression model are highly correlated, meaning that one can be linearly predicted from the others with a non-trivial degree of accuracy. In this situation, the coefficient estimates of the multiple regressions may change erratically in response to small changes in the model or the data. Multicollinearity does not reduce the predictive power or reliability of the model as a whole, at least within the sample data set; it only affects calculations regarding individual predictors. That is, a multiple regression model with correlated predictors can indicate how well the entire bundle of predictors predicts the outcome variable, but it may not give valid results about any individual predictor, or about which predictors are redundant with respect to others.[9]

2.7 Chow Breakpoint Test

The Chow test is a statistical and econometric test of whether the coefficients in two linear regressions on different data sets are equal. In econometrics, the Chow test is most commonly used in time series analysis to test for the presence of a structural break. In program evaluation, the Chow test is

[8] http://en.wikipedia.org/wiki/Ramsey_RESET_test
[9] http://en.wikipedia.org/wiki/Multicollinearity

often used to determine whether the independent variables have different impacts on different subgroups of the population.[10]

2.8 Outliers

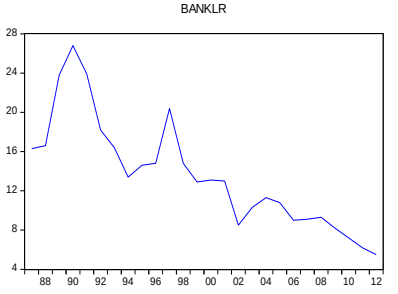
It is an observation with large residual whose dependent-variable value is unusual given its values on the predictor variables. This may indicate a sample peculiarity or may indicate a data entry error or other problem.

3. Results and Discussion

3.1 Trends/Behaviors of Bank Lending Rate, Employment Rate, Government Debt, Foreign Exchange, Inflation Rate, Gross Domestic Product, Government Spending, Interbank Rate, Interest Rate, Philippine External Debt, Philippine Import and Philippine Stock Market

Figure 1. Bank Lending Rate of the Philippines from 1987-2012

Figure 1 shows the trend of the bank lending rate in the Philippines from 1987 to 2012. From the figure, we can see that the bank lending rate is unstable. The graph is increasing from 1987 to 1990 with 16.3 and 26.8 percent respectively; hence, it is decreasing from year 1991 to 1996 with 23.9 to 14.8 percent respectively. Thus, it continued to fluctuate from latter years.



[10] http://en.wikipedia.org/wiki/Chow_test

Figure 2. Employment Rate in the Philippines from 1987-2012

Figure 2 shows the trend of the employment rate in the Philippines from 1987 to2012. The graph shows that the employment rate is unstable. From the year 1987 to 2004 it drastically fall but recover in the year 2005 and shows a behavior upward sloping until the year 2012.

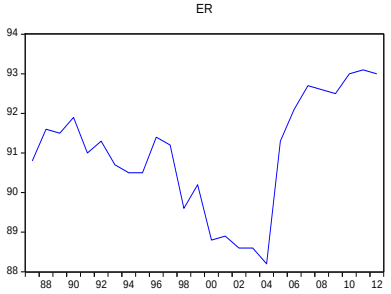


Figure 3. Government Debt of the Philippines in the year 1987-2012

Figure 3 shows the trend of Government Debt in the Philippines from year 1987 to 2012.

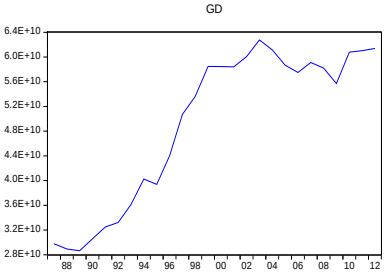


Figure 4. Foreign Exchange in the Philippines from 1987-2012

Figure 4 shows the trend of foreign exchange reserves in the Philippines from 1987 to 2012. As shown in the graph, the trend is increasing, there is only a little fluctuation from the year 1989 to 1991 and the rest of the latter years is increasing.

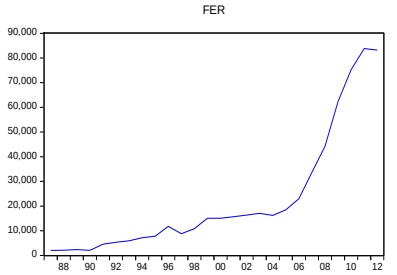


Figure 5. Inflation Rate of the Philippines from 1987-2012.

Figure 5 shows the trend of inflation rate in the Philippines in the year 1987 to 2012. As shown in the figure below, it is unstable and has ma y fluctuations wherein there is a large increase from 1987 to 1990 and corresponded by a decrease from 1998 to 2002.

