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**RESEARCH ARTICLE**

## Analysis of the Determinants of Public Education Expenditures in the Philippines

Cristobal, Jason Paulo S.<sup>1</sup> ✉ | Cordero, Maureen Ann P.<sup>2</sup> | Manapat, Carlos L., DBA.<sup>3</sup>

<sup>1,2,3</sup>Department of Economics, University of Santo Tomas, Manila, Philippines

**Corresponding Author:** Cristobal, Jason Paulo, **E-mail:** [jasonpaulo.cristobal.ab@ust.edu.ph](mailto:jasonpaulo.cristobal.ab@ust.edu.ph)

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**ABSTRACT**

This study examines the values, trends, and variables that determine the public education expenditures of the Philippines from 1990 to 2019. The researchers used the following variables: Public Education, Culture, and Manpower Development Expenditure in Millions, Tax Revenue in % share GDP, Total Population in Millions, and Real Gross Domestic Product Per Capita, to pave the way for a coherent understanding of the determinants of public education expenditure and theories used to build up this economic construct. The study utilized a multivariate Ordinary Least Squares regression analysis needed for the variables, along with statistical measures to assess the significance of the model. Which includes the following: the values of the t-test and f-stat in their respective p valued forms for the significance of the economic model, tests for serial correlation through the Durbin-Watson test and Breusch-Godfrey test, a test for multicollinearity through Variance Inflation Factor, a test for heteroscedasticity through Goldfeld-Quandt test and White's Heteroscedasticity test, testing for specification errors will be done through Ramsey's RESET test, and test for normality will be through a graphical method Histogram. The key findings of this study suggest that the variables; economic growth, tax, and population growth show signs of positive relationship and negation with the dependent variable education expenditure.

**KEYWORDS**

Education, Public Expenditure, Allocation

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**1. Introduction**

Almost every country around the globe considers education as one of its national priorities due to its immense value for human growth and economic development. An inquisitive definition of education is offered by the Economist and Nobel Laureate Amartya Sen (2003), who defines it as an arrangement for training to develop a skill: recognition of the natural world, with its diversity and richness, and an appreciation of the importance of freedom and reasoning as well as friendship. In the last one hundred years, Economists have conjured countless methods both in macroeconomic and microeconomic frameworks, theorizing how and why governments should allocate their resources efficiently to stimulate development in the education sector and reap economic growth out of it.

Yin et al. (2017), for example, establish the following about the relationship between Education, Government Spending, and the Economy; (1) that Education has multidimensional impacts on the economy and it promotes economic growth positively, reduces poverty, provides a social and political environment that will attract future investment; (2) there is a clear linkage between public allocation sizes in the education sector and human resource development; (3) and lastly, an education system empowers people to work in the economy, and through the knowledge, they can contribute to technological development.

Conrad (2011) inferred that government spending on education is an important indicator of human capital formation, which propels economic growth. He argues that an effective allocation of resources for education shall increase the growth rate of human capital and as well increase the growth of the economy. He further says that promoting government spending towards education will then enhance GDP growth in the long run.

The sheer importance emphasized towards education in modern economies has stimulated the need for establishing quality and efficiency in how education is run and implemented. Tsinidou et al. (2010) identify six factors that determine the quality of education. The following are; the academic staff, administrator, library services, curriculum, location, facilities, and career prospects, all of which can be categorized into three main facets: the quality of structure, process, and outcome. With this model, we find that running, maintaining, and developing these three facets will require ample financial resources in the long term, thus making proper and efficient public financing for education a grave necessity. Michael (1975) argues that education consumption and wages have a positive relationship to one another due to the following observations: (1) Education may alter the productivity of one's time and thereby affect wage rates, (2) education may screen individuals on the basis of intellectual capacity and thereby operate in job markets characterized by positive information costs, and (3) Education operates as a bargaining device which enables people. Based on the observations made by Michael (1975), the assumption on education funding will be as follows: an increase in the quality, efficiency, and even the population of people educated will result in a positive form of investment as represented by wage increase, while a decrease in the following variables will result in liability.

Given the facts stated above, there exists a strong bond between economic growth and education consumption. But to further illustrate this complex relationship, objective analysis and manipulation of variables must be utilized. In taking variables into account, frameworks that apply to the logic of these complexities must be used, and one such framework that the researchers have explored is the theory molded by Adolf Wagner. According to Tabar et al. (2017), among the popular theories developed by economists, the model created by Adolf Wagner is popularly used to assess the trajectory of national income to public expenditures. According to Wagner (1997), a linear relationship exists between the growth of government spending and economic growth. He also made the following observations: (1) the rate of public sector growth is higher than economic growth, (2) goods supplied by the public sector have a higher income elasticity, (3) public spending is an important mechanism for developing and increase economic activity. He concluded these three observations with a simple hypothesis; that the direction of casualty comes from economic growth to public expenditure. Tabar et al., (2017) Applying Wanger's theoretical framework is a step forward to understanding the effective factors that government spending offers towards human resource development and education. Given the theories presented above, the researchers of this study surmise that studying the determinants of public education spending can benefit the Philippine economy at large because of the immense value human resource formation offers to its citizens.

### **1.1 The Philippine Context**

The Philippines, a nation with a population of over 108 million in 2021, is already considered a newly industrialized country, according to a recent study conducted by the National Economic Development Agency. Despite accomplishing a handful of economic milestones over the past decades and so, poverty and access to education, among other problems, remain a significant issues for the government and the Filipino people.

The United Nations have defined education as a medium for upward socioeconomic mobility and the key to escaping poverty which highlights its practical use in enabling human development. In the year 2000, a set of eight goals was adopted by the United Nations that aimed to eradicate eight societal ills that include poor education. Upon its expiration in 2015, a new set of seventeen goals known as the Sustainable Development Goals (SDGs) were conjured to take its place. Among the aims listed for educational development, the Philippines is guided to accomplish the following goals: By 2030, ensure that all girls and boys have access to complete free, equitable, and quality primary and secondary education, to quality early childhood development, care, and pre-primary education so that they are ready for primary education, and equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university. Such goals can only be accomplished if financial resources are properly allocated toward the development of education in the country.

