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Master's Thesis of Public Administration

**Does Public Investment in Education
Matter for Economic Growth?
Evidence from Four Central American Countries**

**교육에 대한 공공 투자가
경제 성장에 중요한가?
중앙 아메리카 4 개국의 증거**

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**Graduate School of Public Administration
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Abstract

Does Public Investment in Education Matter for Economic Growth?

Evidence from Four Central American Countries

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This study aims to determine the impact that the public investment in education, as a whole, and in their different levels has on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala by using panel data analysis from 2004 to 2018.

Gross Domestic Product were used as a measure of economic growth; expenditure in primary, secondary, and higher education was chosen as the independent variables. Moreover, five control variables were included in the model. A panel data model was used because allow us to observe multiple phenomena over multiple periods. The study revel that expenditure in primary and higher education has a significant positive contribution to the economic growth of the countries under study.

Key Words: Economic growth, public investment, education, Central America.

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Chapter 1. Introduction

1.1 Purpose of the Study

The accumulation of human capital through education has been recognized as an essential factor in a country's development process. Education is thought to be beneficial because it decreases inequality, improves the quality of life, raises the income level, and facilitates economic growth. (Loening, 2005).

The last educational results of the Dominican Republic and Costa Rica are known in the world. They are recurrently occupying the last places on the Program for International Student Assessment (PISA) of the Organization for Economic Co-operation and Development (OECD). Even though they are both placed in the last places of the rank, exists a difference between them. In 2018, with a total of 79 countries participating in this Student Assessment, Costa Rica occupied the places 64, 61, and 50 in Mathematics, Science and Reading, respectively, and the Dominican Republic 79, 79, 78.

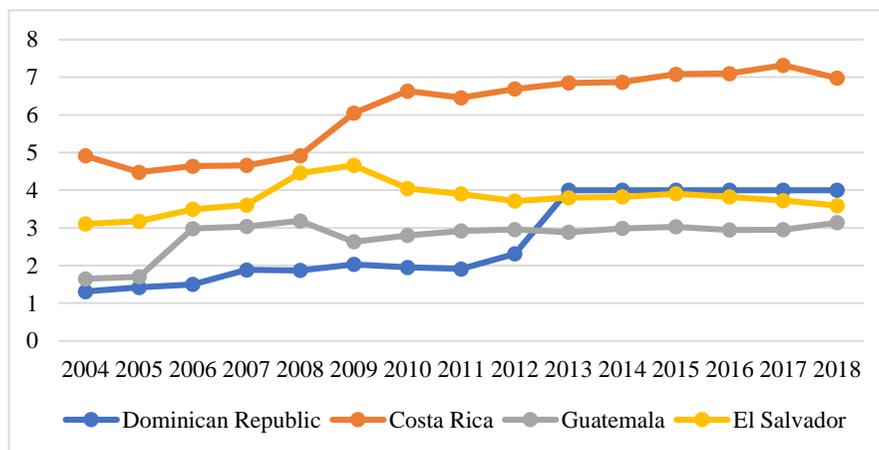
These results can be related to the percentage of Gross Domestic Product (GDP) destined to invest in education and the implementation efficiency. As is shown in Graphic 1, since 2013, Costa Rica has been investing between 6.8% to 7% of its GDP in the education sector, while the Dominican Republic has been static at 4%. El Salvador and Guatemala are not even part of this assessment, and their investors have not exceeded the 3.8% of their GDP.

Historically, it may be that a certain degree of development and growth in Latin American countries was attainable with a skilled elite and a large number of unskilled workforces. Since the economy has been diversified over time and is now less dependent on agriculture than before (Segovia and Lardé 2002), the past exclusionary education policies may present an obstacle for future growth.

After a social mobilization, in 2013, the Dominican Republic government increased the budget allocation for primary and secondary education to the highest level in Dominican history, 4% of GDP. This increase

in the investment has made it possible to the promotion of national policies, such as comprehensive early childhood care, updating the curriculum by competences, and the extended school day until 4 p.m., in this last one, 2400 classrooms have been built, and 1,285,973 (69%) students from the public sector have access. (Lapaix, 2014)

Graph 1 Government Expenditure on Education as a % of GDP



Source: Author, based on World Development Indicators, World Bank.

Costa Rica has made a relevant effort in investment in education, from 4.91% of GDP in 2008 to 7.09% in 2016. Compared with the countries under this study and Latin American in general, the amount allocated to financing education in Costa Rica can be considered high. In 1997 they made a constitutional reform, and it was established that public spending on education should be greater than 6% of GDP (Programa Estado de la Nación, 2005; Molina, 2007). However, in 2001 the percentage of GDP assigned to the education sector barely achieve 5%, and it was only until 2009 that the country managed to invest 6.04%. This increment was an effort at a slow pace, but the result of this reform is that by 2015 the country managed to provide 7.08% of GDP to education.

Looking at the trend of the budget assigned to the education sector in El Salvador, we can observe that the period with the highest growth was during 2004 and 2009, with an increase from 3.10% to 4.65%. This increment can be

explained by the fiscal reform of 2004, promoted to reduce tax evasion and avoidance, producing an increment of the Government's investment capacity, ending with a period of decrease with a 3.59 % in 2018. In general terms, the data reflects a slow growth of public investment in education during the past eight years and invisibility presence in the International Student Assessment.

The investment that Guatemala has made in education compared to the regional and international context places the country among those who invest the least in their citizens' education. From 2009 to 2015, on average, it has been 2.99% as a percentage of GDP.

Throughout history, many studies have shown the positive relationship between economic growth and various macroeconomic factors like human capital. To ensure productive human capital, governments across the globe invest a considerable amount of money in education, even though some countries spend less than others. Mitra (2011) argue that a better-educated population has less unemployment, reduced dependence on public assistance program, and more significant tax revenue, a well-educated nation benefits the whole country.

A review of the empirical literature suggests that investments in human capital are usually understood as an investment in education (Becker, 2007), allow people to gain several knowledge and skills that no technological development can change. Education can be defined as “the stock of skills, competencies, and other productivity-enhancing characteristics” (WEF 2016).

Many reasons can explain the importance of education for a country, yet this study focuses on its contribution to economic growth and outcomes. In general, education as a critical component of a country's human capital increases each worker's efficiency and helps economies move up the value chain beyond manual tasks or simple production processes (WEF 2016).

The examination of the relationship between economic growth and public investment in education has been debated for decades. Education contributes straightforwardly to economic growth by making workers more productive and indirectly by creating knowledge, technical skills, and ideas (Larocque, 2008).

Somewhat surprisingly, relatively few studies at the macro level address the question of level-specific education effects, and among them, Central American cases have not been found. With this in mind, the current study seeks to identify the overall and individual contribution that the investment in education, as a whole, and in their different levels has on the economic growth of four Central American countries.

The investment in human capital as a driver of economic growth has been one of the economic analysis concerns for both developed and developing countries. The purpose of the current study is to identify the impact that public investment in education, as a whole, and in their different levels have on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala over the past fifteen years (2004-2018).

This study is expected to contribute new information to guide policymakers on how they can face the economic and social development in education. Examining education in a disaggregated way also provides more abundant evidence since it indicates how resources should be divided between different education levels.

1.2 Research Questions and Hypothesis of the Study

To explain the impact that public investment in education, as a whole, and their different levels have on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala, the following research question is formulated:

What is the impact that public investment in education, as a whole, and disaggregated in their different levels has on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala?

This research has the following assumptions:

Our main hypothesis is that the Public Investment in education, as a whole, has a positive impact on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala.