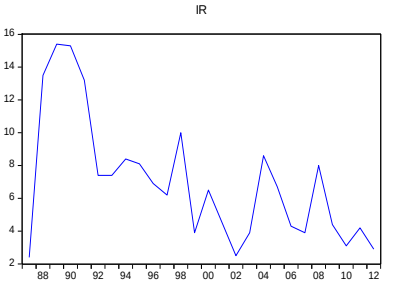


Figure 6. Gross Domestic Product of the Philippines from 1987-2012.

Figure 6 shows the behavior of gross domestic product (GDP) in the Philippines from 1987 to 2012. The figure shows an increasing trend from the year 1990 to 1993, there is a decrease from 1002 to 951 Php Million.

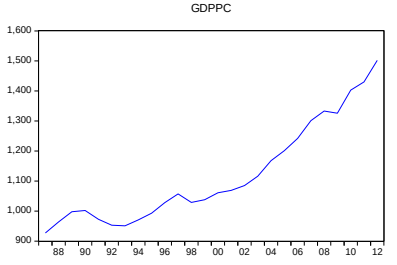


Figure 7. Government Spending of the Philippines from 1987-2012.

Figure 7 shows the trend of government spending in the Philippines from 1987 to 2013. The graph shows too many fluctuations. Starting from the year 1989 to 1992 there is a decrease in government spending with 91574 to 87261 Php Million.

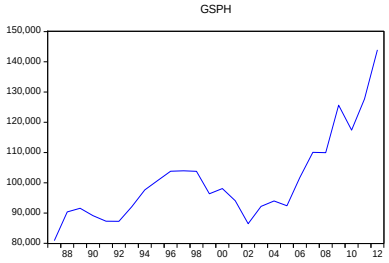


Figure 8. Interbank Rate of the Philippines from 1987-2012.

Figure 8. Shows the trend of interbank rate of the Philippines in the year 1987 to 2012. The graph is unstable since there are a lot of fluctuations. Starting from the year 1987 to 1989, there is a decrease with 22.5 to 10.3 percent. After that, it was followed by an increase to 36.2 percent and vice versa.

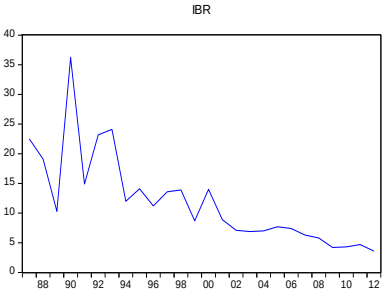


Figure 9. Interest Rates of the Philippines from 1987-2012.

Figure 9 shows the trend of interest rate of the Philippines in the year 1987 to 2012. The graph shows an unstable situation in the interest rate. From 1989 to 1990, there is a large increase

with 11.5 to 56.6 percent and followed by a decrease with only 14.6 percent in the year 1991.

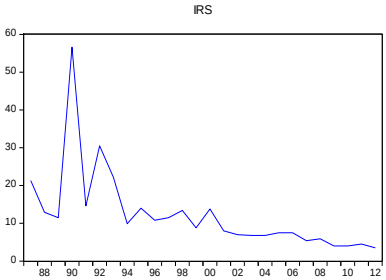


Figure 10. Philippine External Debt from 1987-2012.

Figure 10 shows that the trend of Philippine External Debt in the year 1987 to 2012 in general the graph is increasing notwithstanding the little fluctuation as shown in the graph.

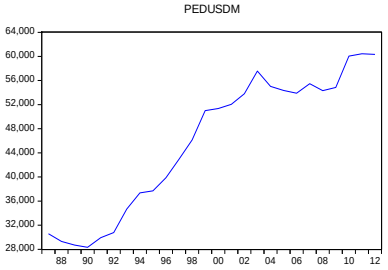


Figure 11. Philippine Import from 1987-2012

Figure 11 shows the trend of the Philippine Import from 1987 to 2012. The figure shows an increasing trend but there is a sudden fluctuation from 1997 to 1998.

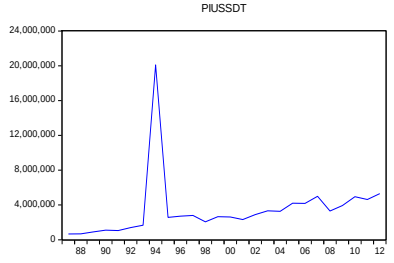


Figure 12. Philippine Stock Market from 1987-2012

Figure 12 shows the trend of Philippine Stock Market from 1987 to 2012 the figure has many fluctuations as shown below. It shows an unstable Philippine Stock Market in Philippine Economy.

