An Analysis on the Unemployment Rate in the Philippines: A Time Series Data Approach

J D Urrutia¹, R L Tampis² and JB E Atienza³

¹Director, Intellectual Property Management Office
Chief, Center for Statistical Studies, Institute for Data and Statistical Analysis
Office of the Vice President for Research, Extension, Planning and Development
Polytechnic University of the Philippines – Sta. Mesa, Manila, Philippines
²Polytechnic University of the Philippines – Parañaque Campus, Philippines
³Department of Mathematics and Statistics, College of Science
Polytechnic University of the Philippines – Sta. Mesa Manila, Philippines

E-mail: jackieurrutia20@gmail.com, math_urrutia@yahoo.com.ph, jdurrutia@pup.edu.ph, razzcelletampis@gmail.com, jackyboyatiena@gmail.com

Abstract. This study aims to formulate a mathematical model for forecasting and estimating unemployment rate in the Philippines. Also, factors which can predict the unemployment is to be determined among the considered variables namely Labor Force Rate, Population, Inflation Rate, Gross Domestic Product, and Gross National Income. Granger-causal relationship and integration among the dependent and independent variables are also examined using Pairwise Granger-causality test and Johansen Cointegration Test. The data used were acquired from the Philippine Statistics Authority, National Statistics Office, and Bangko Sentral ng Pilipinas. Following the Box-Jenkins method, the formulated model for forecasting the unemployment rate is SARIMA (6, 1, 5) x (0, 1, 1)₄ with a coefficient of determination of 0.79. The actual values are 99 percent identical to the predicted values obtained through the model, and are 72 percent closely relative to the forecasted ones. According to the results of the regression analysis, Labor Force Rate and Population are the significant factors of unemployment rate. Among the independent variables, Population, GDP, and GNI showed to have a granger-causal relationship with unemployment. It is also found that there are at least four cointegrating relations between the dependent and independent variables.

1. Introduction
In a country with almost a 100 million people living in it like the Philippines, having a 9.1 million unemployed citizens is a huge problem. According to the latest Social Weather Stations (SWS) survey, 21.4 percent of the population declares themselves as unemployed. The unemployed Filipinos are considered unemployed based on two criteria, either they don’t have a job, or they are currently looking for a job, except for housewives, students, retired workers and disabled person who are considered to be not part of the labor force [1].

Despite of the fact that employment in the Philippines has been growing fast for the past decade, still, many Filipinos are jobless. Employment growth rate was recorded to be almost 50 percent at the beginning of the twentieth century mainly on industrial, agricultural and services sectors. However, as
2000 enters, the country’s population was quickly rising as it reached 76 million. It proves that employment growth is not enough to decrease the number of unemployed due to the rapid growth in population, a rise in the labor force participation, and the slow formation of jobs [2].

The country's uneven employment market has traditionally led millions of Filipinos to seek better-paying jobs overseas. As year 2000 enters, overseas Filipino workers almost reached 2.9 million, about nine percent of the labor force [2]. One out of every ten Filipinos works abroad, sending billions of dollars in remittances home, helping to drive the country's consumption-driven domestic economy — but doing little to promote employment [3]. The Philippines has long been a labor exporting market. About 2,500 Filipinos leave the country on a daily basis to seek for greater opportunities abroad and to provide better for the needs of the family [4].

This study aims to generate a mathematical model that can project the future values of unemployment rate in the Philippines from 2015 to 2020 on a quarterly basis. Aside from the model, factors which relatively affect the Unemployment Rate are to be determined among the considered variables, namely Labor Force Rate, Population, Inflation Rate, Gross Domestic Product (GDP), and Gross National Income (GNI). The relationship between the dependent and independent variables are also to be identified, whether they affect each other, or have a long run relationship, or a linear one. This paper aids to provide insights and information regarding the condition of the unemployment rate in the Philippines to be able to suggest preventive measures in solving the unemployment in the country.

1.1. Research Paradigm
A research paradigm was charted by the researchers with the intention of attaining the purpose of the study by following a set of procedures. The research paradigm includes the inputs used in conducting the study, the process or method applied, and the expected outputs.

Using the quarterly data of the dependent and independent variables, the researchers aim to construct a mathematical model while following the Box-Jenkins methodology. Furthermore, the relationships of the dependent and independent variables, whether causal, cointegration, or linear, are to be identified using several statistical tests.