This main hypothesis is divided in three sub-hypotheses, the first one is that the Public Investment in Primary education has a positive impact on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala.

The second is that Public Investment in Secondary education has a positive impact on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala.

The third hypothesis is that Public Investment in Higher education has a positive impact on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala.

1.3 Significance of the Study

The importance of the current study comes from the fact that it is one of the first empirical research that tries to understand the impact that public investment in education has on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala over the past fifteen years. Focuses not just on the expenditure of education but on the contribution that the investment in the different levels of education has on economic growth. It also has the benefit of providing other countries with similar economic and social panorama the tools to answer the same situation.

This study will be structured as presented below:

Chapter 1 gives the framework in which the study is intended to be developed regarding the background and purpose of the study, research questions, and hypothesis. Chapter 2 describes the literature review that guides the investigation. Includes the different growth theories, an examination of the link between human capital, education, and economic growth.

Chapter 3 defines the methodological approach adopted for the research to give the reader a clear image of the sources of information, variables analyzed, and methodology used. Chapter 4 presents the descriptive statistic, findings, and analysis of the study. Chapter 5 analyze the implications of the findings in terms of conclusions and recommendations.

Chapter 2. Review of the Literature

2.1 Theories of Economic Growth

The history of economic growth is as long as the history of economic thought. Growth theories and models have changed over time, correlating, and progressing with economic reality dynamics, using factors and instruments of economic analysis to be appropriate for development stages. The economic growth theories study the determinants of long-term economic growth and the policies that must be promoted to stimulate growth.

The classical growth theory postulates that a nation's economic growth will be reduced if an increment of population and resources decreases. Such postulation is a consequence of classical growth theorists' belief, who agree that a temporary increment in the real GDP per person indeed conducts to a population explosion, which would limit a nation's resources, consequently reducing the real GDP. As a result, the country's economic growth will start to slow.

Theorists such as Adam Smith, David Ricardo, and Thomas Robert Malthus were the first to study the subject of growth and introduced fundamental concepts such as diminishing returns and its relationship with physical or human capital accumulation.

Smith indicates that the extension of the market was limiting economic growth and that economic growth occurs when the country's wealth increases, this increase is produced by combining three factors, capital, labor, and land, the same factors that Ricardo present in his theory¹. He argues that the land as a growth factor is restrictive because, at some point, the land would end, so no more could be produced, and the economy would stop growing.

Smith, Malthus, and Ricardo are the pioneers of systematic studies on economic growth, despite others' speculations before them, because they questioned the origins, causes, and limits of economic expansion and the wealth

¹ Theory of wealth distribution introducing the concept of "diminishing returns to land" and its consequences.

of nations. The ideas of this school reached its highest level of development in the works of Ricardo.

Ricardo², following the classic theory of Thomas Robert Malthus, argued that the population factor determines a large part of wealth and the relationship between wealth and population is inversely proportional in the future. This relationship occurs because as the population increases, the demand for resources increases subsequently in the short term; nevertheless, in the long run, it causes a shortage of resources in the economy, which leads to the contraction of the economy in the long run term, and vice versa when the population remains low, it demands few resources in the short term. However, in the long term, the economy remains stable, and if the population is below the number of resources, then the economy will grow in that proportion.

According to the classical theorist, money does not influence the real economy; it is neutral. Because the real factors of the economy, such as the production level, employment, and consumption, are not concatenated with the nominal ones, like the level of price, wage, or exchange rate, reflecting the well-known classical dichotomy in the matter. In this regard, any increase of money supply would be transposed into a generalized increase of prices, not into production surplus (Snowdon & Vane, 2005).

The classical model of growth ignores the role efficient technical progress could play for the economy; that is why it has progressively turned into a distinct theory.

Based on the classical growth theory, the neoclassical growth theory was born; this new one is the balance of a competitive economy over time. Specific attention is paid to the accumulation of capital goods, growth in population, and technical progress instead of the land. Explains in what way the capital accumulation and technological changes affect the economy; this is

² Ricardo, D. (1993). *The principles of political economy & taxation*. J.M. Dent & Sons.

explained in the analysis of the economic growth process that being the Solow's neoclassical growth model³. Solow's economic growth model describes different possible situations, allows the explanation of extensive growth and that where the growth is of intensive nature as a result of the intervention of exogenous technical progress.

Unlike the classical growth theory that established that the factors that influence economic growth are land, capital, and labor, this growth model outlines how a steady economic growth rate results from a combination of three forces, labor, capital, and technology. They argue that technological change has a significant influence on an economy, and economic growth cannot continue without technological advances. While an economy has limited resources in terms of capital and labor, the contribution from technology to growth is limitless.

As Hahn (2010) explains, what Solow and Swan proposed is not a growth theory; it aims to supply an element in an eventual understanding of certain important factors in the growth and provide a way of organizing one's thoughts on these matters.

Neoclassical models assume that the economy accomplishes equilibrium in the long run. Besides, they confirm the existence of a convergence, which means faster development of emerging nations than rich ones. The convergence hypothesis says that countries differ only in capital/labor ratios, and they have the same steady-state. Hence, the economies with a lower level of income per capita will achieve a higher rate of growth (Piętak, 2014).

The main difference between the classical and neoclassical growth models is that for the first one mentioned, the population is endogenous, and for the neoclassical second one is exogenous.

³ Solow (1956) developed the neoclassical growth model, ten-month later Swan (1956) published a more complete analysis of technical progress. Sources and references sometimes call it the "Solow-Swan growth model", but more commonly is made only to the "Solow growth model".

Romer (1986) argues that long-term economic growth is a function of accumulating an intangible capital good, such as knowledge (carried through technology and education), which is undertaken by profit-maximizing economic agents.

It is recognized that the productivity of knowledge tends to grow limitlessly and to show increasing returns to scale; Furthermore, the production of knowledge increases as there is no limit to the accumulation. Technological change, for the exponents of this theory, requires extensive investments in education with a view to the formation of human capital and technological research.

The neoclassical economic growth models are reformulated by incorporating the incidence of human capital or worker skills (Lucas, 1988). This economic theory of human capital is based on the time dedicated by individuals to their training and acquisition of skills to improve future workers' efficiency and productivity.

Determinants of Economic Growth

Chirinos (2007) studied economic growth determinants, reviewing the existing literature, and estimates for 1960-2000. The author starts from Solow's work, ⁴ where it was established that growth could not depend merely on the accumulation of capital and productive factors. Then, it went on to Barro's study, which pointed out the determined relationship between economic growth and levels of schooling and political stability. From this last contribution, different authors started to study and propose new determinants for economic growth that we can see in table 1.

Table 1 Determinants of Economic Growth

| Determinant | Indicator |
|--------------------------------------|---|
| Physical capital and infrastructures | Investment ratio, infrastructure measurements |

⁴ Solow, R. (1957) Technical Change and the Aggregate Production Function. *The Review of Economics and Statistics*, 39 (3).

| | |
|-----------------------------|---|
| Human capital and education | Enrollment rate by educational levels |
| Structural policies | Degree of inequality, Gini coefficient, public consumption, and degree of commercial openness. |
| Stabilization policies | Inflation, cycles, macroeconomic volatility. |
| Financial conditions | Ratios of financial deepening, insurance market. |
| External conditions | Terms of trade, foreign aid, risk premium, and changes of specific periods |
| Institutions | Social capital, religion, level of corruption, quality of institutions, ethnic and linguistic diversity |
| Geography and population | Latitude, size of the workforce, scale effect of regional dummies, Mediterraneanness |

Source: Chirinos (2007)

The classification above is not intended to be categorical but rather to present the determining potentials systematically, given the considerable number of these in the empirical literature. It is worth mentioning that Sala-i-Martin et al. (2004) present a list of up to 67 variables that could become determinants of growth.