Upon ratification by the United Nations, the Philippines, from 2000 to 2020, implemented measures to accomplish these goals through the following national policies. The Republic Act No. 10533, also known as An Act Enhancing The Philippine Basic Education System By Strengthening Its Curriculum And Increasing The Number Of Years For Basic Education, Appropriating Funds Therefor And For Other Purposes, was signed and made official in 2013 is an example of a nation-wide reform in education that sought to implement improvements in the curriculum; the lengthening of the duration of high school; and the inclusion of technical-vocational studies in grades eleven and twelve. In 2017, the Philippine government signed into law the bill Universal Access to Quality Tertiary Education Act, officially designated as Republic Act 10931, which institutionalized free tertiary education for all Filipinos opting to study in public colleges and universities and offered equitable scholarships at private institutions to deserving indigent students. These two major policies enacted for the benefit of education in the country have major implications for government spending. A study led by Virola (2019) stressed that the implementation of free tertiary education would lead to inefficiency and budget constraints to fund this ever-increasing expenditure due to a looming population and the deficits incurred during the 2017 Marawi siege and military upgrades that came after the conflict. The advent of the Novel Coronavirus in 2019 further complicates the already fragile and decrepit finances of the Philippines. A study conducted by the World Bank in 2020 expects low to middle-income nations in east Asia and the Pacific, such as the Philippines, to reduce education spending in 2021 to cope with the effects of the Covid-19 pandemic and reallocate financial resources towards health-related spending, particularly

that of vaccination. This further amplifies the need to study the determinants of education expenditure in the Philippines to mitigate the issues faced by the nation.

The Researchers of this study have carefully considered the variables at play in its environment and have laid down a statement of the problem that tackles the essential queries proposed in this study. Access to quality education in the Philippines remains undoubtedly difficult, particularly for the less fortunate, which indicates a great defect in present policies aimed towards improving public education. The lack of infrastructure, manpower, equipment, and technology are the primary tangible and intangible manifestations of this defect. This apparent defect seen in the public education system provides further reason to investigate shortcomings in the allocation of financial resources towards the improvement of education in the Philippines. The questions laid down by the researcher are aimed at solving problems that will, in turn, guide the nation's leaders and policymakers in conjuring effective and diligent systems of financing for the education sector.

1. What is the trend of the Public Education, Culture, and Manpower Development Expenditure in Millions as seen in the country?
2. Is there a significant relationship between the Public Education, Culture, and Manpower Development Expenditure in Millions and Real Gross Domestic Product Per Capita?
3. Is there a significant relationship between Public Education, Culture, and Manpower Development Expenditure in Millions and Total Population in Millions?
4. Is there a significant relationship between Public Education, Culture, and Manpower Development Expenditure in Millions and Tax Revenue in % share GDP?
5. Is Wagner's Law valid and extant in the Philippines?

The Null Hypothesis of the Study is theorized to reject the following:

Ho1: There is no significant relationship between Public Education, Culture, and Manpower Development Expenditure in Millions and Tax Revenue in % share GDP

Ho2: There is no significant relationship between Public Education, Culture, and Manpower Development Expenditure in Millions and Total Population in Millions

Ho3: There is no significant relationship between Public Education, Culture, and Manpower Development Expenditure in Millions and Real Gross Domestic Product Per Capita

Ho4: There are no significant relationships between Public Education, Culture, and Manpower Development Expenditure in Millions, Tax Revenue in % share GDP, Total Population in Millions, and Real Gross Domestic Product Per Capita

The Researchers of this study have identified several indicators to be utilized via an econometric analysis. The following indicators, Public Education, Culture, and Manpower Development Expenditure in Millions, act as the regressand of this model, while the following: Real Gross Domestic Product Per Capita, Total Population in Millions, Tax Revenue in % share GDP, are the regressors of the model. The following indicators represent the following regressors: Economic Growth, Population growth, and Tax revenue. Economic Growth is calculated using the Real Gross Domestic per capita; Population is directly determined using the indicator Population percentage per annual change; then lastly, Tax revenue is also directly determined using the variable Government Tax revenue. The researchers then employed a time-series data framework to collate the observations taken from the Department of Budget and Management and the World Bank through their respective Data repositories. The observations taken from both repositories ranged from 1990 to 2019, which totals thirty observations. The title of this undergraduate thesis uses the wording "Public Education Expenditure" to refer to Public Education, Culture, and Manpower Development Expenditure in Millions to precisely identify Education as a public service. This identification has also been used by the Asian Development Bank in its 2021 Key Indicators for Asia and the Pacific on the same dataset retrieved from the Department of Budget and Management. The study used EViews (Econometric Views) to test the multivariate Ordinary Least Squares regression analysis needed for the variables, along with statistical measures to assess the significance of the model. This includes the following: the values of the t-test and f-stat in their respective p valued forms for the significance of the economic model; tests for serial correlation through the Durbin-Watson test and Breusch-Godfrey test; test for multicollinearity through Variance Inflation Factor; test for heteroscedasticity through Goldfeld-Quandt test and White's Heteroscedasticity test; testing for specification errors will be done through Ramsey's RESET test; and test for normality executed through a graphical method Histogram.

