
| RESEARCH ARTICLE

An Empirical Analysis on the Determinants of Public Education Expenditure in the Philippines

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| ABSTRACT

Using time-series data from 1989 to 2018, this study examines the determinants of public education expenditure in the Philippines. Following Wagner's law, this paper investigated the relationship of gross domestic product per capita, unemployment rate, urban population growth, and lagged public education expenditure to public education expenditure. The ordinary least squares (OLS) method was used to determine the significance of the variables, and statistical tests were conducted to measure the overall significance of the model. The findings show that gross domestic product per capita and lagged public education expenditure were positively significant determinants contributing to the Philippines' growth of public education expenditure. On the other hand, the unemployment rate and urbanization growth were insignificant and did not contribute to the increase in expenditure. The results also provided strong evidence on the relationship between GDP per capita and public education expenditure, supporting Wagner's law in the Philippine context. Finally, this study recommends that policymakers review budget allocation and utilization to achieve wider education accessibility and better quality of education in the Philippines.

| KEYWORDS

Public education expenditure, Wagner's law, Philippine education system, Economic growth.

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1. Introduction

1.1. Background of the Study

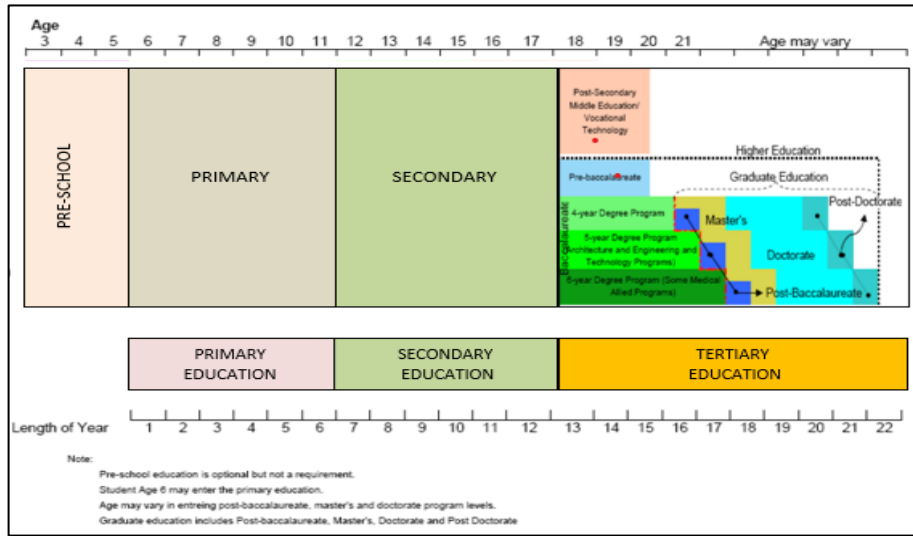
Public expenditure is an essential aspect of economic growth used to build public infrastructures, provide services and protection, and stimulate the economy. It is classified into different compositions – one of them is the spending on and provision of public education from pre-primary until tertiary level. As the population of the Philippines balloons, the government constantly aims to protect and promote the right of every Filipino to quality, equitable, culture-based, and complete primary education where: students learn in a child-friendly, gender-sensitive, safe, and motivating environment and teachers facilitate learning and constantly nurture every learner (DepEd, n.d.). A country that pushes and promotes an excellent educational system will become a stronger society and a more developed economy. Investing in education will also help build a more advanced human capital, boosting a country's economic growth. Researchers also agree that among the numerous benefits of a highly educated nation attributed to increasing education levels are improvements in life expectancy, decreasing participation in criminal activities, and better support to local, national, and global development. (Luy et al, 2019; Loncher and Moretti, 2004; Chankseliani et al, 2021).

The Philippines is a developing and middle-income country; however, it is still plagued with adversities in its educational quality and accessibility. Even with the increasing budget for education every year, the Philippines still sees high dropout rates and repeaters, low passing rates in national tests, insufficient numbers of schools and school facilities, and low salaries, among others (La Consolacion College - Bacolod, 2012). As the population grows, the number of people who cannot access their right to education also rises. This situation is seen in remote rural areas where resources are limited, the number of schools is few, and the physical distance of the schools from people is unbearable. Students in these places, especially children, cannot finish school due to such circumstances. The number of children accessing education, the quality of education they receive, and the condition of their learning environment is causes for concern (Toralba, 2016). To raise the quality and accessibility of education, the government

also needs to plan the budget allocation and utilization crucially. The continuous growth of public education expenditure does not equate to an improved education system in the Philippines; thus, the government needs to look at this and identify the problems besetting the students, teachers and faculties, communities, and the educational system in general.

In 2013, the Philippines, Angola, and Djibouti were the only countries that did not follow the K-12 curriculum. However, under former President Benigno Aquino, K-12 was enacted, Republic Act 10533. Since its implementation, the education system in the Philippines has been changed from the old 6-4-4 to the new 6-6-4 system. This, however, has received tons of backlash and critiques, especially from the public. Many have feared that two more years in secondary education will add to the financial burden of average income-earning Filipino families. Nevertheless, the Philippine Supreme Court has rejected the arguments and petitions seeking to delay the curriculum and allowed the country to go by the new education system.