1.2. Statement of the Problem
So as to meet the objective of the study, the researchers intend to answer the following question which specifically leads to the formulation of the model in forecasting the unemployment rate in the Philippines.

1. What is the trend of the variables starting from the first quarter of 1988 to the fourth quarter of 2014?
   a. Unemployment Rate (y)
   b. Labor Force Rate (x₁)
   c. Population (x₂)
   d. Inflation Rate (x₃)
2. Is there a significant relationship between the dependent and independent variables by means of Pearson correlation?

3. Which among the five independent variables can actually influence the dependent variable using Stepwise Multiple Linear Regression?

4. What is the mathematical model in projecting the unemployment rate of the Philippines generated through Box-Jenkins method?

5. Are the actual values of unemployment rate obtained from BSP, and the predicted ones obtained using the formulated model different from each other?

6. Is there a long run relationship between the dependent and independent variables using Johansen Cointegration test?

7. Can the independent variables affect the dependent variable by means of Pairwise Granger Causality test?

1.3. Scope and Limitations

The study covers the data of the dependent and independent variables starting from the first quarter of 1988 to the fourth quarter of 2014. There are six variables involved in the study namely Unemployment Rate, Labor Force Rate, Population, Inflation Rate, GDP, and GNI. These were obtained in three different institutions: the Philippine Statistics Authority (PSA), National Statistics Office (NSO), and the Bangko Sentral ng Pilipinas (BSP).

2. Methodology

This chapter presents the statistical treatments used by the researchers to be able to come up with the expected outputs. Moreover,

2.1. Multiple Linear Regression

Multiple linear regression is applied to determine which among the five given independent variables can influence the unemployment rate in the country. The model created expresses the value of the unemployment rate as a linear function of the five predictor variables and an error term which is written in a general form of [5]:

\[ y_i = b_0 + b_1 x_{i1} + b_2 x_{i2} + \ldots + b_k x_{ik} + e_i \]  

(1)

where \( y_i \) is the predictand in year \( i \), \( b_0 \) is the regression coefficient, \( b_k \) is the coefficient on the \( k^{th} \) predictor, \( x_{ik} \) is the value of \( k^{th} \) predictor in year \( i \), \( e_i \) is the error term, and \( k \) is the total number of predictors.

2.2. Johansen Cointegration Test

The Johansen cointegration test is seen as a multivariate generalization of the augmented Dickey-Fuller test. The generalization is the examination of linear combinations of variables for unit roots. The Johansen test and estimation strategy – maximum likelihood – makes it possible to estimate all cointegrating vectors when there are more than two variables. The Johansen cointegration test provides estimates of all cointegrating vectors [6]. The researchers applied this statistical test to the data to determine if there exist a long run relationship between the unemployment rate and independent variables.

2.3. Pairwise Granger Causality Test

Granger causality test examines whether the independent variables presented affects the unemployment rate. The idea of Granger causality test is that an independent variable which Granger-causes the dependent variable can be better predicted using the histories of both variables than using the history of the dependent variable alone. In this paper, the researchers examined whether the six
presented independent variables (labor force rate, population, inflation rate, GDP, GNI) have a causal relationship with unemployment. This is done to better analyze the unemployment rate and determine the reasons behind its fluctuating trend. Granger causality can be assessed by regressing the function:

\[ Y_t = \sum_{j=1}^{m} \alpha_j Y_{t-j} + \sum_{i=1}^{m} \beta_i X_{t-i} + D_t + \epsilon_t \]  

where \( D_t \) are the deterministics, \( \epsilon_t \) is the random error term, \( \alpha_j \) is the coefficient on the lagged \( y \) values, and \( \beta_i \) is the coefficient on the lagged \( x \) values [7].