Enumerating and examining the determinants of education spending in the Philippines is significant to the following entities and institutions: *National Economic Development Agency (NEDA)* Since government expenditure on Education is one of the main concerns of this study, the researchers believe that the National Economic Development Agency (NEDA) will benefit from this study as it will serve as a framework for resource allocation and efficiency-driver for future policies in relation to government spending towards Education; *Department of Budget and Management (DBM)* Given that this executive wing of government continuously works to find ways to determine sources for government spending, the researchers of this study believe that this institution can use this study to pattern their existing policies and improve upon them to achieve efficiency and diligence; *Department of Education (DEPED)* The researchers have made this study particularly important to this government institutions as it receives the highest portion of the Philippine public expenditure on Education. This institution could utilize this study by turning it into a framework and taking from it necessary indicators which it could use to rally important and beneficial policies for the betterment of the Education system it employs; *Commission on Higher Education (CHED)* Alongside the Department of Education, CHED or the Commission of Higher Education is also a principal benefactor of this study because it is included in the expenditures for Education. The department, in particular, has increased spending in the past few years due to the Government's implementation of a new law that aims to make tuition in public universities and colleges free. Given this increasing expenditure, this study shall be highly beneficial to the commission, *Technical Education and Skills Development Authority (TESDA)*. As mentioned in the previous lines, alongside DEPED and CHED, the Technical Education and Skills Development Authority shall benefit from this study highly because it is also a contributor to the Education expenditure highlighted in this study. The present researchers of this study have identified several pools of opportunities where this study could possibly be expanded upon. Such as exploring other variables and using a different kind of proxy to test for the determinants of government spending on Education – to the percentage of the GDP is one of the few avenues identified by the researchers.

## 2 Literature Review

### 2.1. Public Expenditures and Wagner's Law

Researchers such as Aggarwal (2017) used the variables Government Expenditure, Government Consumption, Gross National Product, and Net National Product, taking from the hypothesis of Wagner, as indicated in their economic model. This was utilized in 34 countries which yielded interesting results in their study. In the summary of their estimation, there were countries that proved that Wagner's law was indeed evident, but some had shown that there was no significant relationship among the variables; thus, no further conclusion was established to assess the validity of Wagner's law in other countries. This was understood to be a phenomenon that needed further study in the purview of controversy, as the study was conducted to emphasize that Wagner's law shows some shortcomings in its theory.

A study by Jibir & Aluthge (2019) in Nigeria tested to determine the model of government expenditure, where they tried to introduce new variables to the hypothesis. The researchers used the following variables in their model, oil revenue, trade openness, public debt, exchange rate, oil price, taxation, and inflation. In the assessment of their variable, Wagner's theory was used to modify the model they had laid out. They have a variety of results in their models, as there were short-run and long-run effects to consider in the estimation of the variables, also as they did consider this in their regression analysis. In the most salient parts of their study, for the short-run, oil prices were seen to have a negative and insignificant relationship with government size, but in a one-year lag estimation, the results had changed to positive and significant in the variables. Population and inflation had shown positive results with government expenditure, similar to trade openness but the significance of these variables was not as high as the population incurred in the results. The variable public debt, however, showed a negative and insignificant relationship with government expenditure.

This particular study by Sedrakyan & Varela-Candamio, (2018) went to estimate whether these two theories were present in either of the two countries tested. They have garnered results that the theories were somewhat applicable to a certain extent in the specific country. The variables in the study had been the determinants of expenditure, where they estimated the gravity of effects of the two theories on each variable. In Armenia, they saw the existence of Wagner's law in the short-term perspective with the causal relationship of the variable real GDP in their Government Spending, as was the case in Spain, where Wagner's law was also seen but had shown effects on a limited number of variables used.

Another similar study was done in Turkey by Sagdic, Sasmaz, & Tuncer (2020), where the theories of Wagner and Keynes were tested. Again, in definition, Wagner argued that the cause of an increase in public expenditure was the result of economic growth. The study utilized the assessment of elasticity of public expenditure on income, where they had estimated the model in 81 provinces in Turkey for a period of 1992 to 2013. Their results showed that Wagner's law was indeed present in Turkey, with the use of a causality tool in regression. The researchers had concluded that Wagner's law was highly effective in the regional study in the period they had tested the estimates.

Such results were again evidently seen in a study by Eedme et al. (2018) on the evidence of Wagner's law in Nigeria, but in their causality tests, there were varying views of this law. The variables used in the estimation are real GDP, total government expenditure, exchange rate, inflation rate, and monetary policy rate in the period 1961 to 2011, where they have used a regression tool to analyze the causal relation of economic growth and government expenditure. In the short-run analysis, there was no causality seen in the two variables; thus, they concluded that Wagner's law was not present during the short-run period of the observations. However, such a case was the opposite in the long-run period, where there was a causality relation between economic growth and government spending, thus concluding that Wagner's law was present during the long-run period.

Another basis for the following frameworks utilized above was from the study conducted by Facchini (2018), who suggests that the following models utilized to determine public expenditures are the following: a demand model and a supply model. In a way, these studies have common results, and that is the presence of Wagner's law in the assessment of expenditure in a country or region. These studies inevitably provide evidence that this theory is indeed factual and true to its hypothesis, which will be an important factor for the remaining parts of the paper. In the next section, several studies will be discussed that will show the relevance of the claims for this study, also with the variables used to estimate the model of the paper.

## **2.2 Public Education Expenditures**

A study in Kenya by Imana D. (2017) showed the changing patterns and growth of public expenditure in their region. The main variables in the study were the levels of education in Kenya, such as primary, secondary, and university education. The study had used several theories to address their claims, which include Wagner's law and Peacock and Wiseman's hypothesis, but the researcher has included several theories to have a wide understanding of the phenomenon observed and to also aid the definition of the variables used. The study was to analyze the factors that affect the growth of public expenditure on education in Kenya, and their results have found that there was no uniformity in the factors influencing education expenditure in terms of the sub-sector in each educational level. There was an observed significant effect of inflation at the primary and secondary levels, but this was not the case in the general education sector and university level. In each model the study used, the sub educational levels were explained, and the paper concluded that there was a variation of mixed responses to the effects of the variables on the sub educational level with the theories used.

A study in Malaysia by Jabbar & Selvaratnam (2017) had analyzed the determinants of education expenditure seen in the time period of 1990 to 2015, their variables include education as their dependent variable, and their independent variables are as follows, total revenue, budget deficit, GDP per capita, poverty rate, unemployment rate, and population in subgroups by age. Their findings can be used to explain how the allocation for educational expenditure was distributed in the years it was estimated; their results found that their regressors have a significant effect on the total education expenditure in Malaysia. In which the variables they used in detail showed that in revenue, there was a positive and significant impact on the total government expenditure. The budget deficit, however, had shown a negative but significant effect on the growth of total education expenditure, while the unemployment rate had the same negative effect but did not show significance in the mode, where the researchers had stated that this variable might not be considered in the policymaking for education expenditure. In each variable that they have laid out, there was a significant effect of each variable on education; although the study had found that the growth of GDP per capita and the poverty rate is not one of the factors that determine the total education expenditure, thus showing that it is not significant in their model. In their conclusion, they have found that the determinants used in the study had a significant effect on the total government expenditure, but some have a varying effect on public education expenditure.