Figure 1. Structure of Education System in the Philippines



Source: Commission on Higher Education (CHED)

K-12 implementation has led to an increase in public expenditure in the education sector by 18 percent from 2012 to 2013. The expenditure of 279,375 million pesos in 2012 rose to 330,181 million pesos in the year 2013 when K-12 began. Another big jump in the public education expenditure can be seen from 2015 to 2016 when senior high school started. From 453,013 million pesos in 2015, it increased by 22 percent to 551,097 million pesos in 2016. However, the rise in public education expenditure has not been a surprise anymore. In 1969, the public expenditure on education was the highest, with 987 million pesos – 27 percent of the total national spending. During 1985, the cost incurred by the education sector was 10,722 million pesos – 12 percent of the total public expenditure and the highest also during that time. Last 2018, the education sector increased spending to 760,226 million pesos, accounting for 20 percent of that year's total public expenditure. On the other hand, the most significant growth rate of public education expenditure thus far was from 2017-2018, with a 36 percent increase.

The efforts of the Philippine government to improve education can be seen through its public spending records, where the expenditure on the education sector rises every year. However, although the education sector has received the highest budget consecutively for the past recent years, the furtherance of the quality and accessibility of education does not seem to reflect.

1.2. Objectives of the Study

According to Sagarik (2012), the determinants of public policy are crucial as they provide essential information for a nation to achieve desirable outcomes. With the integration of Wagner’s law of increasing state activities and support from related studies, this paper aims to distinguish what factors determine the continuous growth of public education expenditure in the Philippines.

Further, this study aims to find answers to the following questions:

- What is the current status of education in the Philippines?
- What is the effect of GDP per capita, urban population growth, and unemployment rate on increasing public education expenditure?
- What policy recommendations can be formulated based on the study results that could help alleviate education problems in the Philippines?

1.3. Formulation of Hypotheses

This study considers the following hypotheses:

Hypothesis 1: Is there a significant relationship between GDP per capita and public education expenditure?

H0: There is no significant relationship between GDP per capita and public education expenditure.

Hypothesis 2: Is there a significant relationship between urban population growth and public education expenditure?

H0: There is no significant relationship between urban population growth and public education expenditure.

Hypothesis 3: Is there a significant relationship between the unemployment rate and public education expenditure?

H0: There is no significant relationship between the unemployment rate and public education expenditure.

1.4. Scope and Limitations

This paper is bounded by certain limitations—first, due to data availability, the data used for the public expenditure in the education sector was the amount spent only by the national government. The researchers excluded other sources of funds for consistency; hence, this does not fully capture the government size. Furthermore, it should be noted that the results may suffer from limited generalizability since the study could not cover earlier records of the demographic and economic variables used in the study.

1.5. Significance of the Study

This paper is undertaken to understand and clarify gaps in the current education provisions and policies and understand how the increasing public education budget does not address the problems in education, especially the lack of schools and school facilities in rural and remote places.

Since the problem in education affects millions of lives of Filipino people, the government and concerned organizations must double their actions to solve this. Thus, the results from this study could be of importance to the following:

To the Department of Education, Commission on Higher Education, and the Technical Education and Skills Development Authority, insights from this study can be helpful for education sector officials in formulating future policies or frameworks amid the pursuit of improving the system of education and widening the accessibility for all Filipino people.

To the Philippine government, findings from this study can aid in understanding how public education must be funded and make sure that the budget allocation and utilization are analyzed to secure the education of all, especially the youth in remote areas.

To Non-profit organizations and advocates of free education, the results of this study can give more incentives as to why it is crucial to push for broader and more accessible education in the Philippines.

Lastly, to future researchers, this study can give helpful information and additional motivation to pursue doing further research in the same field.

2. Review of Related Literature

2.1. Review of Related Literature

Many studies in the recent past have shown the advantage that a good foundation in education can bring to a country's economy. Many researchers have also proven the significant relationship between economic growth and public expenditure. Among notable theories that supported this is Keynes' theory of total spending (1936) and Wagner's Law of increasing State (1893), and Peacock and Wiseman's Hypothesis (1961)

2.1.1. Economic Growth on Public Expenditure

In a study conducted by Saleh et al. (2017), using the unit root test and cointegration method, results showed a long-run relationship between GDP, consumption, and investment expenditure. This study provides evidence on the validity of Wagner's law on the impact of economic growth on government spending in Sri Lanka.

Irandoust (2017) also evaluated Wagner's law using a sample of twelve OECD countries from 1995 to 2015. Using the bootstrap panel Granger causality approach, the results showed that GDP is a significant determinant of government expenditure in the long run in seven OECD countries. On the other hand, Nusair and Olson (2020) tested Wagner's law among six Gulf Cooperation Council (GCC) countries. Using linear Granger causality tests, the results showed that Wagner's law of increasing state activities applies in four GCC countries. The same results were gathered in the study conducted by Nirola and Sahu (2018). Using panel estimation methods, their results indicated that Wagner's law applies to the all-India level concerning all categories of government expenditure during India post-liberalization 1991.

Jalles (2019) also validated Wagner's law in a sample of 61 advanced and emerging market economies between 1995 and 2015. Findings from panel data analyses show that the positively significant relationship of economic growth and public spending seems more prevalent in advanced economies and when countries grow above potential. Thus, more economically developed countries have more public spending.