### 2.4. Seasonal Autoregressive Integrated Moving Average (SARIMA)

The researchers used Seasonal Autoregressive Integrated Moving Average (SARIMA) in forecasting the Unemployment Rate for the next six years starting from 2015 to 2020. SARIMA is used when seasonal behavior is present in the time series. The seasonal ARIMA model incorporates both non-seasonal and seasonal factors in a multiplicative model. One shorthand notation for the model is ARIMA \((p, d, q) \times (P, D, Q)\) where \( p \) is the non-seasonal autoregressive (AR) terms, \( d \) is the non-seasonal differencing, \( q \) is the non-seasonal moving average (MA) terms, \( P \) is the seasonal AR terms, \( D \) is the seasonal differencing, \( Q \) is the seasonal MA terms, and \( s \) is the time span of repeating seasonal pattern. The general model is written formally as:

\[ \Phi(B) \phi(B)(x_i - \mu) = \Theta(B) \theta(B) \omega_i \]

where \( \phi(B) \) is the non-seasonal autoregressive terms, \( \theta(B) \) is the non-seasonal moving average terms, \( \Phi(B^s) \) is the seasonal AR terms, \( \Theta(B^s) \) is the seasonal MA terms [8].

### 2.5. Box-Jenkins Methodology

Box-Jenkins Analysis refers to a systematic method of identifying, fitting, checking, and using autoregressive integrated, moving average (ARIMA) time series models [9]. Box-Jenkins method follows a set of procedures in formulating the model [10]:

1. Model Identification – involves determining the order of the model required \((p, d, q)\) in order to capture the salient dynamic features of the data. This mainly leads to use graphical procedures such as plotting the series, the autocorrelation function, and the partial ACF.
2. Model Estimation and Selection – involves estimation of the parameters of the different models identified and proceeds to a first selection of models using information criteria.
3. Model Checking – involves determining whether the model specified and estimated is adequate. Notably, residuals undergo diagnostic tests.

#### 2.5.1. Augmented-Dickey Fuller Test

A Dickey-Fuller test is an econometric test for whether a certain kind of time series data has an autoregressive unit root, and has a general form of [11]:

\[ y_t = \alpha + \rho y_{t-1} + \delta t + u_t \]  

where \( u_t \) is an independent and identically distributed zero-mean error term, \( \alpha \) is a constant term, \( \delta \) is the time trend, and \( y_t \) follows a unit root process. This unit root test is used to satisfy the assumption of stationarity in the data of unemployment rate. Before formulating the model, the data for unemployment rate have to be differenced to be able to satisfy the said condition.

#### 2.5.2. Correlogram

The plot of the autocorrelation function as a function of lag is also called the correlogram. Autocorrelation refers to the correlation of a time series with its own past and future values. An important guide to the persistence in a time series is given by the series of quantities called the sample autocorrelation coefficients, which measure the correlation between observations at different times. In this research, correlogram is used for the first step of Box-Jenkins methodology of
identifying seasonality within the time series data of unemployment rate. This also dictates what time series model to use in forecasting, whether ARIMA or SARIMA. It is given an equation of [12]:

\[
    r_k = \frac{\sum_{i=1}^{N-k} (y_i - \bar{y})(y_{i+k} - \bar{y})}{\sum_{i=1}^{N} (y_i - \bar{y})^2}
\]

where \( r_k \) is the autocorrelation coefficient at lag \( k \), \( i \) is the amount of observed periods, \( x_i \) is the observation in \( i \) period, \( \bar{y} \) is the mean.

2.5.3. Paired T-test. A paired t-test is used to compare two population means where you have two samples in which observations in one sample can be paired with observations in the other sample. The predicted values of the unemployment rate obtained using the formulated model was tested against its actual values using this test. This determines if there is a significant difference between the two and tells if the model is good enough to estimate the unemployment rate. The assumptions must be that the data are normally distributed, and the sample is randomly selected [13]. The t-statistics is obtained from the formula [14]:

\[
    t = \frac{\bar{u}}{s^2 / n}
\]

where \( \bar{u} \) is the mean difference, \( s^2 \) is the sample variance, \( n \) is the sample size, and \( t \) is a student t-quantile with \( n - 1 \) degrees of freedom.

3. Results and Discussion
This section provides the interpretation of data and analysis of the results.

3.1. Trend of the Variables
Within the span of 26 years, the six variables shows fluctuating trends, either upward or downward trend with seasonal patterns because of some reasons.

![Graph of the unemployment rate.](image)

3.1.1. Unemployment rate. For the past 26 years, unemployment rate reveals a downward trend with seasonal patterns with a major fall between the years 2005 to 2006. An all-time high of 5,002 persons, accounting for 15.9 person of the total unemployed population was recorded in the second quarter of 2004 brought about by 1.9 million new entrants that joined the labor force—including the seasonal influx of new graduates and vacationing students seeking work—that exceeded the 3.6 percent or 1.1 million employment generated during the quarter 2004. This was also due partly to the slump in
employment in the agriculture sector and the rise in underemployment rate. The lowest unemployment rate was noted in the fourth quarter of 2014 with 2,482 persons unemployed or six percent because of the millions of jobs created within that year [15].