## **2.3 Public Education Expenditures and Economic Growth**

A study by Rathanasiri (2020) wanted to show the impact of public education expenditure on economic growth in Sri Lanka. This study had not discussed the use of Wagner's theory, as they have stated in their paper that another study concluded that this was not seen in their country and thus opted to not test for this theory but used several macroeconomic theories to prove their claims. The tools for regression estimation had been used to test their model, and this consists of the following variables: dependent variable as their Gross Domestic Product and the rest will be the independent variables; these are capital, gross domestic capital formation, labor as labor force, public expenditure on general education and public expenditure on higher education. The study also included inflation rate and trade openness in their model. These observations are from 1974 to 2018 to have a full scope of the potential impact of government expenditure on education on economic growth in Sri Lanka. The researcher had concluded that there is a significant and positive relationship between higher education and economic growth in both the short run and long run (Rathanasiri, 2020)

The study of Tabar et al. (2017) analyzed the impact of educational expenditures of the government on the economic growth of Iran and showed contributing results to the claims of this paper. They have used Wagner's theory in detail and had also shown through the regression tool ARDL on how this was estimated to be true in their model. Their results showed that in the short-term, the real GDP and labor force stock had a significant relationship on government expenditures, which if a percent increases in each

of the coefficients, then public expenditure will also increase. Their findings further discussed that when the country has an increase in their production, there will also be an increase in the labor force and thus an increase in government expenditure.

#### **2.4 Education Quality and Efficiency and Public Education Expenditures**

A more in-depth study by Hužvár and Rigová (2016) in relation to multiple variables examined the efficiency of education expenditure in OECD countries. This study utilized the following variables; Education Expenditure per student, students to teacher ratio, and an average of OECD-PISA tests scores (Math), to measure the efficiency of Education expenditures in the following nations: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. The variable government expenditure on education as % of the GDP was also used in this study to measure the allotment of resources of each nation to public education spending.

A study by Dufrechou (2016) conducted in Croatia has tackled spending efficiency, similar to the previous study mentioned in this chapter. However, this study sought to compare Croatia's Public expenditure on Education with its fellow countries included in the New Member States' status in the European Union. The indicators used in this study are expenditure on secondary education as a percentage of government expenditure on education, expenditure on tertiary education as a percentage of government expenditure on education, and results of the Programme for International Student Assessment. The study then steered towards identifying possible budget cuts that would not decrease the efficiency of public spending as compared to other NMS's nations. This could be used as a suitable framework in future studies to determine whether the Philippine Education Spending, as compared to neighboring nations, particularly the ASEAN states, is favorably efficient or not.

#### **2.5 Human Resources and Public Education Expenditures**

A study conducted in India by Patel and Annapoorna (2019) sought to investigate the possible impact of Public education expenditure towards the development of Human resources in the said nation by analyzing the relationship between HDI (Human Development Index) and the public education expenditure negate the results of Dao & Nguyen, 2020. The study concluded using the Granger Causality test, an asymmetrical relationship between the two indicators utilized in the study.

A study by Miningou (2019) that sought to assess the efficiency of public education expenditure in 130 countries using a stochastic frontier-model bore significant results. Using the following indicators: public expenditure per individual school-age PPP, Unemployment, Primary completion rate, and student-to-trained teacher ratio, the study found that the following variables bear a positive relationship to each other, and the efficiency of public education spending could indeed be determined using the following indicators.

#### **2.6 Theoretical Framework**

There are numerous research studies that have discussed the factors that affect government spending, where researchers analyzed what has been going on with the current policymaking enacted by government institutions. These papers have common findings in each discussion, even with the variants in the variables used, in which there has been an established pattern along with the analysis of expenditure. The theories that aided the examination of these patterns that gave massive contributions to solving a phenomenon in a nation's economic standing are *Wagner (1883)*, *Goffman (1968)* and *Peacock and Wiseman (1967)*.

##### **2.6.1 Adolf Wagner's Law of Increasing State Spending**

Adolf Wagner tells us in his model for public expenditure growth that there are certain factors that emphasize a significant impact on expenditure. Specifically, the positive relationship that exists between economic growth and the public sector stimulates expenditure. Aggarwal (2017). Wagner then further tries to prove that there is a linear way of defining the variables in the aspect that it is theorized to be a law that states this phenomenon is inevitable to occur. His theory explicitly states that the factor that affects both the demand and supply side of public expenditure activities are the following: (1) The Per Capital-Income and Wealth, which contributes a positive impact on demand and on the cost of government services, and the (2) Growth of Population and Density which affects the demand for government services and the cost of supplying the services. This theory was again tested by Wagner & Weber (1977) during the post-World War II for a sample size of 34 countries, where the researchers examined using empirical analysis to assess if this theory was indeed factual. In definition, they stated that it is necessary for utilizing Wagner's law to use a time-series data format in examining the growth of government expenditure to determine the effects of the factors that affect economic growth and to see the economic activity present in their time of analysis. Wagner further expanded his theory by defining the causes of increasing state activity, increasing urbanization, a growing population, and increasing public income. According to researchers Dutt and Ghosh (1997), Wagner did not present his law in mathematical form and was not explicit in the formulation of his hypothesis. Due to this nuance, a handful of economists over the years have conjured different mathematical forms to test this law. There are at least six versions of Wagner's law formulated in mathematical form. According to (Verma & Arora 2010), these six are the following: Peacock-Wiseman (1961), Gupta (1967), Goffman (1968), Pryor (1969), Musgrave (1969),

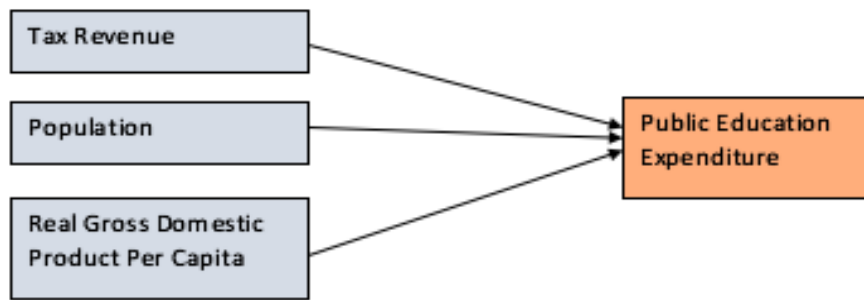
and Mann (1980). The researchers of this study have chosen to utilize Peacock-Wiseman's Model and Goffman's Model as the mathematical foundation of this study.