Among the determinants mentioned in Table 1, researchers such as Levine and Renelt (1992) have emphasized the robustness of the variable “capital and infrastructure” along with the level of income and have exposed as evidence their study where physical capital was the variable that explained the average growth in a sample of 119 countries in the period 1960-1985. It is also convenient to consider that the better an economy is invested with infrastructure, the better the platform for growth.

About the variable Human Capital and Education, Chirinos (2007) explain that the disparities in income levels predicted by the neoclassical model

improved sustainably as the weight of the capital factor in the production function increased, which was equivalent to the fact that in the national accounts the factor that received the highest compensation was capital and not the labor. This prediction was accurate considering a new definition, human capital, according to which an individual's productive capacity can be increased through improvements in their health and education.

A positive relationship between enrollment rates in primary and secondary education and economic growth have been found by Barro (1991) when he registered a cross country study between 1960 and 1985. Lucas (1998) emphasizes the process of acquiring human capital through two primary sources: formal education and learning through practice; He affirmed that those economies that registered the most significant accumulation of human capital over time would result in those with the highest growth rates. Nelson & Phelps (1966) explains that the disparities between the countries growth rates are the capital stock accumulated by each country. We have to clarify that this approach gives rise to scale effects, meaning that economies with a larger labor force tend to grow faster.

Regarding structural policies, there are defined as those characteristics of a country that are not easily modified in the short term, as trade liberalization, the coefficient of inequality, and government consumption. Trade liberalization, it is considered as a significant variable, given the demonstrated economic growth in commercially open economies, due to 5 channels: greater specialization, taking advantage of economies of scale as a result of the expansion of local firms, reduction anti-competitive practices, diffusion of technological innovations and best business practices learned from abroad.

Numerous authors such as Alesina and Rodrik (1994) highlight the ambiguous effect that the variable coefficient of inequality has on growth; this, due to the unequal distribution of income, which may be beneficial for the poorest if these differences in income represent incentives and encourage savings, or harmful if it generates greater macroeconomic volatility. Barro and Sala-i-Martin (1999) have concluded that the provision of public goods is seen

as a positive factor because it stimulates growth. However, it is financing through taxes distorts the economy that retard growth.

Moving on to the determinant, stabilization policies, we can say that poor government performance generates macroeconomic instability and tends unfavorable to economic growth. The effect of this behavior is notable through inflation and product volatility. Authors such as Barro (1997) conclude in the strictly negative relationship between growth and inflation, and others such as Easterly & Levine (2002) and Loayza & Soto (2002) , who present inconclusive studies regarding the relationship mentioned above. About macroeconomic volatility, its positive and also negative effects have been discussed by different authors. Loayza (2003) and Ramey & Ramey (1995) are the first to indicate a negative relationship between volatility and growth, being more extensive if the country is of low income. If the country lacks the institutional mechanisms to reduce the inherent risk of an investment, the resulting uncertainty would be unfavorable to the growth.

King and Levine (1993) studied financial growth and incorporated the country's financial conditions as a determining factor in economic growth. It contributes to the effective allocation of capital through different channels, such as mobilizing savings, reducing transaction costs, and risk diversification credit, among others. Among the different ways to measure the effect of the financial system and stability on GDP growth, Levine (1997) proposes that the degree of participation of the Central Bank in banking operations compared to the total amount of banks in the system and the credit to the private sector as a percentage of GDP is the most effective. Authors such as Claessens & Laeven (2003) expose that financial markets operate more adequately when property rights are well defined because enhancing and guarantee companies' access to capital markets.

In addition to the factors cited above, others are determinant for growth, such as the shocks to trade and changes in the world economy. Blattman (2007), affirming that price volatility affects less developed economies and favors long-term growth in industrialized economies.

As a penultimate determinant is the inclusion of institutional factors, a set of formal and cultural rules of interaction between agents in society, mechanisms to ensure compliance since they contribute to reducing transaction and information costs of a market. These can be corruption, religious beliefs, institutions' quality, democracy, and social division. Acemoglu et al. (2001) indicate that countries with better institutions guarantee more adequacy property rights and avoid policies that distort private agents' investment decisions. The inclusion of institutional and cultural factors in the growth regressions is increasing, helping to reduce the part not explained by production's physical factors.

Characteristics such as the size of the country (a large country has more possibilities of sharing borders with other countries), access to the sea or not (a Mediterranean country has fewer possibilities of carrying out commercial activities by the seaway), and the size of the labor force are the ones studied by Frankel & Romer (1999), they point out that geography is a powerful determinant of bilateral trade and in general for the total trade of a country, the latitude or distance in degrees from the Equator is also considered a geographical characteristic that affects growth.

2.2 Education and Economic Growth

Education raises an individual's competence and creativity and promotes entrepreneurship and advances in the technology industry (Ozturk, 2001). In its methodical sense, education is the formal process by which society, through educational institutions at all levels (schools, colleges, universities, and other institutions), deliberately transmits its cultural heritage and its accumulated knowledge, ideals, principals, values, and skills to the next generation. (European Union Commission, 2016). Education is the human capital of a nation, is essential to the process of nation structure, and should be given importance in the development efforts.

Like other capital, human capital⁵ grows through being invested in, and that investment is called education. Not all education is completed in schools; families are an incredibly important part of the process. However, education in schools is perhaps the primary lever for policies on human capital.

The concept of “human capital” implies human beings’ productive capacities as generators of income and wealth in an economy. The effects of human capital on economic growth have been studied for many years. From the beginning of this century, the discussion on the role of human capital in growth presents two positions: the first is that although human capital affects economic growth, it is not the only factor, and others could explain the growth to an equal or even greater extent.

The second position defends the posture that the effect of human capital has been underestimated in the estimates of economic growth and that this capital could be explaining a much larger proportion of the observed growth.

Acemoglu & Dell (2010) analyze the differences between the per capita income of different municipalities in various countries from Latin America. They find that differences in human capital explain about half of these differences. However, the other half of the differences are institutional, geographical, and even cultural.

Human capital explains a larger part of economic growth has been gaining ground at the level of recent empirical studies. Gennaioli et al. (2014) build a regional database and carried out econometric estimates; these authors find that human capital differences explain most of the per capita product differences of the analyzed regions. However, authors insist on the need to separate human capital from workers and of entrepreneurs, which, at least at a theoretical level, have different effects on economic growth.

⁵ Burguess (2016) take human capital as the stock of skills, traits, and knowledge that an individual possesses. In his study of Human Capital and Education he emphasis that there are multiple valuable skills, and that human capital does not just mean IQ coefficient. It is really only relatively recently that researchers have begun to map out the range of skills that can be considered part of human capital and we cannot yet determine precisely which types of human capital matter most in particular eras and contexts.

Manuelli and Seshadri (2014) first propose a theoretical model that calibrating it allows them to build human capital pools by country. After this analysis, the cross-sectional econometric study shows that the human capital has a remarkably high influence on factor productivity total, which, in turn, in economic growth.

All the studies have been done on the profitability of investment in education and training to confirm its high returns and externalities. The 1991 “world development report” produced by the World Bank shows that, in developing countries, if the workforce's average period of education is increased by one year, the Gross Domestic Product grows by 9% per year.