There is also a long-term relationship between government expenditure and economic growth in Indonesia. Confirming Wagner's hypothesis, the study results showed a causal relationship between government expenditure and economic growth in West Kalimantan between 2009 and 2015 (Kurniawati, 2018). Sekantsi and Molapo (2017) study validated Wagner's law in Lesotho from 1982 to 2013. They used the autoregressive distributed lag (ARDL) approach, cointegration, and an error correction model (ECM). The results indicated long-run and short-run relationships between Lesotho's national income and government spending.

Using panel data analysis, Sagdic et al. (2020) proved Wagner's law in some of Turkey's provinces from 1992 to 2013. The results of their study provide strong support for the validity of Wagner's law as variables showed a significant long-run relationship with each other. In a similar study, Wagner's theory proved true again in a time-series study over 1975 to 2014 for Turkey. Uzener et al. (2017), using the Johansen cointegration test and granger causality test, confirm a long-term relationship between the variables.

Wagner's law holds in the United Kingdom in a study conducted by Paparas et al. (2018). Applying unit root tests with structural breaks, cointegration techniques, and the Granger causality test indicated a long-run relationship between national income and government spending from 1850 to 2010. Estimation results from a study conducted by Abbasov and Aliyev (2018) also revealed the validity of Wagner's law in all selected post-Soviet countries (Estonia, Latvia, Lithuania, Uzbekistan, Azerbaijan, Georgia, Kyrgyz Republic, Moldova, and Ukraine) except Lithuania and Kyrgyz Republic in the short-run. Results revealed that real per capita GDP could determine real per capita government expenditures by employing the ARDL modeling approach.

2.1.2. GDP on Public Expenditure

Confirming Wagner's law, Kahran (2018) used a panel VAR approach to prove that economic growth positively correlates with public expenditures for Brazil, Russia, India, China, South Africa (BRICS), and Turkey in 1989-2019. Kahran suggested expansionary fiscal policies will not benefit economic growth in the short run and posited that the Keynesian perspective could be invalid in some countries. Tesarova (2020) also concluded in her study that there is a significant relationship between gross domestic product and public expenditures in nominal terms. Wagner's law holds for Visegrád Four countries (Czech Republic, Slovakia, Poland, and Hungary) as their GDPs determine the growth of their public expenditure.

GDP and labor force also positively correlate with public education expenditure in Iran, while the capital stock negatively affects the dependent variable. Tabar et al. (2017) found this after using bivariate and multivariate models on time-series data from 1981 to 2012. On the other hand, according to the study of Munir and Ali (2018), in analyzing an annual time series data of Pakistan from 1976 to 2015, Wagner's hypothesis exists from GDP to expenditure on current subsidies, expenditure on social, economic, and education services, defense expenditure, and current expenditure.

Kumar and Cao (2019) studied Wagner's law among East Asian countries (China, Hong Kong, Japan, and South Korea). They found out that there exists a weak cointegrating relationship between the log of nominal public expenditure as a share of nominal GDP to the log of real per capita GDP. However, it can still support Wagner's law when the relationship is extended to include the population structure.

Another study empirically examined the validity of Wagner's hypothesis for the Indian economy in pre (1967–1990) and post (1991–2015) reform period. Rani and Kumar (2020), using the ARDL model, found out that there is a long-run relationship between government expenditure and economic growth. The results showed strong evidence of Wagner's hypothesis during the post-reform period, while the elasticity of government expenditure to economic growth is low.

Time-series data for Nigeria spanning between 1970 and 2017 were analyzed using the ARDL model. The study's findings reveal that oil revenue, GDP, population, trade openness, oil price, taxation, and inflation are essential determinants of Nigeria's government expenditure size. Thus, proving Wagner's theory (Jibir & Aluthge, 2019).

Ghazy et al. (2020) also validated Wagner's law in Egypt through a time series data analysis from 1960-to 2018. Using Johansen's cointegration approach, results provided strong evidence of a long-term relationship between GDP and government expenditure. Moreover, the causal relationship is found to be bidirectional.

2.1.3. Unemployment Rate on Public Expenditure

Using fully modified ordinary least square (FMOLS) and dynamic ordinary least square (DOLS) on time-series data from the year 1997 to 2016 in Southern African Development Community (SADC) countries, Mhlari (2019) found out that unemployment has an inverse but significant impact on total educational expenditures. This means that increasing the workforce, which boosts economic growth, impacts the growth of public spending on education in SADC countries.

Yun and Yusoff (2018) used the ARDL bound testing approach to determine the determinants of public education expenditure in Malaysia in the period 1982-2016. Their results concluded that there exists between public education expenditure and its determinants: real gross domestic product, unemployment rate, inflation rate, and working-age population, in the long run in Malaysia. The unemployment rate is also a significant and indirect determinant of public expenditure in a study conducted by Mohammad Alawneh (2021). One of his recommendations is for the Jordan government to increase government spending to be compatible with the increasing population growth.

2.1.4. Urban Population Growth on Public Expenditure

In a study conducted by Sharma and Singh (2019), they found out that Wagner's law of increasing state activities proved to apply in the Indian scenario during the post-liberalization period of 1988 to 2017. In a time-series analysis using Vector Error Correction (VEC) model, the results showed that both the GDP and the urban population have a positive and statistically significant effect on government expenditure in the long run. However, they also concluded that it only applies in the long run in the Indian setting because results showed that neither GDP nor urban population influences public expenditure in the short run.