**2.6.2 Peacock-Wiseman's Hypothesis on Public Expenditures**

The Researchers of this paper have also decided to take another variable which is taxation, as one of the regressands to consider the framework drawn by Peacock-Wiseman, which states that the increase in taxation to boost government spending is a natural fiscal situation caused by social upheaval. Peacock-Wiseman has identified this phenomenon as the displacement effect.

**2.7 Conceptual Framework**

The study used the theories of Wagner's law and Peacock and Wiseman as an aid in determining the changes in public education expenditure, which the figure (Figure 1) below will show the conceptual framework designed for this study. These variables are to be tested to understand the effect on public education expenditure, should any of these variables increase or decrease. A Correlation research design was implemented in the study to test the relationship between these variables (Creswell, 2012).



**Figure 1: The effects of Gross Domestic Product per capita, Population, and Tax Revenue on Public Education Expenditure in the Philippines.**

**2.8 Synthesis**

The following studies have determined that public spending on education has direct and indirect effects on the economic well-being of a particular nation. The efficiency of public spending, as discussed in a few studies, sheds light on the value of identifying the proper determinants of public education spending as it shows that efficiency is achieved with proper resource allocation, which in turn is the purpose of this study.

**3 Methodology**

**3.1 Research Design**

There are numerous types of approaches for the experimental design to help provide evidence for the study's claims, which include: Descriptive, Correlational, Quasi-Experimental, and Experimental (Sukamolson, 2007). This study will be using the correlational approach where there are two primary forms of this research design: explanation and prediction (Creswell, 2012). As for this study, a correlational explanation design will be integrated to define where the explanatory variable tests how many degrees of association or relation the variables of a model have with one another at a specific point in time. The study's objective is to analyze the determinants of government education expenditure on the effects of said dependent variables. A correlational quantitative approach was done to the variables that test the relationship of Education Expenditure with the independent variables of tax, population, and gross domestic product.

**3.2 Data Collection**

The data observations collected for this study were sourced from the Department of Budget and Management of the Philippines and the World Bank, directly from their Fiscal Statistics Handbook and National Expenditure Program repository. The observations went through several corrective analyses, as they were compared with other online database such as the Philippine Statistical Authority and the World Bank. The researchers will be conducting time-series data analysis with the variables Public Education, Culture, and Manpower Development Expenditure in Millions, Tax Revenue in % share GDP, Total Population in Millions, and Real GDP Per Capita of the Philippines. The years included in the observation will be from 1990 to 2019, for a total of 30 observations to be conducted in this study.

### 3.3 Statistical Treatment of Data

The study used EViews (Econometric Views) to test the multivariate Ordinary Least Squares regression analysis needed for the variables, along with statistical measures to assess the significance of the model. Which includes the following: the values of the t-test and f-stat in their respective p valued forms for the significance of the economic model, tests for serial correlation through the Durbin-Watson test and Breusch-Godfrey test, a test for multicollinearity through Variance Inflation Factor, a test for heteroscedasticity through Goldfeld-Quandt test and White's Heteroscedasticity test, testing for specification errors will be done through Ramsey's RESET test, and test for normality will be through a graphical method Histogram.

- **The goodness of Fit: The Coefficient of Determination**

This is one of the results seen in the regression estimation of the R<sup>2</sup> or also known as the total sum of squares, which summarizes the measurement of how significant the data observed in the economic model. Specifically, this will show how close the observations are on the regression line, also resulting in indicating the variation of the dependent variable on the regression model. This will aid measure the regressor's variability (TAX, POP, and GDP) on the dependent (EDUC). If the R<sup>2</sup> value shows that it is somewhat close to 100% or, at most, greater than 85%, this indicates that the econometric model will show significant results to the claims of the study.

- **Hypothesis Testing for the Significance of the Parameters**

The t-test is the most used hypothesis testing for the estimation of the significance of the regression model, with the given hypotheses to reject or accept will identify the relationship of the regressors on the regressand. In this test, a specific significance level will be followed, with the given null hypothesis, which states the regression coefficient is equal to zero ( $H_0: \beta = 0$ ). This shall be rejected to provide evidence that each independent variable is not equal to zero, implying that one of the assumptions for regression analysis is met. For the t-test to reject the null hypothesis, the t-value must show a result greater than the critical values. The tests must be accepted at the significant value to be specified by the results to conclude that the coefficients are significantly different from zero.

- **Hypothesis Testing for the Significance of the Regression Equation**

The F-test is used to assess the significance of the explanatory variables on the regression equation, where if the hypothesis  $\beta = 0$  is accepted, then this shows that the independent X variables do not affect the dependent Y variable, and any results indicating the variation in the Y variable is due to the error terms. Thus, the reason why the explained sum of squares (ESS) also gives the R<sup>2</sup> a value of zero. In this method, the hypothesis  $H_0: R^2 = 0$  and  $H_1: R^2 > 0$  will be used to test for the significance of the model.

- **Test for Multicollinearity**

If a regressor shows that there is a linear relationship with other regressors used, then this indicates that multicollinearity is present in the model, which will result in an incorrect interpretation of the coefficients as the model is biased by the unreliable hypothesis tests from the regression estimation. In detecting multicollinearity, the Variance Inflation Factor (VAR) will be used to measure the degree of multicollinearity present in the model.