Education's public investment is one of the key elements of development. Graphic 2 offers an overview of the impacts concerning economic returns to education. An increase in individuals' incomes directly affects while increasing externalities associated with education is indirectly (Dahlin (2005); Heckman and Klenow, (1997) and Michaelowa, (2000)). At all levels (macro and micro), investment in education is very advantageous for society and directly and indirectly affects the system.

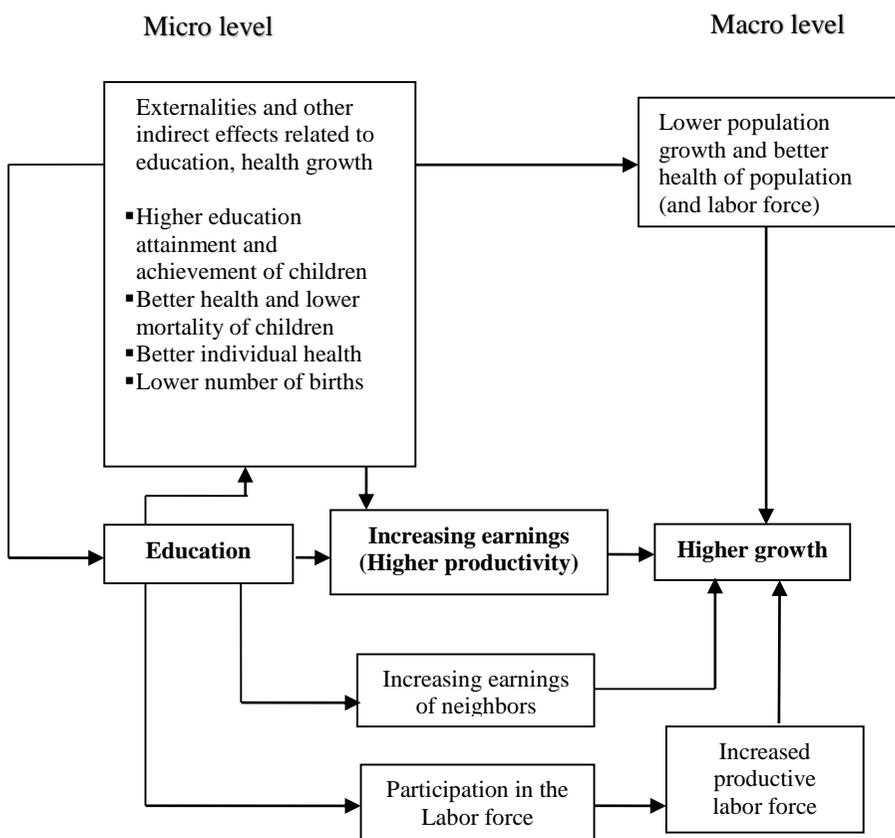
The decreasing industrial capacity utilization, the incrementation of unemployment, the rising of poverty, threats by social insecurity by ebullient jobless youths, and structural inequality and system configuration result from an inadequate educational system (Borishade, 2001).

Barro (1991) used data of 98 countries for the period between 1960-1985 and searched the empirical relationship between economic growth and some of its possible determinants such as investment and public spending in human capital, using for these various measures such as approximation of both real public investment and initial human capital.

For decades and in recent history, the relationship between public investment and economic growth has been studied by different authors; this empirical evidence considers different approaches, variables, and methodologies but detects one common thing, the existence of economic growth induced by education.

Furthermore, many authors consider investment in education an essential element for economic growth and have established a vast literature that relates investment in education and economic growth. For example, Gylfason & Zoega (2003) studied the influence of gross secondary-school enrolment, public expenditure on education relative to national income, and expected years across countries of schooling for girls to the distribution of income as measured by the Gini coefficient as well as to economic growth.

Figure 1 Economic Returns to Education



Source: Adapted by the author from Michaelowa (2000).

Studies found that these proportions of education are straightforwardly identified with income equality. It likewise finds that more and better education

directly empowers economic development and indirectly through increased social equality and cohesion.

Bommier & Lambert (2000) have examined the relationship between schools and school enrollment rates, the common in their studies is that the outcome of having an available school nearby on school enrollment rates is positive. Filmer (2007) confirms that there is a positive relationship between school availability and school enrolment rates but adds that the scale of the effect is small. Gupta, Verhoeven, and Tiongson (1999) and Gallagher (1993) provide empirical evidence for a positive relationship between public education expenditure and school enrolment rates.

Self and Grabowski (2004) studied the impact of education on income growth in India by categorizing the education into the primary, secondary, and tertiary to determine which category of education has a causal impact on growth. Moreover, the education variables are also fragmented by gender, and the analysis is carried out to determine whether casual results change by gender. The results suggest that primary education has a strong and solid casual impact on growth than the impact of secondary education.

In another study from Tilak (2007), tried to prove that secondary and tertiary education levels are not necessary for the economic growth of the country, while post-elementary education is more important, especially for the diminution of poverty, a reduction of infant mortality rate, an increment in life expectancy and particularly for the economic growth of the country.

Ararat (2007) examines the role and impact of education on economic growth to estimate different educational levels' connotation, for initiating substantial economic growth that now is developed in the Russian Federation and Ukraine as the two largest economies of the former Soviet Bloc. This study estimates the linear and log-linear equations and model of endogenous economic growth that account for different time lags in the possible impact of higher education on economic growth.

The outcomes from the system of equations indicate that an increment of citizens' access to higher education brings positive results for the per capita

GDP growth in the long term. To increase sustainable economic growth, it is necessary to increase the number of college-educated specialists.

Using a simple regression equation to measure the contribution of higher education to economic development from 49 countries in the Asia Pacific region, Tilak (2003) found a significant effect on the level of economic development (represented by GDP per capita). He pre-empted the argument that a correlation between the two could only exist by letting a time lag for higher education causes economic development. The more considerable the population with higher education levels, the higher the potential for economic growth. There are reasons to suspect a direct relationship between the educational levels of the population and economic growth. This relationship is so because individuals' productive, innovative, and creative capacity seems to depend directly on the educational levels reached on average by the population.

Almajdob & Marikan (2019) explored the dynamics of education and economic growth expenditure in selected five major Arab countries with balanced panel data from 2000 to 2014. The results show that there is a long-term balance between education and economic growth expenditure in all countries. The study argues that education is an essential economic growth ingredient in all five major Arab spring countries.

Babatunde & Adefabi (2005) investigated the long-run relationship between education and economic growth in Nigeria, and their result establishes a long-run relationship between education and economic growth. A labor force well-educated significantly influences economic growth through total factor productivity and factor in the production function. On the contrary, Ayara (2003) offered proof of the relationship between the paradox of education and economic growth in Nigeria using the standard growth-accounting model. The results indicate that education has not had the expected positive growth impact on economic growth.

Mallick et al. (2016) investigate the effect of expenditure on education and economic growth in selected 14 major Asian countries using balanced panel data. The results expressed long-run equilibrium relationships between expenditure on education and economic growth in all the countries. The study

argues that the education sector is one of the important ingredients of economic growth in all 14 Major Asian countries studied and that the Education sector should be given priority by enhancing the expenditure in various elementary, higher, and technical educations in the respective nations.

The outcomes are different depending on the model specifications and the data sets in use. Nevertheless, of the precise model implemented, there appears to be strong evidence that higher educational contributions increase productivity and economic growth. Akram & Pada (2009) present a brief overview of the studies on the relationship between education and economic growth performance.