![Graph of the labor force rate.](image)

**Figure 3.** Graph of the labor force rate.

### 3.1.2. Labor force rate.

Labor force participation rate is the proportion of the population ages 15 and older that is economically active which includes all people who supply labor for the production of goods and services during a specified period [16]. The movement of the labor force rate continues to decline with the unemployment from 1988 to 2014. On the second quarter of 1991, it reached its peak of 71.4 percent and on the fourth quarter of 2007, a record low of 63.2 percent was noted. These fluctuations were caused by the ageing of the population, cyclical effects of the Great Recession, and an unexplained portion, which might be due to pre-existing trends unrelated to the first two [17].

![Graph of the population.](image)

**Figure 4.** Graph of the population.

### 3.1.3. Population.

For almost three decades, the Philippines has emerged into a country with a hundred million people living in it with continuous increase starting from 1988 to 2014. As of 2014, there is approximately 98 million Filipinos are living in the country, making the Philippines as the 12th most populated nations in the world. This rapid growth in population is caused by the unbalanced condition of the natality and mortality rate. Many are born, but only few dies. Natality rate continues to rise because of an increase in life span and lack of family planning [18].
3.1.4. Inflation rate. Inflation rate reveals to have a decreasing pattern with fluctuations from the year 1988 to 2014. The country experienced an inflation rate of 19.77 percent in the third quarter of 1991 due to economic contraction in the early 1990s, which was caused by underlying macroeconomic imbalances, compounded by supply bottlenecks, natural disasters, political instability, a global recession and the Persian Gulf crisis of 1990 to 1991. It was the rebounded in the third quarter of 2009 having the lowest rate record of 2.07 % during the recovery stage of the Philippines after being hit by the Asian Financial Crisis on 2008 [19].

3.1.5. Gross Domestic Product. Gross Domestic Product exhibits an elevating trend fluctuating seasonally from 1988 to 2014. The Philippines’ growing middle class, strong domestic demand, and stable political environment emphasize job creation and inclusive economic growth. Under the administration of President Benigno Aquino, the Philippines implemented reforms to improve the investment climate, making strides in good governance, transparency, and accountability. This result to the continuous rise of GDP, placing the country behind China, which had the fastest economic growth for the year at 7.4 percent, with a record of 6.1 percent in 2014 [19].
3.1.6. Gross National Income. Gross National Income exhibits an escalating trend with seasonal patterns for the past 26 years which identical movements with GDP. The government of President Corazon Aquino, embarked on a stabilization program aimed at preventing an upsurge in inflation, controlling the fiscal deficit and improving the external current account position. The economy responded favourably to these measures, posting increases in GNI, investments, private consumption and imports. Successive administrations also intervened in domestic economic affairs by imposing quantitative trade barriers, price controls and subsidies. Initially, the economy grew rapidly, with GNI growing largely due to increased exports and Government investments [19].

3.2. Significant Relationship between Dependent and Independent Variables
To be able to determine the significant relationship between the dependent and independent variables, Pearson correlation was used. The scatterplot diagram was also ascertained to show the linear relationship between the two types of variables.

Table 1. Correlation table.

|                          | Pearson r | p-value |
|--------------------------|-----------|---------|
| Labor Force Rate (x₁)    | 0.830     | 0.000   |
| Population (x₂)          | -0.381    | 0.000   |
| Inflation Rate (x₃)      | 0.131     | 0.178   |
| GDP (x₄)                 | -0.488    | 0.000   |
| GNI (x₅)                 | 0.480     | 0.000   |

Table 1 shows that among the five independent variables, only Inflation Rate reveals to have no significant relationship with the dependent variable having a p-value of 0.178 which is greater than the level of significance of 0.01 accepting the null hypothesis (there is no significant relationship between the dependent and independent variable). Conversely, Population and GDP reveals to have a weak negative correlation with Unemployment Rate based on their Pearson coefficient of determination, but shown to have a significant linear relationship with the dependent variable.
Figure 8. Scatterplot diagram between the dependent and independent variables.