- **Test for Serial Correlation**

This occurs when the error terms or the residual of a parameter shows autocorrelation, which is a violation of one of the Classical Multiple Linear Regression Models. This is commonly seen in time series data as what this study will be estimating. Thus, to determine whether there is autocorrelation among the error terms, two tests shall be used to detect serial correlation, the Durbin-Watson test to detect first-order autoregressive correlation and the Breusch-Godfrey Serial Correlation test to detect higher-order serial correlation. In detecting first-order autoregressive serial correlation, the Durbin Watson test indicates a hypothesis that shall be rejected or not to interpret the results. The null hypothesis of  $H_0: \rho = 0$  will be tested against  $H_1: \rho < 0$  in order to determine if there is a negative serial correlation present in the model, where the decision rules indicated to reject or accept the hypothesis are as follows:  $4 - d_L < d < 4 + d_U$  rejects the null hypothesis that there is no serial correlation thus a negative serial correlation is present in the model, test inconclusive with the condition  $4 - d_U \leq d \leq 4 - d_L$ , and under the condition  $d < 4 - d_U$  accept the null hypothesis that there is no serial correlation. In the detection of higher-order serial correlation, the Breusch-Godfrey Serial Correlation test was used; this allows the regression model's serial correlation even without the use of lagged dependent variables in place for the regressors. With the given hypothesis to reject or accept, the test regresses the residuals on all of the regressors that were used in the model and therefore determined the R<sup>2</sup> of the regression estimation.

- **Test for Heteroscedasticity**

There is Heteroscedasticity present in the data when the residuals variance is not constant, which can lead to incorrect interpretations, as the necessary hypothesis testing will be unreliable. There are two methods that can be used to detect



the presence of Heteroscedasticity; the first to be used is the Graphical Method, this is where the residuals are to be plotted on a graph against each explanatory variable. If the graph had shown a cone-shaped pattern, then this is commonly found to have the presence of heteroscedasticity in the model. The second test to be used is the Goldfeld-Quandt Test, which is to distinguish the equal residual variances of the groups of observations. This method implies that omitting a central observation can help aid the detection of heteroscedasticity. To test using this method, observations must first be arranged in ascending order according to the X values, then omit the central observation, more specifically is, the middle value and separate the difference of the central observation  $n-c$  into two subsamples with each observation in  $(n-c) / 2$ . Afterwards, regress the first  $(n-c) / 2$  observations and thus will result in the RSS1 and then obtain the RSS2. Using the formula above will then be able to show results for the hypothesis with a specific significance level. Conditions to reject or accept the null hypothesis are as follows: when the computed F has a greater value than the critical F at a specific level of significance, the null hypothesis is rejected that there is no heteroscedasticity; while if the F shows to have less than the critical F then it accepts the null hypothesis that there is no heteroscedasticity present in the model. The third test to use for heteroscedasticity will be the White test; in order to get a good result, one must be able to accept the null hypothesis of no visible heteroscedasticity in the model. This is done by estimating the residuals obtained using ordinary least squares with the constant regressors, the original regressors, their squares, and their cross-products. Thus, obtaining an  $R^2$  from the auxiliary regression.

- **Test for Specification Errors**

There are specification errors that can be observed in multiple regression analysis, thus can show problems in the estimation later on in the study. This can be seen under the types of specification errors; the first is omitting a relevant explanatory variable, which can be caused by the lack of data for the said variable. The second is the inclusion of an irrelevant explanatory variable, and the last is an incorrect functional form of the model. To test whether an added variable contributes to the explanation of the dependent variable, one must be able to reject the null hypothesis that the additional variables are not significant, showing that the variable does not belong in the equation model. This is done through Ramsey's Regression Specification Error Test (RESET), which can test two of the three types of specification errors, which include omitted variables and the incorrect functional form, where the estimate will be run through OLS by the restricted equation.

### **3.4 Sample and Sampling Technique**

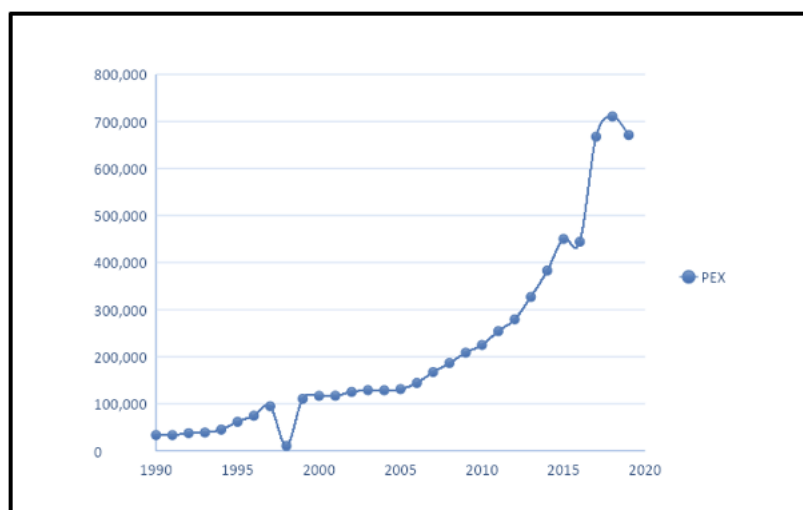
**Figure 3: The Economic Model**

Variable abbreviations of the econometric model are as follows:

- Public Education Expenditure
- y intercept or the constant term
- slope coefficient of Tax Revenue in percentage share of GDP
- slope coefficient of Total Population in Millions
- slope coefficient of Real GDP per capita
- slope of the Error term

## 4 Results and Discussion

### 4.1 Trendline



**Figure 4: The trend of Public Education Expenditure in the Philippines**

As shown in the graph (figure 2.), there has been a steady upward trend of public education expenditure in the Philippines from the years 1990 to 1997, but there was an observed massive decrease in expenditure in the year 1998. The years after that showed a steady growth of public education expenditure with an upward trend, which from a decline in the year 2016 showed an enormous increase of expenditure in the year 2017. That year with the proposed budget by the Philippine Budget Secretary Benjamin Diokno, the key area of funding to focus on was education, as this was one of the campaign promises by the Duterte Administration, also seen with the leap of the proposed budget by the Department of Education to aid the transition of the K-12 program. This was observed in the massive leap in education expenditure from the year 2016 to 2017 (Rappler, 2015). The trend of the public education expenditure in the country has shown an upward trend which validates the statement of the PSA in their National Education Expenditure Accounts that education expenditure continues to rise through time, with an occasional percentage decrease from specific periods.