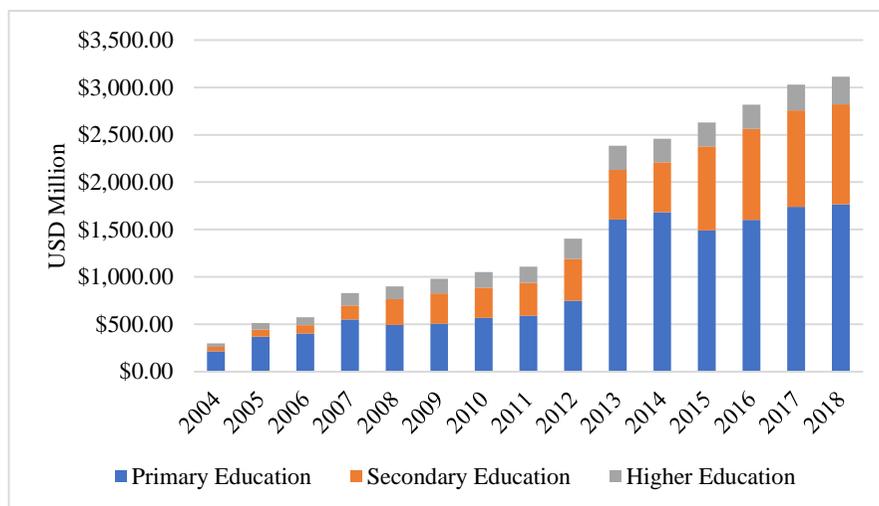
Even though every researcher had a different approach to their work, the results seem similar. The literature review supports the notion that there is a positive relationship between education, economic growth, and development in developed and developing countries.

2.3 Historical Educational Investment Context of the Selected Countries

To better understand the impact of the investment in education, it is useful to relate the country context and events during the educational reform and the implications of policies designed to improve educational outcomes that the different countries under study have adopted.

Dominican Republic

Graph 2 Dominican Republic Expenditure in Education by Levels



Source: Author, based on World Development Indicators, World Bank

Investment in education in the Dominican Republic was distinguished by its randomness. This characteristic results from the “main concern” of the governments that have administered public affairs in those periods and of the systemic events that have affected national finances. The budgets of education and those of social spending served the ruling parties to balance the moment's public accounts in many of these economic crises (Lapaix, 2014).

The Dominican Republic experienced a banking crisis⁶ between 2002 and 2004, a financial event that unbalanced public finances' entire configuration. Likewise, this decade marks the development of the budgetary and fiscal constraints known nowadays in the Dominican Republic, electric deficit, quasi-deficit, and increase in total public debt. As we can see in Graph 2, in 2004, the investment in education did not even reach USD 400 million. Fell by 1.30 percent of GDP, a level lower than that experienced in 1992, which was 1.33% of GDP.

⁶ The banking crisis was caused by a series of bank fraud of more than USD 4.9 million, highlighting the fraud of the Intercontinental Bank (BANINTER), equivalent to USD 3.1 million, and a flight of capital from the international reserves of the Dominican Central Bank.

In 2008 when the government started the Second Decennial Educational Plan, an increase of the expenditure is noted, almost reaching USD 1,000 million invested. 1.86% of GDP is assigned in 2008 and ends in 2009 with 1.92%. The Decennial Plan 2008-2018 follows the lines of previous plans such as 1992 and 2002; with the difference, its structure was based on policies and strategic lines formulated with a more extensive quantitative base. The main point was to recover the lost time of the previous decades and taking into account the fiscal and political realities of the country, experts recommended a gradual investment, to learn in pedagogical and administrative terms the mechanisms to create value in the sector, between 2008 to 2011 the investment in Primary and Secondary education was almost even. Under this, it addressed interventions that guarantee the real increase in investment per student, putting a barrier to reach in the short term (no more than four fiscal periods) an investment of more than 1,000 USD per student at the Initial, Basic and Middle levels.

2010 starts with a new social movement seeking a change in the reality of investment in the education sector. These movements, as well as some political actors internal/external to the government and business, express their concern with the state of secondary education and the negative consequences regarding the country's productivity, likewise, pointed out the implications for the increase in inequality and its negative effect with a view to the possible sustained development of the country.

In 2011, was invested 1.99% of GDP, as in the previous year; but the increase in social pressures in 2012 led the government to invest 2.46% of GDP, an increase of almost USD 1,500 million, meaning 23.62% more, compared with the previous year, the largest increases recorded.

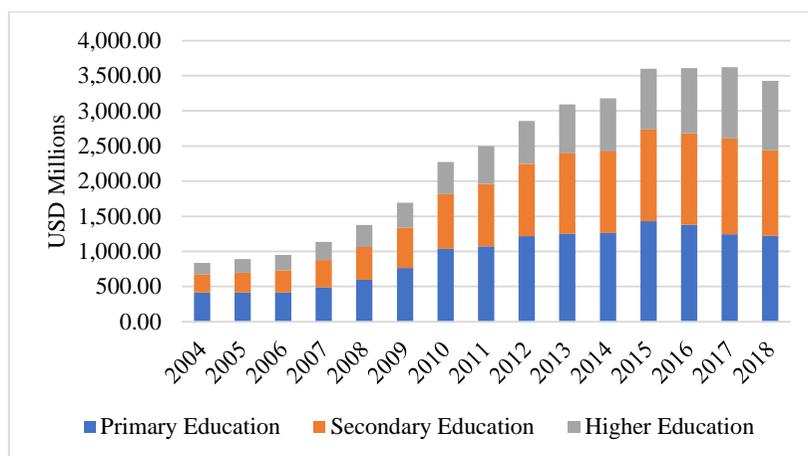
The social movements for education manage to commit the government to comply with the minimum established by the Education Law of 1997, which establishes the Education sector's investment of 4% of GDP or 16% of public spending. The registered increase was 70.27% in terms of budget allocation compared to 2012, went from about USD 1,500 million to almost USD 2,500 million; however, since 2013, the investment has been constant, but

the distribution prioritize primary education overall and neglecting the higher and secondary education, this may be explained by the percentage of literacy rate⁷ of the country during this period and the compromise of the government to eradicate the analphabetism.

Costa Rica

Graphic 3 shows the expenditure on education by the Costa Rican government under the year of study. Public investment in education went from USD 2,270 million in 2010 to around USD 3,400 million in 2018, representing cumulative growth of 49.77%. This increase means an average annual of about 6%, although with marked differences over the decade. In 2015, the public expenditure allocation started to be distributed among the three different levels. Costa Rica is one of the Latin American countries that has invested more in education over the last century (Molina, 2018).

Graph 3 Costa Rica Expenditure in Education by Levels



Source: Author, based on World Development Indicators, World Bank

⁷ According with the Literacy rate obtained from the World Bank Development Indicators, the rate went from 89.53% in 2010 to 93.77% in 2016.

The importance of the budget distribution among the levels of education lies in the fact that it is reflected in the government's economic and social policy since it has the status of Law and authorizes the use of resources for specified purposes. It allows knowing how much money will be allocated to each area of public spending and where the priority will be.

In Costa Rica, the budget invested in education goes to the Ministry of Public Education, Public Universities, and Technical Colleges. As we can see in graph 3, around 80% of the public budget for education is dedicated to primary and secondary education, and 20% is transferred to public universities.