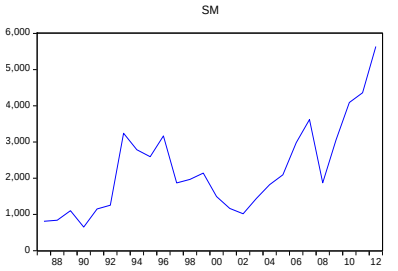
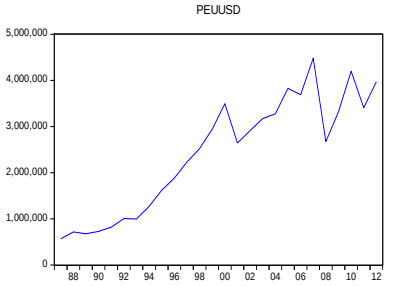


Figure 12. Philippine Export from 1987-2012

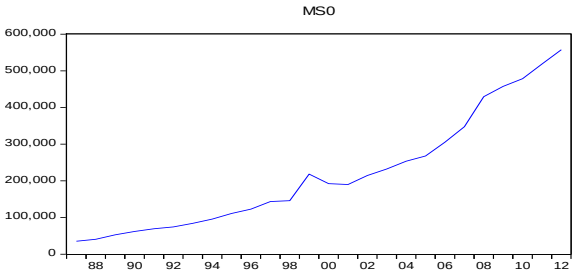
Figure 12 shows the trend of the Philippine Export from 1987 to 2012. The graph is increasing but in the year 2001 there is a decrease from 3496370 to 2645470 USSD Thousand.



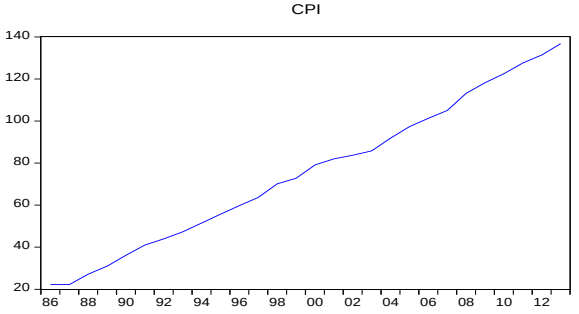
This Independent Variables composed of Government Debt, External Debt, Inflation Rate, Employment Rate, Interest Rate, Bank Lending Rate, Import and Export annual Growth, Government Expenditure and Stock Market does not have a significant relationship to our dependent variable which is the money supply (M0) because the probability of this independent variables is not less than the level of significance which is 0.05 and does not pass the different assumptions and test that this study used.

Independent Variables that have a SIGNIFICANT relationship with the Dependent Variable.

This study focuses on the data collected for trends and differences between independent variables such as Consumer Price Index (CPI), External Debt, and Gross Domestic Product in Billion Pesos. This chapter will also interpret the data for further statistical analysis regarding the effects of chosen predictors on Money Supply M1.

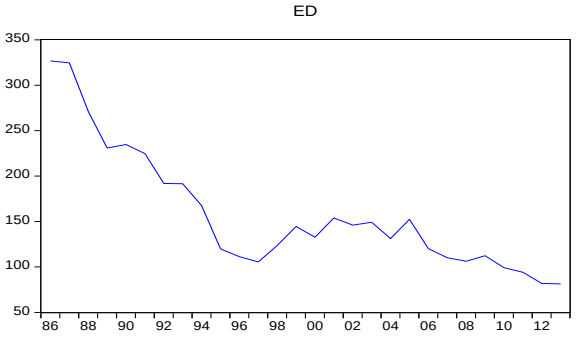


According to the graph, the trends of Money Supply (M1) in Php Million has increased from the year 1987-2012, but in the year of 1998 there are some fluctuations because of the Asian Financial Crisis that really affect the Philippines.

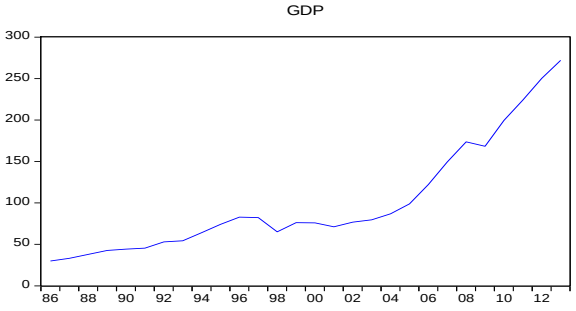


According to the graph, the lowest Consumer Price Index is in the year of 1986 and 1987 both measures 22.2 in index points. The highest Consumer Price Index is in the year of 2013 measures 136.8 in index points. As we can see as time goes by every year, the consumer price index increase together with the

increase of money supply indicating that they have a positive relationship.