### 4.2 Relationship of the Independent Variables with Public Education Expenditure

#### 4.2.1 Significance of the Parameters (t-tests)

Variable	Coefficient	T-statistics	P-values
Tax Revenue	0.020606	0.414726	0.6817

Hypotheses:

H0:  $\beta_2 = 0$ ,

H1:  $\beta_2 \neq 0$

Level of Significance: = 0.05

Degrees of Freedom: d.f.=28

T- statistics and p-values

t2= 0.414726

p2= 0.6817

Decision Rule: To reject H0, the p-value should be less than the significance level.

Decision and Interpretation: Since t2= 0.414726 with a p-value of p2= 0.6817 is greater than 0.05, it accepts H0. Thus, 2 shows no difference from 0.

The following hypothesis conditions and assumptions will be followed in the interpretations. The null hypothesis is equal to 0, and the hypothesis for each coefficient is not equal to 0. This will be followed along with each of the parameters that will either be rejected or accepted with a significance level of 0.05 or 5%. The coefficient of Tax Revenue shows how it affects Public Education Expenditure, in which an increase in tax by 1 unit will increase public education expenditure by 0.02. Although this does not completely hold in the model, as shown in the results, which indicate that there are varying differences in the relationship of the variables with Public Education Expenditure. The result of the probability with Tax Revenue and Education Expenditure indicates that they do not affect each other, with the stated p-value which accepts the null hypothesis, wherein the conclusion indicates that Tax Revenue does not affect Public Education Expenditure in the Philippines.

<b>Table 4.3 Relationship of Population with Public Education Expenditure</b>			
<b>Variable</b>	<b>Coefficient</b>	<b>T-statistics</b>	<b>P-values</b>
Population	5.93E-08	7.931319	0.0000

Hypotheses:

H0:  $\beta_3 = 0$ ,

H1:  $\beta_3 \neq 0$

Level of Significance: = 0.05

Degrees of Freedom: d.f.=28

T- statistics and p-values

t3= 7.931319

p3= 0.0000

Decision Rule: To reject H0, the p-value should be less than the significance level.

Decision and Interpretation: Since t3=7.931319 with a p-value of p3= 0.000 is less than 0.05; it rejects H0. Thus,  $\beta_3$  shows it is significantly different from 0.

The results on the coefficient of this variable imply that an increase in population by 1 unit will increase public education expenditure by 5.93, showing a positive and direct relationship of these variables with one another. In their regression results by the value of the variable's P-value and at the given level of significance of the model, Population rejects the null hypothesis and thus indicates that it shows a significant effect on Public Education Expenditure.

<b>Table 4.4 Relationship of Real GDP per capita with Public Education Expenditure</b>			
<b>Variable</b>	<b>Coefficient</b>	<b>T-statistics</b>	<b>P-values</b>
Real GDP	0.087629	1.969614	0.0596

Hypotheses:

H0:  $\beta_4 = 0$ ,

H1:  $\beta_4 \neq 0$

Level of Significance: = 0.05

Degrees of Freedom: d.f.=28

T- statistics and p-values

t4= 1.6969614

p4= 0.0596

Decision Rule: To reject H0, the p-value should be less than the significance level.

Decision and Interpretation: Since t4= 1.6969614 with a p-value of p4=0.0596 is greater than 0.05; it accepts H0. Thus,  $\beta_4$  shows no difference from 0.

The results on the coefficient of this variable imply that an increase in population by 1 unit will increase public education expenditure by 0.08, showing a positive and direct relationship of these variables with one another. Although this coefficient does not particularly hold in the model as their regression results state that the given p-value of Real GDP per capita in the Philippines indicates that it accepts the null hypothesis; thus, it shows that Real GDP per capita does not have a significant effect on Public Education Expenditure.

#### 4.2.2 Goodness of Fit: Coefficient of Determination

<b>Table 4.5 Estimation Equation of the Regression</b>	
<b>R-squared</b>	0.877772
<b>Adjusted R-squared</b>	0.863669

The R<sup>2</sup> of the economic model of Public Education Expenditure states that the variability of the variable's population, tax revenue, and GDP per capita is 87.78%, close to the variability in the public education expenditure in the country. This proves that the overall model designed has a strong standing and relationship with one another, which will help the interpretations of the study. The adjusted R<sup>2</sup> will define the variability of the variables with the adjustment of the degrees of freedom, and this is by 86.37%

#### 4.3 Significance of the Model (f-tests)

<b>Table 4.6 F-statistics and Probabilities</b>	
<b>F- statistic</b>	62.23911
<b>Probability</b>	0.000000

Hypotheses:

H<sub>0</sub>: R<sup>2</sup> = 0

H<sub>1</sub>: R<sup>2</sup> ≠ 0

Level of Significance: = 0.05

Degrees of Freedom: d.f.=28

F- statistics and p-values

F=62.23911

p=0.00000

Decision Rule: To reject H<sub>0</sub>, the p-value should be less than the significance level.

Decision and Interpretation: Since F=62.23911 with a p-value of p = 0.0000, which is less than 0.05, it rejects the H<sub>0</sub>. Thus, the R<sup>2</sup> is significantly different from zero.

The tests show that the overall significance model of the study holds true, given that the results accept the R<sup>2</sup> value at its level of percentage.