In another study conducted by Imana (2017), the general results showed that most of the factors (inflation, real GDP per capita, population growth, urbanization) tested were positively significant and caused an increase in public expenditure on education. However, Imana suggested that the Kenyan government focus on increasing their financial allocation and finding reliable funding sources for their education sector.

2.1.5. Lagged Dependent Variable as a Determinant

Sheik (2019) studied the determinants of the growth of public education expenditure in Bangladesh. The results disclosed that the lagged or past year's expenditures primarily determined education financing policy in Bangladesh. The indirect tax also increased the total education expenditure as a percentage of GDP.

2.2. Synthesis and Gaps

There is a lack of studies in the Philippines analyzing the determinants of public education expenditure. However, some studies are conducted in neighboring countries such as Malaysia, but their education system and budget allocation differ from the Philippines. On the other hand, the related studies show similar results on how factors of economic growth such as GDP per capita, urban population growth, and unemployment rate have a significant relationship with the growth of public education expenditure. This has yet to be proven in the Philippine setting since there have been difficulties finding related literature that tackles the same area of study.

To put it briefly, related studies show how crucial it is for the government to analyze the factors contributing to the continuous climb of the Philippine public education expenditure. The analysis of the determinants can help the policymakers address the problem of the education system, such as misallocation and insufficient funding - which directly affect the effectiveness and accessibility of the Philippine education system. In addition, the government can also use the results from this study to make reforms and more responsive policies to improve the efficiency of budget allocation.

The lack of empirical studies in the Philippines regarding the determinants of public education expenditure incentivizes the need to conduct this study. Thus, this paper contributes to the literature by analyzing the determinants of public education expenditure in the Philippine setting.

2.3 Theoretical Framework

This paper is highly anchored to Wagner's law. It is a model of public expenditure growth made by Adolf Wagner (1835-1917), which explains the changes in levels of public expenditure. This theory holds that if a nation becomes more progressive, economic growth and development will push the country to become more monitoring in nature, thus expanding its role, which would probably cause higher public spending.

Wagner stated that as an economy grows and develops over time, so will a government's functions and activities. According to him, as he observed in many nations when per capita income and output rises, the public sector grows as a proportion of total economic activity. He also attributed the increase of government spending to three factors: industrialization/modernization, growth of income, and social progress.

According to Peters (2006), Wagner's hypothesis presents six various formulations presented below:

1. Peacock-Wiseman 'traditional' version $G = f(\text{GDP})$
2. Pryor version $C = f(\text{GDP})$
3. Goffman version $G = f(\text{GDP}/N)$
4. Musgrave version $G/\text{GDP} = f(\text{GDPR}/N)$
5. Gupta/Michas version $G/N = f(\text{GDP}/N)$

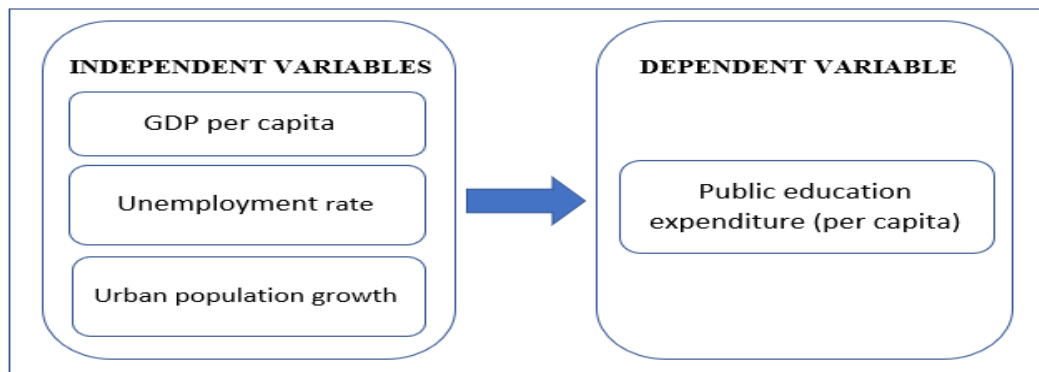
6. Peacock–Wiseman ‘share’ version $G/GDP = f(GDP)$

Whereas G is nominal total government expenditure, GDP is a nominal gross domestic product, $GDPR$ is a real gross domestic product, N is the total population size, and C is government consumption expenditure (Sagarik 2016). Given Wagner’s law, this paper aims to validate the factors (gross domestic product per capita, urban population growth, and unemployment rate) as there have been past studies that demonstrated the significant effects of these on public education expenditure (Yun & Yusoff, 2018).

2.4 Conceptual Framework

The rise in GDP per capita, employment rate, and urbanization rate are signs of social progress, and in response to this, the government has to expand its spending according to Wagner’s law. Moreover, this study follows the conceptual framework seen below. Public education expenditure per capita is the dependent variable assumed to be determined by the changes in GDP per capita, unemployment rate, and urban population growth.

Figure 2. Illustration of the relationship of economic growth factors and public education expenditure



3. Methodology

This chapter presents the methodology used in the study about the determinants of public education expenditure in the Philippines. This part also includes the variables used, the econometric model, and the statistical tools conducted to examine the significance of the coefficients and the overall significance of the regression model.