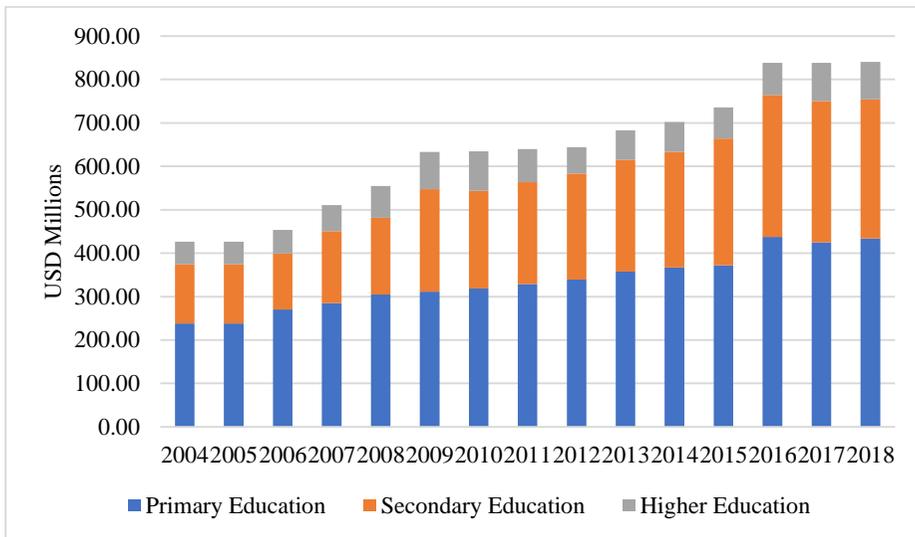
In terms of national production, as we can see in graphic 1, the investment in education finally achieves in 2009 to comply with the constitutional norm of having 6% of the GDP invested in the Education Sector.

In the 2010-2018 period, public investment in education has experienced unprecedented growth in Costa Rica, with a clear tendency to prioritize pre-university education over the university. The fact is that this investment grows in a higher proportion than shows the interest of governments, regardless of their political affiliation, to counteract the effects of the educational lag that occurred during the 1980s⁸ and 1990s and to maintain the competitiveness of the country, through the training of the workforce, in attracting foreign direct investment, particularly in services activities and high technology industry.

El Salvador

Graph 4 El Salvador Expenditure in Education by Levels

⁸ From 1981, in the context of the economic crisis of those years, coverage collapsed, and it was not until 2002 that it recovered the level reached twenty-one years earlier. So far, this is the main setback experienced by Costa Rican education in its entire history. Faced with a systematic underfunding from 1980, public universities responded with protest and mobilizations in defense of their budget, however, in 1981 the coverage of public higher education represented 14% of the population between 18 and 24 years old, that proportion it had dropped to 11.7% in 1996 and was only surpassed in 2010 (Molina, 2018).



Source: Author, based on World Development Indicators, World Bank

Graph 4 shows a public investment in education with slow growth, in relation to investment from neighboring countries like Costa Rica. The increases in the budget⁹ of education have been spent for additional allocations that have arisen in response to various needs of attention: emergencies such as hurricanes or storms, pressure from groups due to salary increases, urgent demands, requirements for the implementation of the anti-crisis plan. These requirements have been financed with international loans, issuance and placement of government bonds, and various executive agreements¹⁰ that have materialized in financial transfers from the Ministry of Finance to the Ministry of Education.

Between 2004 and 2009, in which a growing trend is shown with an increment going from USD 395 to USD 993.10 million, this is mostly the result of external loans destined mainly to the provision of school uniforms, as a measure of the Global Anti-crisis Plan, the School Food and Health Program¹¹

⁹ Information obtained from the analysis carried out by The Ministry of Education of El Salvador and UNICEF about Financing education in El Salvador.

¹⁰ Ministerio de Hacienda. State Financial Management Report. 2002 to 2011.

¹¹ According to the 2009 State Financial Management Report, from the Ministry of Finance, USD 48.2 million were invested in 2009 for the purchase of uniforms and USD 8.0 million for the School Food and Health Program.

and the Attention to Early Childhood Education administered by the Community.

An interesting increment occurred in 2009; this can be related to the fiscal reform¹² promoted in 2004 that pursued reduce tax evasion and avoidance, increasing the State's investment capacity. This year, the free secondary education program came into force, and the new Government promoted its measure of delivery of supplies (UNESCO-IBE, 2006/07).

We could say that between 2009 and 2014 was a period of stability and stagnation in public investment in education. Stability because the percentage remained in numbers relatively higher than the previous five years and stagnation because it could not exceed more than USD 700 million in its entire period.

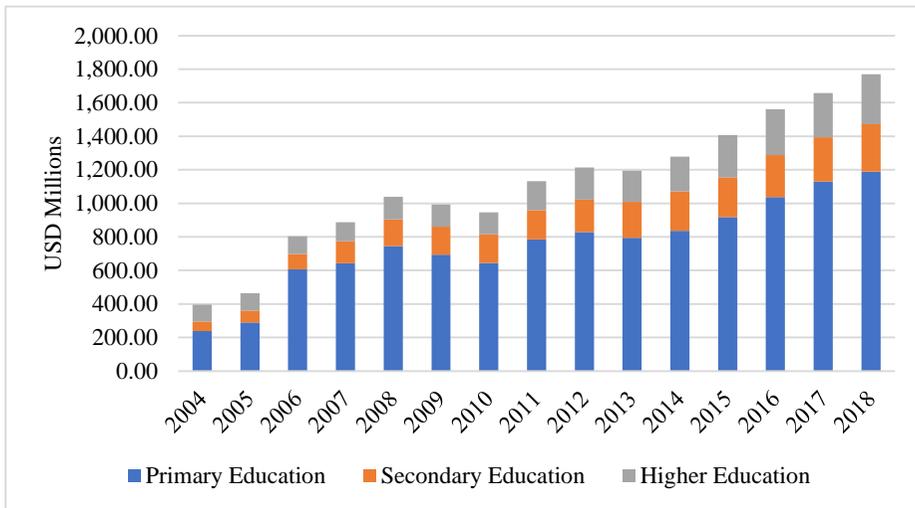
The government period between 2014 and 2019 a negative part is highlighted by serious fiscal problems leading the country to a default in 2017 and with it, to a strong suppression of the public spending, and the approval of a reform to the private pension system that increased the contribution of employers and employees (Candray, 2018). However, investment in education went from USD 837 million in 2017 to around USD 840 million in 2018, with a growth of about USD 3 million, showing the government's intentions to education policies. In general, it is observed that Primary Education has taken the largest investment over the years. The investment in Secondary education is almost five times less than it; for that reason, it is not surprising that according to the data of the Ministry of Education (2016), only 40% of young Salvadorans have access to secondary education, on investment in Higher Education, the data reflects that, according to GDP, the only public university in the country never exceeded 0.4%.

Guatemala

¹² The main goal of this reform was achieved a progressive increase in Social Investment to raise the Human Development indices of our country, in education, nutrition, health, employment, income, housing, etc.

Investment in education in Guatemala has advanced significantly in recent years; however, it is still left behind with El Salvador, compared with countries under study.

Graph 5 Guatemala Expenditure in Education by Levels



Source: Author, based on World Development Indicators, World Bank

Guatemala is a lower-middle-income country; between 2004 and 2007, it registered an average annual GDP growth of 4.2%, but after the global financial crisis, it slowed down, reaching 0.5% in 2009. As shown in Graph 5, the country reduced its spending from around USD 1,000 million in 2008 to USD 948 million in 2010.

In 2015, an increase in the investment was almost USD 130 million compared to 2014; this is because the budget for education was increased to 3.1% of GDP. In the policy formulations of the government was raised the need to achieve what the National Education Law of Guatemala establishes, which is an investment in the education of 7% of GDP.