#### 4.4 Test for Multicollinearity

<b>Table 4.7 Variance Inflation Factor</b>	
<b>Auxiliary Regression</b>	<b>VIF</b>
Tax Revenue	1.378210
Population	2.296887
GDP	1.799870

**4.4.1 Variance Inflation Factor**

H0: there is no multicollinearity  
 H1: multicollinear is present

The value of the variance inflation factor of each variable is stated as follows, Tax Revenue with 1.378210, Population with 2.296887, and GDP with 1.799870. In the condition for multicollinearity to be detected, the VIF must be greater than 10 (Gujarati, 2013). As seen with the results, the values are less than 10; thus, the results accept the null hypothesis that there is no multicollinearity.

**4.5 Test for Serial Correlation**

**4.5.1 Durbin-Watson Test**

<b>Table 4.8 Durbin-Watson Statistic</b>	
<b>d-statistic</b>	2.360474

Hypotheses:

H0: there is no serial correlation at up to 1 lag  
 H1: serial correlation is present

Level of Significance: = 0.05  
 Number of Regressors: k =3  
 Sample Size: n =30  
 Lower Boundary of d: dL =1.214  
 Upper Boundary of d: dU =1.650  
 d- statistic  
 d=2.360474

Decision Rule:

If d is less than dL, reject H0 or  
 If d is greater than dU, accept H0  
 If d is less than dL and is greater than dU, test shows inconclusive.

Decision and Interpretation: Since d=2.360474 is greater than dL =1.214 and dU =1.650 accept H0. The d- statistic with a value of 2.360474 indicates that there is no serial correlation at up to 1 lag. To further test for the presence of serial correlation in the study at up to 2 lags, the Breusch-Godfrey Test was done.

**4.5.2 Breusch-Godfrey Test**

<b>Table 4.9 Breusch-Godfrey Test</b>	
<b>Number of Lags</b>	<b>Prob. Chi-Square</b>
2 lags	0.5378

Hypotheses:

H0: there is no serial correlation at up to 2 lags  
 H1: serial correlation is present

Level of Significance: = 0.05  
 Prob. Chi-squares: p=0.5378  
 Decision Rule: If p-value is less than the significance level of 0.05, reject H0  
 Decision and Interpretation: Since p=0.5378 is greater than 0.05, this rejects H0.

The tests of Durbin-Watson and Breusch-Godfrey show that there is no serial correlation present among the regressors at 1 to 2 lags.

#### 4.6 Test for Heteroscedasticity

##### White Test

Table 4.10 White Test	
Obs*R-squared	Prob. Chi-Square
14.29841	0.0973
Variables	Probability
TAX^2	0.2772
TAX*POP	0.1226
TAX*GDP	0.6527
TAX	0.6621
POP^2	0.2237
POP*GDP	0.4095
POP	0.7484
GDP^2	0.0337
GDP	0.7590

The tests had shown with the given p-values presented on the table of the auxiliary regression and with the significance level of 0.05 that all variables do not show a heteroscedastic nature. Given the conditions that the p-values must be lower than the significance level set at 0.05, then will it only accept the null hypothesis of a homoscedastic residual in the variables tested. The result of White at its Obs\*R-squared with a prob-chi square value of 0.0973 shows that the residuals of the regressors are not heteroscedastic and show no constant variance among each other.

#### 4.7 Test for Specification Errors

##### Ramsey RESET

Table 4.11 Ramsey RESET Test	
F-test	Probability
0.120954	0.7234

Hypotheses:

H0:  $R^2 = 0$

H1:  $R^2 \neq 0$

Level of Significance: = 0.05

F-test Probability:

$p = 0.7234$

Decision Rule:

If p-value is less than the significance level of 0.05, reject H0

Decision and Interpretation: Since  $p = 0.7234$  is greater than 0.05, this accepts H0. Thus, it shows that the  $R^2$  of the auxiliary regression is not different from zero.

This shows that there is no error done in the econometric design of the variables, validating that the variables are in their correct functional form. Thus concluding that there is no misspecification on the variables, stating that the variables are in their correct functional form.

#### 5 Conclusion

The results conjured by the following tests presented above have suggested that the variables; economic growth, tax, and population growth show signs of a positive relationship with the dependent variable education expenditure, derived from a time

series data from 1990 to 2019. Given the minimal relationship among variables, the researchers have concluded that these indicators can and will indeed influence public education expenditure in the Philippines. These variables, if considered carefully, can influence public education expenditure and bring out the financial resources required by the education sector. A growing population is an indicator of growing need, as explained in the introduction and the review of literature presented in this paper. The same goes for the Gross Domestic Product and Taxes, as both stand as important facets for financing the necessary services required by the people of a particular state. In the discussion of the regression results with each variable of Tax Revenue, Population, and Real GDP per capita, the results provide evidence that the Wagner's theory does not hold with the observed relationship of these variables with one another, compared to the findings of Yun and Yusoff (2018) where it was also observed in this paper as their findings show that there was an observed positive relation of tax revenue with education expenditure, also with the relationship of Real GDP per capita in which there was an observed increasing effect of this variable along with Public Education Expenditure. Their study also indicates that Real GDP in their model may have an increasing effect on expenditure, but it does not have a significant impact on the dependent variable. The variables used in the study showed that there was a negation in terms of significance among the variables presented in Wagner's law in the Philippines. However, there was an observed positive relationship between the coefficients of the independent variables in Public Education Expenditure in the country. This implies that the two variables of Tax Revenue and Real GDP do not affect the dependent variable of the study, thus further negating the presence of Wagner's law at the given significance level set, but with a higher level, it will indicate that Wagner's Law holds in the Philippines. Where in the case of Population, it shows a positive and significant relationship with our dependent variables, which implies that the Peacock and Wiseman somehow holds, but with the negation in the variables, Tax Revenue shows an inconclusive result of the hypothesis.

### **5.1 Recommendations:**

- The need for more years to include in the analysis to assess the actual effect of the theories used in the study, as seen in one of the variables where a higher significance level would change the significance of Peacock and Wiseman in the economic model.
- Future researchers are encouraged to replicate the data and variables utilized in this study and incorporate new variables as mentioned in the studies in the review of related literature of this study. The use of Gross Domestic Product may be altered in the cause to redefine economic growth.
- Future researchers should explore the political repercussions involved in public education expenditure to further eliminate the limitations faced by this study.

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