Figure 3 shows the scatterplot diagram revealing the linear relationship between the dependent and independent variables. It can be seen that Population, GDP and GNI have downward trends indicating an inverse relationship with unemployment, while Labor Force Rate and Inflation Rate indicates a direct relationship since the regression line is inclined upward.

3.3. Significant Factors of Unemployment Rate

After conducting a multiple linear regression using the six variables with the Unemployment Rate as the dependent variable, the researchers were able to identify the significant factors of unemployment rate among the five independent variables considered.

| Table 2. Regression analysis. |
|-----------------------------|
| **p-value**                 |
| Labor Force Rate ($x_1$)    | 0.000 |
| Population ($x_2$)          | 0.004 |
| Inflation Rate ($x_3$)      | 0.571 |
| GDP ($x_4$)                 | 0.072 |
| GNI ($x_5$)                 | 0.474 |

Based on the results obtained, Labor Force Rate and Population revealed to be a significant factor that can actually influence the movement of Unemployment Rate with a p-value of 0.000 and 0.004 correspondingly, with 0.01 level of significance. Since the p-values are less than the level of significance, the null hypothesis was rejected concluding that the variables are significant factors of unemployment rate. This indicates that any movement in the two variables can affect the unemployment in the country. Any increase in the labor force rate and the population can cause the unemployment rate to rise. On the other side, the p-value of Inflation Rate, GDP, and GNI, which is
greater than 0.01, accepts the null hypothesis. Therefore, those three remaining variables does not influence unemployment rate.

3.4. Mathematical Model for Forecasting Unemployment Rate

3.4.1. Model identification. By examining the correlogram of the unemployment rate, it is found out that there exist seasonality in the time series, and it was non-stationary. So as to satisfy the assumptions of time series that the data must be stationary, the researchers conducted a regular differencing. To minimalize the errors, a logarithmic transformation was applied to the data series of unemployment rate, being stationary at the first regular differencing.

3.4.2. Model estimation. The formulated model was written in the form of SARIMA (6, 1, 5) x (0, 1, 1)4 which contains six non-seasonal AR terms and five non-seasonal MA terms with one regular differencing, and one seasonal MA term with one seasonal differencing, and a time span of repeating seasonal patterns of four as the data used is quarterly.

![Graph of the actual and forecasted values of unemployment rate.](image)

Using this model, the researchers are able to forecast the unemployment rate from 2016 to 2020 in a quarterly basis, and result shows that unemployment rate for the next five years ranges from six to eight percent. As shown in figure 5, unemployment is stable within the range of six to eight percent for the next five years. This indicates that the unemployment rate in the country will be constant for the following years.

3.4.3. Model checking. R-squared, Durbin-Watson statistics, Mean Absolute Error, and Akaike Information Criterion were considered in choosing the model that can forecast the unemployment rate accurately. The model reveals to have an r-squared of 0.787, a Durbin-Watson of 2.000, an MAE of 0.721, and an AIC of 3.048 indicating that the model is fitted to forecast the unemployment, that the errors are uncorrelated, that the values of the actual and forecasted unemployment rates are closely related, and that it is parsimonious. Furthermore, the residuals are normally distributed as stated by the result of the Jarque-Bera Test having a p-value of 0.01, and the Breusch-Pagan-Godfrey test reveals that the variances are equal with a p-value of 0.0510.

3.5. Predicted Values
Through the chosen model, the predicted values of unemployment rate was obtained. To test whether there is a difference between the actual and predicted values of the data series, the researchers used the Paired T-test.

| Model | p-value |
|-------|---------|
| Table 3. Paired t-test. |
|       |         |


Based on the results, it is found out that there is no significant difference between the two values having a p-value of 0.9942. This indicates that the model is actually good enough in estimating the unemployment rate since the actual and predicted values are 99 percent identical.

3.6. Cointegration between Dependent and Independent Variables
Using E-Views, the researchers determine whether there exist a long run relationship between the dependent and independent variables while applying the Johansen Cointegration Test, accounting the Trace Test and the Maximum Eigenvalue Test.

The test shows that there are four cointegrating equations rejecting the null hypothesis of no cointegration from ‘none’ until ‘at most 3’ cointegrating vectors with a p-value less than the level of significance of 0.05. This leads to a conclusion that there are at least four cointegrating relations between the dependent and independent variables. This means that there is a long run relationship between the unemployment rate and the dependent variables.