3.1. Research Design

The paper used the quantitative approach to explain the variables’ degree of association within a specific period. The study employed the Ordinary least squares (OLS) regression method to evaluate whether GDP per capita, urban population growth, and unemployment rate are statistically significant determinants of public education expenditure.

3.2. Data Collection

The paper only used secondary data obtained from Philippine Statistical Yearbooks from 1990 to 2019 and the World Bank database. The observations were thoroughly checked and were compared with other online databases to avoid unreliable and incorrect data. The researchers conducted a time-series study from 1989 to 2018, with a total number of thirty observations. The variable used in the study are as follows:

Table 1. Summary of Variables

Variables	Definition	Source
Public education expenditure per capita	The spending on schools, universities, and other public and private institutions delivering or supporting local services divided by the midyear population.	Philippine Statistics Authority
GDP per capita (constant LCU)	The gross domestic product divided by the midyear population.	World Bank Database

Urban population growth (annual %)	Refers to the increase of people living in urban areas.	World Bank Database
Unemployment, total (% of the labor force)	Refers to the share of the labor force without work but available for and seeking employment.	World Bank Database

3.4 Econometric Model

The paper follows the multivariate Ordinary Least Squares regression model presented as:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n + \varepsilon$$

The econometric model describes the effects of the independent variables (GDP per capita, urban population, and unemployment rate) on the dependent variable (public education expenditure per capita). For regression and estimation, the econometric model in this research will be developed into the log-linear form and is specified as follow:

$$\ln EDEX = \beta_0 + \beta_1 \ln Y + \beta_2 \ln URB - \beta_3 \ln UNEM + \varepsilon$$

Whereas:

EDEX= Public Education Expenditure Per Capita

Y = Gross Domestic Product Per Capita (Constant LCU)

URB = Urban Population Growth (annual %)

UNEM = Unemployment, total (% of labor force) (modeled ILO estimate)

ε = Error Term

3.4. Statistical Treatments

The study used Econometric Views (EViews) as its statistical tool and performed multivariate Ordinary Least Squares regression analysis to determine if all the independent variables are statistically significant factors to the change in the dependent variable. The researchers also conducted statistical measures to test the significance of the model, including hypothesis testing through the values of t-statistic and f-statistic in their respective p-values; test for multicollinearity through Variance Inflation Factor; tests for serial correlation through Durbin-Watson test and Breusch-Godfrey test; test for heteroscedasticity through White's Heteroscedasticity test; test for specification errors through Ramsey's RESET test; and test for normality through a histogram.

A. Hypothesis Testing for the Significance of the Parameters

The T-Test is used to test the significance of an individual coefficient in the regression. The result indicates whether to reject the null hypotheses and identify the relationship of the regressors on the regressand.

B. Hypothesis Testing for the Significance of the Regression Equation

F-Test is used to determine whether or not the model has a significant overall fit. The F-Test of overall significance indicates whether the regression model provides a better fit to data than a model that contains no independent variables.

C. Test for Multicollinearity

Multicollinearity shows a linear relationship within the independent variables present in the model. This indicates that there might be an incorrect interpretation of the coefficients as the model is biased with the unreliable hypothesis tests from the regression estimation. The value of all centered VIF must be less than ten to say that there is no multicollinearity in the model.

D. Test for Serial Correlation

The first way to see if there is a serial correlation in the model is to look at the value of the Durbin-Watson statistic. By rule of thumb, values from 1.5 to 2.5 are acceptable and indicate no autocorrelation. The second test is the Breusch-Godfrey Serial Correlation Test. The null hypothesis in this test states that there is no serial correlation of any order up to p. Thus, to accept the null hypothesis, the p-value of the f-stat must be greater than 0.05.

E. Test for Heteroskedasticity

The white test is used to identify heteroscedastic errors in regression analysis. The null hypothesis in this test indicates no visible heteroscedasticity in the model. The p-value of the f-stat must be greater than 0.05 to prove that there is more robust evidence to accept the null hypothesis.

F. Test for Specification Errors

Specification errors are usually caused by omitting a relevant explanatory variable, caused by the lack of data for the said variable, inclusion of an irrelevant explanatory variable, and an incorrect functional form of the model. In the Ramsey RESET test, the p-

value of the f-stat must be greater than 0.05 to reject the null hypothesis, which states that some variables are not significant in the model.

G. Test for Normality

The easiest way to determine if the distribution is normal is by looking at the histogram. If the graph shows a bell shape, one can assume normality.

4. Results and Discussion

This part presents the detailed presentation of the statistical tools and data analysis of the results gathered from these tests. The findings are presented in four parts: the trends, descriptive statistics, OLS regression results and diagnostic tests results, and the treatment for serial correlation.