According to the graph For External Debt of the Philippines, the highest debt of our country was on the year 1986 which is 326.7 (US Dollars Million) and the lowest debt was on the year 2013 which is 81.3 (US Dollars Million). As we can observe every year, the external debt become low except in the year 2009 because of fluctuation causes from the lag effect of Global Financial Crisis in 2007. Compare to the money supply, the external debt has a negative relationship.



As shown in the graph, the highest Gross Domestic Product was on the year of 2013 and lowest on the year 1986 which is 272 and 29.9 respectively. There are some fluctuations in the year 1998 because of the Asian Financial Crisis.

MODEL SPECIFICATION

LOG(MS0)^2 = C(1) + C(2)*LOG(CPI)/2 + C(3)*ED^2/2 + C(4)*GDP^2/2

Where:
MS0 = Money Supply (M0)
CPI= Consumer Price Index
ED= External Debt
GDP= Gross Domestic Product

MODEL ESTIMATION

LOG(MS0)^2 = -24.6575199324 + 77.8623735657*LOG(CPI)/2 + 0.000236023636677*ED^2/2 + 0.000348514184232*GDP^2/2

For every change of 77.86237 in the LOG(CPI)/2 shows that with the ED^2/2 and GDP^2/2 held constant/fixed, as the LOG(CPI)/2 decrease in 1 point, Money Supply (m1) LOG(MS0)^2 will increase 77.86237 in PHP Million Ceteris Paribus

The coefficient 0.000236 of ED^2/2 shows that with the LOG(CPI)/2 and GDP^2/2 constant/fixed, as the ED^2/2 increase 1 U.S Dollars (million), Money Supply (m1) LOG(MS0)^2 will increase 0.000236 in PHP Million.

The coefficient 0.000349 of GDP^2/2 shows that with the LOG(CPI)/2 and GDP^2/2 held constant/fixed, as the GDP^2/2 increase 1 PHP Billion, Money supply (m1) LOG(MS0)^2 will increase 0.000349 in PHP Million.

Lastly, as all explanatory variables LOG(CPI)/2, ED^2/2 & GDP^2/2) where held fixed at zero, LOG(MSO)^2 would be -24.65752 in PHP Million.

REGRESSION ANALYSIS

Dependent Variable: LOG(MS0)^2
Method: Least Squares
Date: 02/28/15 Time: 16:38

Sample: 1987 2012
Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-24.65752	9.379917	-2.628757	0.0153
LOG(CPI)/2	77.86237	4.161299	18.71107	0.0000
ED^2/2	0.000236	7.37E-05	3.201226	0.0041
GDP^2/2	0.000349	7.12E-05	4.896602	0.0001

R-squared	0.991259	Mean dependent var	144.9330
Adjusted R-squared	0.990067	S.D. dependent var	19.40436
S.E. of regression	1.933903	Akaike info criterion	4.297596
Sum squared resid	82.27961	Schwarz criterion	4.491149
Log likelihood	-51.86875	Hannan-Quinn criter.	4.353333
F-statistic	831.6393	Durbin-Watson stat	1.874113
Prob(F-statistic)	0.000000		

Summary of Findings

The researchers use e-views as a statistical software to determine the relationship of the variables. In a 25 included observation, in the regression analysis it shows that the dependent variable LOG(MS0)^2 (Money Supply M1) and independent variables such as LOG(CPI)/2 (Consumer Price Index), ED^2/2 (External Debt), and GDP^2/2 (Gross Domestic Product) has a significant relationships.

B_0 Constant:

Given the level of significance or alpha level which is 0.05 or 5% it is estimated that the average value of Money Supply -24.65752 in PHP Million, when the value of Consumer Price Index, External Debt and Gross Domestic Product is 0.

B_1 Consumer Price Index

Ho: There is no significant relationship between Money Supply and Consumer Price Index.

Ha: There is a significant relationship between Money Supply and Consumer Price Index

The Probability value of independent variable Consumer Price Index (LOG(CPI)/2) is 0.0000 which is the perfect probability that obviously less than the 0.05 or 5% alpha level or level of significance. Therefore, we reject the null hypothesis, hence, there is a significant relationship between Consumer Price Index (LOG(CPI)/2) and Money Supply (LOG(MS0)^2).

For every 1 index point increase in the Consumer Price Index (LOG(CPI)/2),coincide with the Money Supply (LOG(MS0)^2). will also increase at 77.86237 in PHP Million Ceteris Paribus.

B_2 External Debt

Ho: There is no significant relationship between Money Supply and External Debt.

Ha: There is a significant relationship between Money Supply and External Debt.