In Guatemala, many laws and agreements regulate the educational sector. However, they were elaborated and approved many years ago; the national education law was entered into force in 1991, almost 30 years ago, and the last Educational Reform was in 1998. This is why they no longer conform

to national or international demands with the new postulates of UNESCO for education or for the same globalization. While Guatemala is still struggling to reach 7% of GDP invested in education, Costa Rica is already focused not only on the amount of investment but also on its quality¹³. A country with three times fewer inhabitants (5 million) but with a public budget three times larger than Guatemala's.

In Graph 5, it can be seen that the country had increased spending on primary education from USD 289 million in 2005 to USD 917 million in 2015, but it also can be seen the disparity between the expenditure in primary education and the others levels of education.

Chapter 3. Methodology

3.1 Research design

To find responses to our research questions and measure the impact that public investment in education, as a whole, and their different levels have on the economic growth, as a previous study (Blankenau, Simpson, and Tomljanovich (2007), Mallick, Das & Pradhan (2016), and Almajdob & Marikan (2019)), we will use a quantitative approach based on secondary data and a panel data model.

In recent years, many studies on the different economic topic have been employing panel data rather than time-series data to investigate economics data, due to advantages of panel data in contrast with time-series data; such as: controlling for individual heterogeneity and give more informative data, more variability, less collinearity among the variables, and more efficiency (Baltagi,

¹³ In Latin America, Costa Rica is recognized for its leadership in education. It is the first country of the region in achieving full enrollment in primary school; in addition to educational achievements Costa Rican have contributed to significant economic growth, as well as high levels of wellness (Schleicher, 2019).

2014). A panel data from 4 countries for which information on each variable is available for 2004 to 2018.

According to the literature review, a panel data model is the econometric model that fits the most in our investigation. The reason is because a time series dataset contains observations over multiple periods but just on a single phenomenon, and a cross-sectional dataset contains observations on multiple phenomena but just at a single point in time. Moreover, this study investigates multiple phenomena over multiple periods; the panel data give this benefit.

As Li (2010) explains, the primary factor that distinguishes time series data and cross-sectional data from panel data is that both time series and cross-sectional data are one dimensional, while panel data is two dimensional. Time-series data suffers from its lack of spatial sensitivity and requires that observations be equally spaced in time. Cross-sectional data analyses do not adequately capture the inter-relationships amongst variables as they occur across time and largely ignore the possibility of consistency of phenomenon across the temporal domain. Panel data offers an alternative widely used in economic analysis and can be viewed as offering spatial-temporal information.

The three most common approaches to consider in panel data are pooled, fixed, and random-effects models. The Pooled is an OLS technique run on Panel data; in the random effects, the omitted time-invariant variables are assumed to be uncorrelated with the included time-varying covariates, and in the fixed effects, they are allowed to correlate (Tadesse, 2014).

An ordinary least squares regression model fails to control for unobserved heterogeneity and the fixed-effects or random-effects models could potentially overcome this problem ¹⁴ (Ullah et al. 2018). Fixed-effects

¹⁴ Researchers rarely consider what problem Fixed Effects actually solves, and why the Random Effect parameter estimates can be wrong or not. This bias is often described as “endogeneity”, a term that covers a wide and disparate range of different model misspecifications (Bell & Jones, 2015). Sometimes researchers using Fixed Effects model leads to use it without taking full advantage of the benefits that Random Effect models can offer. The Random Effect framework allows a wider range of research

estimation is employed to deal with endogeneity in circumstances where firm-specific characteristics (time invariant) are correlated with the explanatory variable (Wintoki et al., 2012).

To decide between them and determine the model, we need to conduct the necessary tests. First, the Breusch-Pagan test¹⁵ and F test for the fixed effect model will be conducted to know whether to use fixed effects or pooled OLS.

Depending on the results, we need to conduct a Hausman test¹⁶. If the Breusch-Pagan test and F test's null hypothesis is not rejected, it means that our data are poolable and the effects do not need to be fixed so that we can use a panel data pooled model. After deciding which model we will apply to measure the impact that public investment in education has on economic growth using panel data, we need to consider first the theory of production function, where output is a function of labor and capital.

For the impact of education on economic growth, we have to include government expenditure on education as a crucial variable in the production function. Following the similar study undertaken by Mallick et al. (2016).

Where GDP represents the total economic growth, Expenditure in Education refers to government expenditures on education. The expenditure on education presents human capital formation, which can make a skilled labor force. This skilled labor force in the country can enhance the productivity of

questions to be investigated: involving time-invariant variables, shrunken random effects, additional hierarchical levels, and random slopes estimates that allow relationships to vary across individuals, or allow variances at any level to vary with variables (Bell et al., 2019).

¹⁵ Another benefit of the Breusch-Pagan test is that involves looking for patterns in a plot of the residuals from regression to determinate if we have or not heteroscedasticity tends in our data. If we have it, it may cause p-values smaller than they should be (Breusch & Pagan, 1979).

¹⁶ The Hausman specification test compares fixed and random effect models under the null hypothesis that individual effects are uncorrelated with any explanatory variable in the model (Hausman, 1978). Fixed Effects models are often presented as a technical solution, following, and responding to a Hausman test taken to mean that a Random Effect model can or cannot be used (Bell et al., 2019).

physical and human capital, and in return, it would have a positive impact on economic growth.

The following panel data econometric model will be used:

$$\log Y_{it} = \alpha + \beta_2 \log X_{it} + \beta_3 \log X_{it} + \beta_4 \log X_{it} + \beta_4 \log Z_{it} + (u_i + v_{it}),$$

The variables are generated as logarithm values, where Y represents GDP, X represents the variables of interest (Expenditure at the three different levels of education), Z represents the control variables, u_{it} is a fixed or random effect specific to the individual (group) or time period that is not included in the regression analysis¹⁷, and errors are independent identically distributed v_{it} .

The collected data will be set into Microsoft Excel and the code by Statistical Analysis System (SAS) program according to each study variable for analysis. The collected data will be analyzed using descriptive statistics to achieve the research objective.

3.2 Definition of Population

This study has decided to study the Dominican Republic with all Central American countries; however, based on data availability, it will just cover Costa Rica, Guatemala, and El Salvador.

The Dominican Republic is situated in the Caribbean, not in Central America; however, it has experienced strong economic growth in recent years, averaging 6.3% between 2014 and 2018, reaching 7% percent in 2018, one of the highest rates in the region. It was the fastest-growing economy in Latin America and the Caribbean (World Bank, 2020).

Vélez (2019) explains that among the economies that compose the Caribbean, six of them present a situation of recession, another six very low

¹⁷ In the regression analysis is also used the Lagged dependent variables (LDVs) to provide robust estimates of the effects of independent variables, but some research argues that using LDVs in regressions produces negatively biased coefficient estimates, even if the LDV is part of the data-generating process; in panel models that have a LDV and fixed effects, researchers need to be attentive to the problem of Nickell (1981) bias in data with low T (with fixed T, Nickell bias does not go to 0, even as $N \rightarrow \infty$) (Wilkins, 2018).

growth, and only five of them present growth greater than 3%. This is why in terms of economic growth; it is not feasible to analyze the Dominican Republic with the other economies of the Caribbean; they are not comparable.