3.7. Granger-causality between Dependent and Independent Variables
By means of Pairwise Granger Causality test, the researchers identify which among the five independent variables Granger-cause the dependent variable.

| Table 4. Granger-causality. |
|-----------------------------|
| p-value                     |
| Labor Force Rate (x₁)       | 0.1654 |
| Population (x₂)             | 0.0321 |
| Inflation Rate (x₃)         | 0.7539 |
| GDP (x₄)                    | 0.0093 |
| GNI (x₅)                    | 0.0079 |

After conducting the test with the aid of E-Views, it is concluded that Population, GDP, and GNI have a Granger-causal relationship with the Unemployment Rate in the Philippines with a p-value of 0.0321, 0.0093, and 0.0079 correspondingly with a level of significance of 0.05 as shown in table 4. Population was also shown to be one of the significant factors of unemployment rate. This finding only means that the population has a great influence in the movements of the unemployment rate.

4. Conclusion
This paper aims to forecast the unemployment rate in the Philippines using a time series model. The formulated model for estimating and forecasting the unemployment rate in the Philippines is written as SARIMA (6, 1, 5) x (0, 1, 1)₄. Forecasted values are within the range of six to eight percent, and is found to be 72 percent closely relative to the actual values. Significant factors of unemployment rate are found to be Labor Force Rate and Population. Also, Population, GDP and GNI are shown to Granger-cause the dependent variable. These variables can affect the movement of the unemployment rate. Any increase on those variables can cause the unemployment rate to ascend or descend.

5. Recommendations
The government must find a way to maintain or reduce the unemployment rate in the Philippines. With over a hundred million people living in it, the government must prevent the rapid growth in the population since it is found that population affects the unemployment rate in the country, or better yet create millions of jobs enough to provide those unemployed a suitable occupation. The researchers suggest investigating on other factors that can affect unemployment rate, as well as adding more observations to the time series data for further studies.
References

[1] Flores H 2016 9.1 Million Pinoys remained Unemployed – SWS Retrieved from www.philstar.com/headlines/2016/02/9.1-million-pinoys-remain-unemployed-sws

[2] Brooks R 2002 Why is Unemployment High in the Philippines? Retrieved from www.unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN027367.pdf

[3] Salvosa F 2015 Philippine Struggles with Unemployment despite Economic Growth Retrieved from www.cnnbc.com/2015/09/01/unemployment-in-philippines.html

[4] Six Reasons why Philippines Jobless Rate is High 2009 Retrieved from www.pinoy-ofw.com/news/224-reasons-why-philippine-unemployment-rate-is-high.html

[5] Granger-causality testing within the Context of the Bivariate Analysis of Stationary Macroeconomic Time Series 2012 Retrieved from http://www.slideshare.net/ThomasReader/granger-causality-testing

[6] Seasonal ARIMA Models Retrieved from onlinecourses.science.psu.edu/stat510/node/67

[7] The Box-Jenkins Method Retrieved from www.researchgate.net/file.PostFileLoader.html?id=401442285922155

[8] Pelgrin F (2011) Box-Jenkins Methodology Retrieved from http://math.unice.fr/~frapetti/CorsoP/Chapitre_5_IMEA_1.pdf

[9] What’s Augmented Dickey-Fuller Test? Retrieved from http://economics.about.com/cs/economicsglossary/g/augmented.htm

[10] Autocorrelation Retrieved from www.ltrr.arizona.edu/~dmeko/notes_3.pdf

[11] Paired t-tests Retrieved from www.statsdirect.com/help/parametric_methods/paired_t.htm

[12] Paired t-test. Retrieved from data.worldbank.org/indicator/SL.TLF.CACT.ZS?display=map

[13] Braun S Coglianes J Furman J Stevenson B & Stock J 2014 Understanding the Decline in the Labor Force Participation Rate in the United States Retrieved from voxeu.org/article/decline-labour-force-participation-us

[14] Cheung A 2014 Rapid Population Growth: Its Causes and Effects on Health Retrieved from https://prezi.com/snbzjcf1yu8/rapid-population-growth-its-causes-and-effects-on-health/

[15] Philippine Economy Retrieved from www.globalsecurity.org/world/philippines/economy.htm