4.1. Trends

Figure 3. The plot of Public Education Expenditure Per Capita

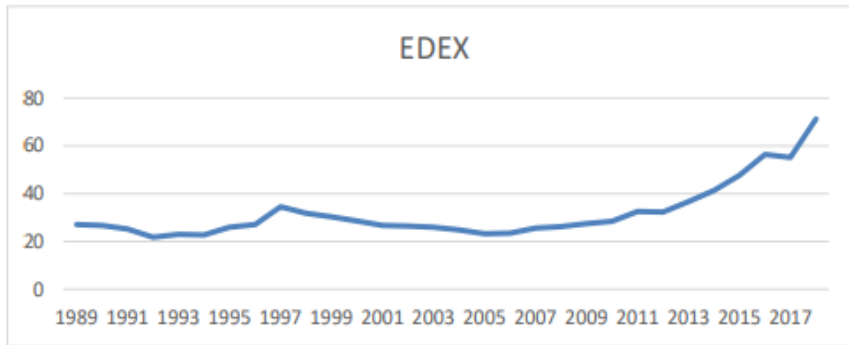


Figure 4. Plot of GDP Per Capita (Constant LCU)

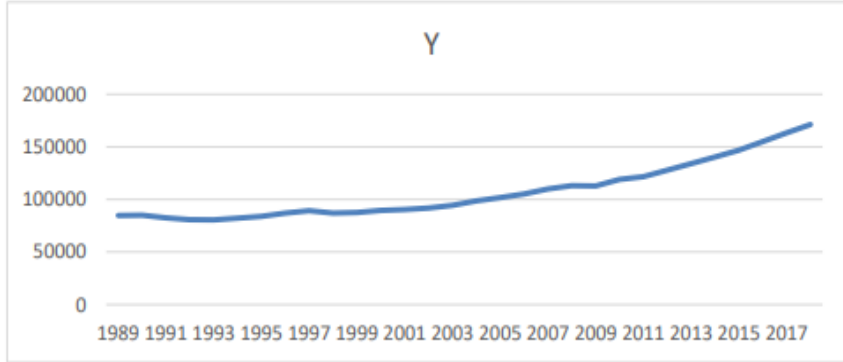


Figure 5. Plot of Urban Population Growth (annual %)

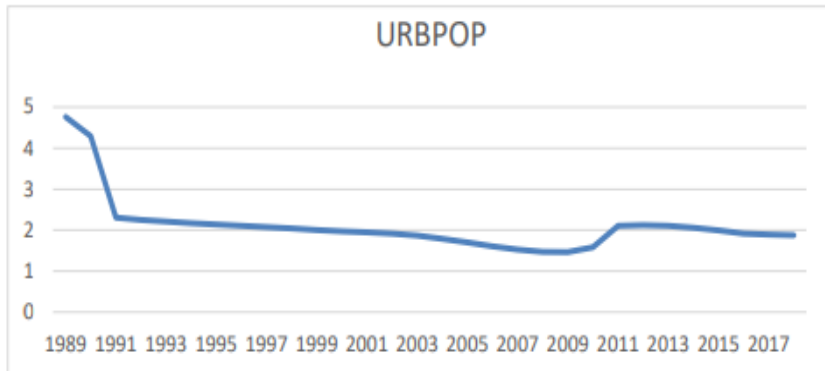
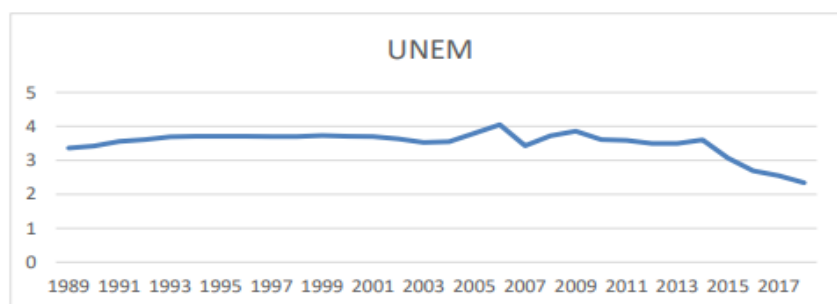


Figure 6. Plot of Unemployment Rate (% of the labor force)



As shown in the figures formulated above, the Philippine public education expenditure has increased over the past few decades. Subsequently, the GDP per capita has also risen from 1989 to 2018, while the unemployment rate has slowly declined in recent years. However, the Philippine urban population growth rate has shown a minor and unstable increase. On the other hand, it is graphically proven that public education expenditure and the GDP per capita may have a positive and significant relationship.

4.2. Descriptive Statistics

Table 2. Descriptive Statistics

Variable	n	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
EDEX	30	31.90519	11.57318	21.79853	71.28104	1.974812	6.320184
Y	30	107238.6	26619.99	80575.21	171259.8	0.981785	2.818054
URBPOP	30	2.109866	0.698106	1.464890	4.760377	2.870519	10.90918
UNEM	30	3.511000	0.377764	2.340000	4.050000	-1.842263	5.864501

This figure shows the statistical summary of the raw data. This table helps understand the level of distribution of the data and analyze if there are outliers present.

Table 2 shows that the average public education expenditure per capita is almost 32 PHP. The highest public education expenditure per capita was in 2018 with 72 PHP, while the lowest was in 1992 with 22. This data clearly shows how the budget grew throughout the years, but the access to education still does not improve compared to neighboring countries. The trend also went down through the years in terms of urban population growth, indicating that more Filipinos relocated to rural or provincial areas. On the other hand, the unemployment rate in the Philippines only seems to vary from 2 to 4 percent in the years 1989 to 2018.