The Probability value of independent variable External Debt ED^2/2 is 0.0041 which is less than the 0.05 or 5% alpha level or level of significance. Therefore, we reject the null hypothesis, hence, there is a significant relationship between External Debt (ED^2/2) and Money Supply (LOG(MS0)^2).

For every 1 US Dollars Million increase in the External Debt (ED^2/2) coincide with the Money Supply (LOG(MS0)^2).will also increase at 0.000236 in PHP Million Ceteris Paribus.

B_3 Gross Domestic Product

Ho: There is no significant relationship between Money Supply and Gross Domestic Product.

Ha: There is a significant relationship between Money Supply and Gross Domestic Product

The Probability value of independent variable Gross Domestic Product GDP^2/2 is 0.0001 which is less than the 0.05 or 5% alpha level or level of significance. Therefore, we reject the null hypothesis, hence, there is a significant relationship between and Money Supply (LOG(MS0)^2).

For every 1 PHP Billion increase in the Gross Domestic Product GDP^2/2 coincide with the Money Supply (LOG(MS0)^2).will also increase at 0.000236 in PHP Million Ceteris Paribus.

Ho: ßi=0;All independent variables (Consumer Price Index, External Debt and Gross Domestic Product) are not predictors of dependent variable.(Money Supply M1).

Ha: ßi≠0; All independent variables (Consumer Price Index, External Debt and Gross Domestic Product) are predictors of dependent variable (Money Supply M1).

Where i = 0, 1, 2…k and k-1 is the number of regressors.

The Probability value of F-statistics is 0.000000 which is the perfect value of probability is greater than the 0.05 or 5% alpha level or level of significance., Therefore ,we reject the null hypothesis, and hence all independent variables (Consumer Price Index, External Debt and Gross Domestic Product) are predictors of dependent variable (Money Supply M1).

In interpreting goodness and fitness (R-squared), based on the computed R-squared which is 0.991259 or 99.12 % of the total variability of Money Supply is explained by the changes in the Consumer Price Index, External Debt and Gross Domestic Product.

Correlation Matrix Table

	MS0	CPI	ED	GDP
MS0	1.000000	0.967200	-0.725755	0.970230
CPI	0.967200	1.000000	-0.821953	0.905062
ED	-0.725755	-0.821953	1.000000	-0.708659
GDP	0.970230	0.905062	-0.708659	1.000000

Hypothesis

Ho: ρ =0 (There is no actual correlation)

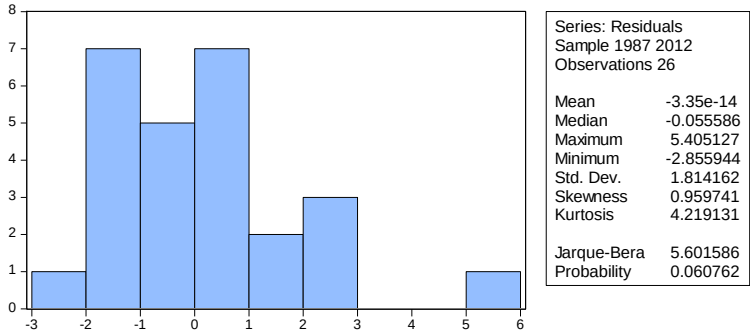
Ha: ρ ≠0 (There is a correlation)

According to the correlation matrix table, it shows that CPI has 0.967200 correlation coefficient and GDP has a 0.970230 correlation coefficient. Therefore, the CPI and GDP has a strong/linear positive relationship with the MS0, thus the variables move in the same direction when there is a positive correlation.

Whereas, the ED has a -0.725755 correlation coefficient. Therefore, the ED has a strong negative relationship with the MS0, thus the variables move in opposite directions when there is a negative correlation.

Therefore, because our independent variables are correlated with our dependent variable, we reject the null hypothesis.

Normality Test



Jarque-Bera	5.601586
Probability	0.060762

Hypothesis

Ho: ß > 0.05

Ho: Data follows normal distribution

HA: data does not follow normal distribution

The p-value is 0.060762 which is greater than the alpha or level of significance of 0.05. The Jarque-Bera test, on the other hand, shows that the JB Statistics is 5.601586 which is also greater than the level of significance whch is 0.05 or 5%. Thus, we failed to reject the null hypothesis (Ho) that the residual terms are normally distributed. Data follows normal Distribution.

Multicollinearity Test

Variance Inflation Factors
Date: 02/28/15 Time: 16:42
Sample: 1987 2012
Included observations: 26

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	87.98285	611.6484	NA
LOG(CPI)/2	17.31641	541.9564	7.282030
ED^2/2	5.44E-09	12.03376	4.895620
GDP^2/2	5.07E-09	3.714403	2.242409

Hypothesis

Ho: VIF<10 (There's no collinearity)

Ha: VIF>10 (There's collinearity)

The Variance Inflation Factors (VIF) is one way of finding if there is multicollinearity among independent or individual variables. If the VIF exceeds 10, then the variable is highly collinear; given the rule of thumb.