Focusing on numbers, based on the table, the variables GDP per capita (Y), public education expenditure per capita (EDEX), and urban population growth (URBPOP) are all positively skewed, with values, 0.98(>0), 1.97 (>0), and 2.87 (>0) respectively. This indicates that the tail on the right side is longer, and the mean and median will be greater than the mode. The unemployment rate (UNEM), on the other hand, poses a negative skewness as its value, -1.84, is less than 0, which indicates that the left tail is longer, and the mean and median will be less than the mode. Second, the kurtosis values of variables public education expenditure, urban population growth, and unemployment rate show that these data are Leptokurtic, or the data are heavily concentrated about the mean than a normal distribution. The value of a normal distribution kurtosis is 3, where values of EDEX (6), URBPOP (11), and UNEM (6) are all lesser than those. Only the variable GDP per capita has a normal distribution with a kurtosis value of 3. Lastly, only the variable GDP per capita shows normal distribution based on the probability values. With a p-value of 0.08, greater than 0.05 level of significance, it cannot reject the null hypothesis, which states a normal distribution. EDEX, URBPOP, and UNEM, all with values amounting to 0.00, are all less than 0.05, indicating that it rejects the null hypothesis and shows that the distribution is not normal.

4.3 Regression Results

Panel A				
Variables	Coefficient	Std. Error	t-statistic	Prob.
C	-2.954398	2.289312	-1.290518	0.2082
In Y	0.671177	0.167926	3.996865	0.0005
In URB	0.093702	0.110879	0.845079	0.4058
In UNEM	-1.163230	0.299649	-3.881973	0.0006

Panel A shows the coefficient of each corresponding variable, which determines the change in the dependent variable (EDEX) given a one-unit change in each independent variable, holding other variables constant. Based on the result of the OLS regression, GDP per capita and urban population growth have a positive relationship with public education expenditure. In contrast, the unemployment rate has a negative relationship with it. Furthermore, all independent variables showed significance except the urban population growth with a p-value of more than 0.05. Hence, the estimated regression equation could be written as follows:

$$\ln \text{EDEX} = -2.95438 + 0.671177 \ln Y + 0.093702 \ln \text{URB} - 1.163230 \ln \text{UNEM} + \varepsilon$$

Panel B				
R-squared	Adj. R-squared	F-stat	Critical value of F	Decision
0.842833	0.824698	46.47622	3.6697	46.47622 > 3.6697

Panel B shows the R-squared value of 0.842833. This means that 84.29% of EDEX variability can be explained by the variability or changes in Y, URB, and UNEM. On the other hand, based on Panel B, the model is statistically significant according to the value of f-statistic, which is greater than the critical value. Thus, this indicates that the model is significant and can explain the variation in the dependent variable around its mean.

Panel C				
Variables	P-value	T-statistic	Critical value of t	Decision
In Y	0.0005	3.996865	2.462	3.9968 > 2.462*
In URB	0.4058	0.845079		0.8450 < 2.462**
In UNEM	0.0006	-3.881973		3.8819 > 2.462*

*Statistically different from zero
 **Not statistically different from zero

Panel C shows the significance of each variable to the model. The panel also determines that null hypotheses for variables Y and UNEM will be rejected since their t-statistics are greater than the critical value. This implies that Y and UNEM have a significant relationship with the dependent variable, EDEX. This can also be proven by looking at the p-values of Y and UNEM, with values of 0.0005 and 0.0006, respectively, which are both less than 0.05 levels of significance. On the other hand, the p-value of URB is 0.4058 > 0.05 level of significance, which means that it is not statistically significant. The t-test further proves that URB fails to reject the null hypothesis and indicates that URB may not be a determinant of EDEX.

Panel D		
White Test	0.7279	No heteroskedasticity
Ramsey RESET Test (t-stat, f-stat)	0.0600, 0.0600	No specification errors
Breusch-Godfrey Serial Correlation LM Test	0.0006	There is a serial correlation
Durbin-Watson Stat	0.605446	There is auto-correlation
Centered VIF	In Y (2.860807) In URB (1.474555) In UNEM (2.532111)	No multicollinearity

Panel D shows the results from the statistical tools conducted. For the white test, the p-value of the probability chi-square is 0.7279, which is greater than the 0.05 level of significance. Thus, we accept the null hypothesis of homoscedastic residuals.

In the Ramsey RESET test, if the associated p-value is significant, then there are specification errors. Based on Panel D, the p-values of t-statistic (0.0600) and F-statistic (0.0600) are insignificant because they are both >0.05 level of significance. Thus, the model is free from specification errors.

To determine if multicollinearity is present in the regression model, the independent variables' centered Variance Inflation Factors (VIF) must be less than 10. Since the centered VIF of Y is 2.860807, URB is 1.474555, and UNEM is 2.532111, all less than 10.

However, Panel D shows that serial correlation and autocorrelation are present in the model. The Breusch-Godfrey Test showed that the p-value of probability chi-square is 0.0006, which is less than the 0.05 level of significance. Further, by the rule of thumb, the acceptable Durbin-Watson (DB) stat ranges from 1.5 to 2.5, but the DB stat of the model is 0.605446, which is out of the range of acceptable DB stat.

4.4 Treatment for Serial Correlation

The results show a serial correlation in the regression model, based on the Breusch-Godfrey Serial Correlation LM Test and the Durbin Watson stat. This problem needs to be treated as it can cause the estimated variances of the regression coefficients to be biased.

Thus, the researchers lagged the dependent variable (EDEX) to see if public education expenditure's previous or past values affect the government's ensuing spending. Regression tests were also run to see if the model with lagged EDEX could cure the problem of serial correlation.

Panel E				
Variables	Coefficient	Std. Error	t-statistic	Prob.
C	-2.006469	1.667998	-1.202920	0.2407
In Y	0.393387	0.134671	2.921105	0.0075
In URB	0.129189	0.099596	1.1297124	0.2069
In UNEM	0.043879	0.321243	0.136592	0.8925
lag EDEX	0.024022	0.004847	4.956148	0.0000

Panel E shows the regression results with lagged EDEX as an independent variable. Based on the results, lag EDEX has a direct relationship with the dependent variable. In addition, lag EDEX is also a significant variable together with Y. However, Panel E also shows that unemployment and urban population growth are insignificant. The new estimated regression equation could be written as follows:

$$\ln \text{EDEX} = -2.006469 + 0.393387 \ln Y + 0.129189 \ln \text{URB} + 0.043879 \ln \text{UNEM} + 0.024022 \text{lag EDEX} + \varepsilon$$

Panel F				
R-squared	Adj. R-squared	F-stat	Critical value of F	Decision
0.925397	0.912964	74.42613	3.3289	74.42613 > 3.3289

Based on this Panel, the r-squared to 0.925397. In other words, 92% of the EDEX variability can now be explained by changes in the independent variables - a big jump from 84% from before. On the other hand, the model is still statistically significant, which indicates that changes in the independent variables can determine the shifts in the dependent variable.

Panel G				
Variables	P-value	T-statistic	Critical value of t	Decision
ln Y	0.0075	2.921105	2.462	2.2911 > 2.462*
ln URB	0.2069	1.297124		1.2971 < 2.462**
ln UNEM	0.8925	0.136592		0.1365 < 2.462**
lag EDEX	0.0000	4.956148		4.9561 > 2.462*

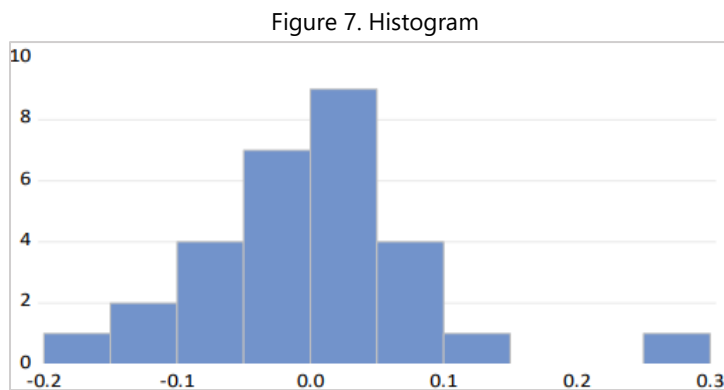
*Statistically different from zero
 **Not statistically different from zero

Panel G indicates that lag EDEX and Y are the significant independent variables with t-stat values greater than the critical value. On the other hand, UNEM and URB are insignificant, which means they cannot determine changes in EDEX.

Panel H		
White Test	0.6120	No heteroskedasticity
Ramsey RESET Test	0.2315	No specification errors
Breusch-Godfrey Serial Correlation LM Test	0.0618	No serial correlation
Durbin-Watson Stat	1.857990	No auto-correlation
Centered VIF	ln Y (3.492810) ln URB (1.370614) ln UNEM (5.672242) lag EDEX (6.912447)	No multicollinearity

Panel H shows that adding the lag of EDEX as an independent variable has treated the problem of serial correlation and autocorrelation in the model.

According to Amin (2019), if the dependent variable is time-series, it is most likely that its present value depends on past values (i.e., autocorrelated). It is logical to include lagged values of this dependent variable as explanatory variables.



The histogram shows a bell-shaped curve which means that the data distribution in the model is normal.

In summary, GDP per capita and lagged values of public education expenditure are significant determinants of public education expenditure. First, the rise in GDP per capita indicates that a country's economy is generally growing, and there is betterment on the people's standard of living. Higher GDP per capita can indicate development in the economy, wherein Wagner stated that with economic growth and development, a nation would experience an increase in the activities of the public sector. Second, past values of public education expenditure can affect the dividend of the following value since the government may consider the growing population relative to the budget allocated.

5. Conclusion

The Ordinary Least Squares regression results showed that GDP per capita and lagged or past values of public education expenditure are significant determinants and have a positive relationship with public education expenditure. Thus, although the unemployment rate and urbanization growth are statistically insignificant (which does not entirely conclude that these variables cannot be determinants of public education expenditure as supported by related studies), the results of this study show that Wagner's Law may apply in the Philippine setting. The trends indicate that economic growth indicators such as GDP contribute to increasing public expenditure on education.

In addition, given the study results, the government can further analyze the determinants of public education expenditure in the Philippines and regulate a more efficient budgetary allocation. Based on the data, the budget for the education sector is increasing every year, but thousands of Filipinos are still uneducated, millions of children are out-of-school, school facilities are still not enough, and teachers' salaries are low. This clearly determines that the government should carry out intensive reviews on budgetary allocation and utilization to ensure that there will be wider access to education facilities and enough subsidies to help low-income level families go to school. The increasing public education expenditure shall equate to an improved quality of education in the Philippines.

Moreover, findings from this study also imply that future research on this field may also include other economic-demographic indicators such as population growth of a specific group age and number of teachers employed to strengthen the significance and further validate the application of Wagner's law in the Philippine setting.

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