The table shows that the Variance Inflation Factors (VIF) of Consumer Price Index, External Debt, and Gross Domestic Product ranges has 7.282030, 4.895620 and 2.242409 respectively therefore it does not exceed 10 in the Centered VIF. Thus, the explanatory variables are not collinear and have

significant relationship with each other. Hence, we fail to reject the null hypothesis.

Durbin Watson Test

Durbin-Watson stat	1.874113

Hypothesis:

Ho: ρ = 0

Ha: ρ> 0

Durbin-Watson test is the most popular test in finding serial correlation. For 25 observations and 3 individual variables, with an alpha level of 0.05, Durbin-Watson Statistics of 1.874113 indicates that *d is greater than the du and dl having the values 1.408 and 0.906 respectively.* Therefore, we fail to reject the null hypothesis.

Ramsey RESET Test

Ramsey RESET Test
Equation: UNTITLED
Specification: LOG(MS0)^2 C LOG(CPI)/2 ED^2/2 GDP^2/2
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.792457	21	0.0875
F-statistic	3.212902	(1, 21)	0.0875
Likelihood ratio	3.701443	1	0.0544

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	10.91800	1	10.91800
Restricted SSR	82.27961	22	3.739982
Unrestricted SSR	71.36162	21	3.398172
Unrestricted SSR	71.36162	21	3.398172

LR test summary:

	Value	df
Restricted LogL	-51.86875	22
Unrestricted LogL	-50.01803	21

Unrestricted Test Equation:
Dependent Variable: LOG(MS0)^2
Method: Least Squares
Date: 02/28/15 Time: 16:44
Sample: 1987 2012
Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	191.2588	120.7896	1.583404	0.1283
LOG(CPI)/2	-96.09388	97.13008	-0.989332	0.3338
ED^2/2	-0.000503	0.000418	-1.202626	0.2425
GDP^2/2	-0.000823	0.000657	-1.252357	0.2242
FITTED^2	0.007883	0.004398	1.792457	0.0875

R-squared	0.992419	Mean dependent var	144.9330
Adjusted R-squared	0.990975	S.D. dependent var	19.40436
S.E. of regression	1.843413	Akaike info criterion	4.232156
Sum squared resid	71.36162	Schwarz criterion	4.474098
Log likelihood	-50.01803	Hannan-Quinn criter.	4.301826
F-statistic	687.2715	Durbin-Watson stat	2.208701
Prob(F-statistic)	0.000000		

Hypothesis

Ho: the correct specification is linear.

Ha: the correct specification is non-linear.

The result of the Ramsey RESET Test indicates that the model of the study is correctly specified for the reason that it's computed F-value 3.212902 with the degrees of freedom of (1,21) and its F-statistic probability value is 0.0875 which is greater than the level of significance or alpha level which is 0.05 or 5%. Therefore, we can conclude that there is a correct specification which is linear. Hence, we failed to reject the null hypothesis.

Heteroskedasticity Test: White

Heteroskedasticity Test: White

F-statistic	0.112165	Prob. F(3,22)	0.9521
Obs*R-squared	0.391686	Prob. Chi-Square(3)	0.9420

Scaled explained SS	0.451383	Prob. Chi-Square(3)	0.9294

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/28/15 Time: 16:43
Sample: 1987 2012
Included observations: 26

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.614999	10.68407	0.431951	0.6700
(LOG(CPI)/2)^2	-0.190868	2.274502	-0.083917	0.9339
(ED^2/2)^2	-1.27E-09	3.28E-09	-0.387967	0.7018
(GDP^2/2)^2	-1.77E-09	6.99E-09	-0.252674	0.8029

R-squared	0.015065	Mean dependent var	3.164600
Adjusted R-squared	-0.119244	S.D. dependent var	5.790351
S.E. of regression	6.125864	Akaike info criterion	6.603555
Sum squared resid	825.5766	Schwarz criterion	6.797108
Log likelihood	-81.84621	Hannan-Quinn criter.	6.659291
F-statistic	0.112165	Durbin-Watson stat	2.195647
Prob(F-statistic)	0.952065		

Hypothesis:

Ho: constant variance

Ha: non − constant variance

Ho: $\sigma_i^2 = \sigma^2$

Ha: $\sigma_i^2 \neq \sigma^2$

Given the value of Prob F value, which is 0.9521 that is greater than the 0.05 or 5% level of significance or alpha level. Therefore, we failed to reject the null hypothesis "the residual has no heteroskedasticity". Hence, the residuals are homoscedastic.

Chow Breakpoint Test

Chow Breakpoint Test: 1999

Null Hypothesis: No breaks at specified breakpoints

Varying regressors: All equation variables

Equation Sample: 1987 2012

F-statistic	2.786962	Prob. F(4,18)	0.0580
Log likelihood ratio	12.53224	Prob. Chi-Square(4)	0.0138
Wald Statistic	11.14785	Prob. Chi-Square(4)	0.0250

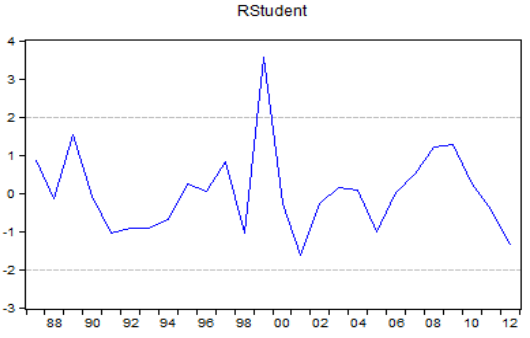
Hypothesis

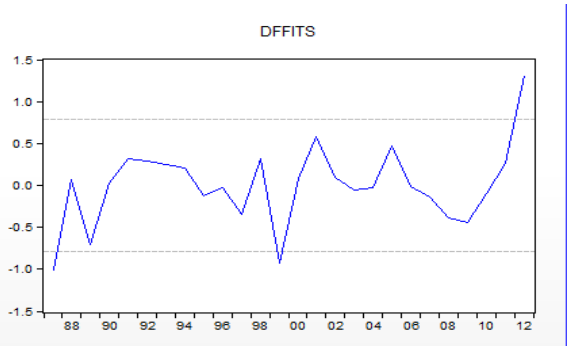
Ho: No breaks at specified breakpoints

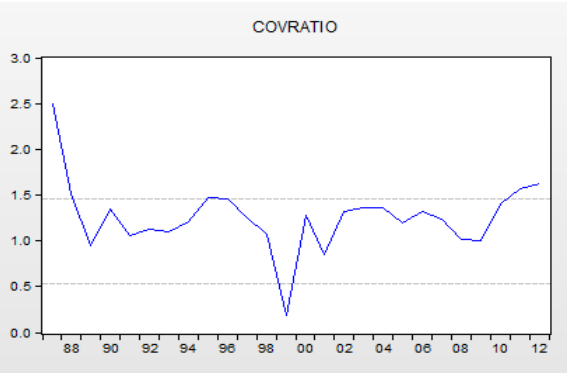
Ha: Have breaks at specified breakpoints

The Chow Breakpoint Test with the Probability of 0.0580 which is greater than the 0.05 or 5% level of significance with the degree of freedom of (4,18) indicating that the coefficients in two linear regressions on different data sets are equal. Therefore, we failed to reject the null hypothesis because there is no break at the year 1999.

Outliers Test





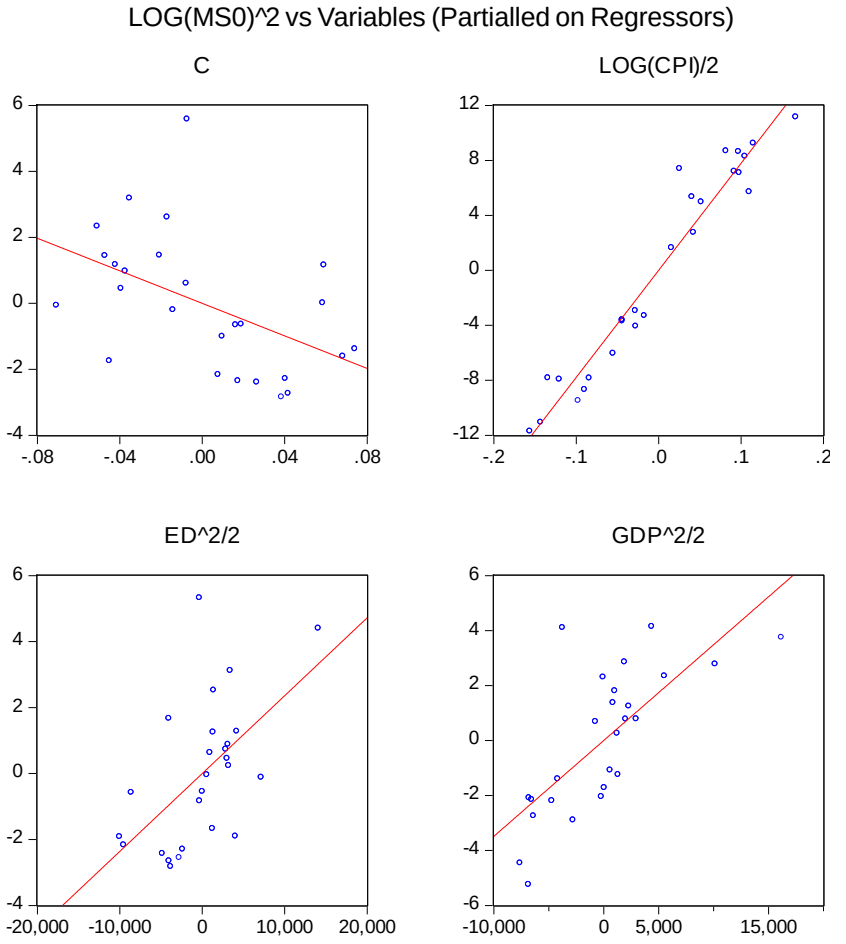


Influence Statistics
Date: 03/08/15 Time: 08:01
Sample: 1987 2012
Included observations: 26

Obs.	Resid.	RStudent	DFFITS	COVRATIO
1987	1.078391	0.854329	-1.002324	2.496857
1988	-0.253286	-0.143976	0.074080	1.517407
1989	2.619453	1.533916	-0.699883	0.951614
1990	-0.170710	-0.091148	0.031118	1.342780
1991	-1.965849	-1.063384	0.315210	1.062377
1992	-1.701239	-0.919729	0.292015	1.132197
1993	-1.738837	-0.928437	0.250808	1.100326
1994	-1.288534	-0.688588	0.211361	1.205397
1995	0.443104	0.249552	-0.122019	1.474915
1996	0.081459	0.045328	-0.020921	1.460557
1997	1.454065	0.810817	-0.345250	1.257845
1998	-1.922664	-1.042219	0.320671	1.077674
1999	5.405127	3.577733	-0.922892	0.191422
2000	-0.550173	-0.289802	0.083384	1.283580
2001	-2.855944	-1.625021	0.578677	0.845085
2002	-0.521851	-0.278803	0.094225	1.322408
2003	0.282871	0.152071	-0.055067	1.356477
2004	0.135077	0.072468	-0.025869	1.356651
2005	-1.805335	-1.027520	0.469148	1.196285
2006	0.059537	0.031555	-0.010007	1.325411
2007	0.945713	0.498818	-0.138656	1.237869
2008	2.192081	1.201718	-0.383319	1.017094
2009	2.317353	1.286703	-0.445110	0.995582
2010	0.412535	0.226216	-0.094709	1.401935
2011	-0.760475	-0.448109	0.264166	1.562496
2012	-1.891872	-1.377461	1.310356	1.623407

Ho: There are no outliers in the data set
Ha There is at least one outlier in the data set

In our study the r- student value in the year 1999 is 3.577733 therefore it is greater than the -2 to +2 range of standardized outliers. Hence, we failed to reject the null hypothesis that there are no outliers in the data set.



Hypothesis:

Ho: There are no outliers in the data set
Ha There is at least one outlier in the data set

Conclusion

The purpose of econometrics is to prove the economic phenomena by presenting empirical evidence to support an existing theory. In economics, a theory exists explaining that macroeconomic variables are interdependent to each other on a certain level of degree. In this paper, the researchers are trying to test the level of various independent variables to a dependent variable by presenting it in a numerical context.

Through statistical model the researchers have had investigated the relationship between four key macroeconomic variables (i.e. Money Supply, Consumer Price Index (CPI), External Debt, and Gross Domestic Product) in the economy of the Philippines.

In this study, the researchers conclude that the several independent variables (Consumer Price Index (CPI), External Debt, and Gross Domestic Product) have a high significance level of relationship to the dependent variable (Money Supply) having a prob (F-Statistics) of lower than 0.05 and an R-Squared of 99.12 %. These variables could be predictors of the money supply. Consequently, the certain changes in these predictors could influence the behavior of money supply.

Recommendation

After a thorough study regarding the factors affecting the money supply and based on the statistical results that the researchers have conducted, this study is recommended primarily to the Bangko Sentral ng Pilipinas, market institutions and students.

Having the power to control over price, the researchers suggests that market institutions must properly regulate prices of the goods since these prices have a high influence/effect to the economy's money supply(m0).

This study is also recommended to the students that will have their own study regarding or may be related with this study for better understanding of some factors (the CPI, GDP and External Debt) that may affect the money supply(m0).

This study is still open for rectification and improvement. It could be recommended to the future researchers in conducting a study correlated to this. This would serve as their basis and/or their guide.

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