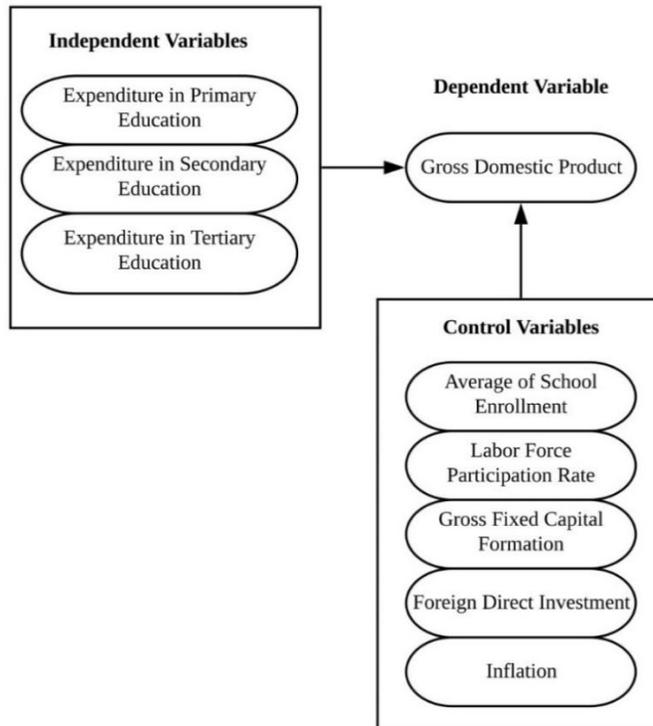
For years, the Dominican Republic and the Central American region have been developed by a preferential commercial relationship. From the political and economic point of view, the Dominican Republic is considered part of this region since it is a member of the Central American Integration System, a body in charge of facilitating the integration of the region, the Central American Parliament, and the free trade agreement between the United States, Central America and the Dominican Republic.

3.3 Analytical Framework

The research will use the panel data model to determine the impact of investment in education on economic growth performance. Figure 2 illustrates the framework, which shapes the present study to answer whether independent variables have a relationship with the dependent variable.

To test empirically the main, we have constructed a dataset taken from four countries for the period from 2004 to 2018. Economic growth is described as the increment in a nation's capacity to generate goods and services over time, as is shown. There are various measures to represent economic growth; in this research, we are going to employ GDP (USD) as a proxy for economic growth.

Figure 2 Conceptual Framework



Source: Compiled by the author

The independent variables of the study are public expenditure on education (USD) divided into three subcategories, primary, secondary, and higher education. The control variables are, labor force participation rate represented by the proportion of the population ages 15-64 that is economically active; Average enrollment in Primary, Secondary, and Higher Education is incorporated as a proxy for Human Capital; Gross Fixed Capital Formation in millions of US dollars to represent physical capital; Inflation to uncover the real growth, if any, also to stabilize the variance of random or seasonal fluctuations and highlight cyclical patterns; Foreign Direct Investment inflows. All the selected countries' data are for the period 2004-2018, collected from World Development Indicators (WDI), World Bank.

3.4 Conceptualization and Operationalization

Conceptualization

In this section we are going to conceptualize the variables of this study. Gross Domestic Product is the standard measure of the value of final goods and services produced by a country during a period (OECD, 2009). Expenditure in Primary Education, the amount expended on primary education from the Education Budget per year. Expenditure in Secondary Education, the amount expended on secondary education from the Education Budget per year.

Expenditure in Higher Education the amount expended on higher education from the Education Budget per year. Average of school enrollment: the number of students who are officially enrolled in primary, secondary, and higher in public and private's school/university in thousands.

Labor Force Participation rate is the proportion of the population ages 15-64 that is economically active, all people who supply labor for the production of goods and services during a specified period; Gross fixed capital formation, the acquisition of produced assets (including purchases of second-hand assets), including producing such assets by producers for their use, minus disposals. The relevant assets relate to assets intended for use in the production of other goods and services for more than a year. (OECD, 2020)

Foreign Direct Investment: the value of cross-border transactions related to direct investment during a given year. (OECD, 2020) and inflation measured by the GDP implicit deflator's annual growth rate shows the rate of price change in the economy as a whole. The GDP implicit deflator is the GDP ratio in current local currency to GDP in constant local currency.

Operationalization

| Variable | Classification | Operationalization | Source |
|----------------------------------|-----------------------|----------------------------------|---------------|
| Gross Domestic Product | Dependent Variable | Official US\$ amount reported | World Bank |
| Expenditure in Primary Education | Independent Variable | Expenditure in Primary Education | World Bank |

| | | US\$ amount reported | |
|------------------------------------|----------------------|---|---|
| Expenditure in Secondary Education | Independent Variable | Expenditure in Secondary Education | World Bank |
| Expenditure in Higher Education | Independent Variable | Expenditure in Higher Education | World Bank |
| Average of school enrollment | Control Variable | The number of students enrolled. | Calculate by the author, from World Bank data |
| Labor Force Participation rate | Control Variable | The proportion of the population ages 15-64 that is economically active | World Bank |
| Gross fixed capital formation | Control Variable | Official US\$ amount reported | World Bank |
| Foreign Direct Investment | Control Variable | FDI inflow as a share of GDP | World Bank |
| Inflation | Control Variable | Rate of price change in the economy as a whole | World Bank |

Source: Compiled by the author

Chapter 4. Research Findings

4.1 Descriptive analysis

The analysis conducted is based on panel data of the Dominican Republic, Costa Rica, El Salvador, and Guatemala over the past fifteen years

(2004-2018). First, a descriptive statistical analysis was conducted based on the interpretation of mean and standard deviation for each variable. Second, an analysis of extreme values is conducted for dependent and independent variables.

Further, as we explained in the methodology of Chapter 3, based on the literature review, the Breusch-Pagan test, F test for the fixed-effect model, will be conducted, and then because of the results, we perform the Hausman test to know whether to use fixed effects or pooled OLS panel data model.

Finally, based on the previous test results, a panel data regression analysis will be conducted.

Table 2 shows the mean and standard deviation of each variable expressed in logarithm. Gross Domestic Product has a mean of 24.3238 (36,621 billion of USD) with a standard deviation of 0.505454; the mean of Expenditure in Primary Education is 20.2549 (626,036 million of USD) with a standard deviation of 0.609503, this variable is the highest between the independent variables; The mean of the Expenditure in Secondary Education is 19.5267 (302,245 million of USD), the standard deviation of 0.846756 and now, the lowest among the explanatory variables, Expenditure in Higher Education with a mean of 18.9654 (172,413 million of USD) and a standard deviation of 0.828105.

Table 2 Descriptive Statistics

| Variable | Label | N | Mean | Std Dev | Min. | Max. |
|------------------------------------|--------------|----------|-------------|----------------|-------------|-------------|
| Gross Domestic Product | GDPlog | 60 | 24.3238877 | 0.505454 | 23.3425 | 25.1724 |
| Expenditure in Primary Education | ExPElog | 60 | 20.2549198 | 0.609503 | 19.1878 | 21.2921 |
| Expenditure in Secondary Education | ExSElog | 60 | 19.5267506 | 0.846756 | 17.6245 | 21.0331 |

| | | | | | | |
|---------------------------------------|---------|----|------------|----------|---------|---------|
| Expenditure in Higher Education | ExHElog | 60 | 18.9654055 | 0.828105 | 17.4281 | 20.7398 |
|---------------------------------------|---------|----|------------|----------|---------|---------|

The next table 3 shows the extreme observation of the Dependent variable, “Gross Domestic Product.” From 2004 to 2009, El Salvador has reported having the lowest GDP among the countries under study. On the contrary, the Dominican Republic occupied the highest position in 2018.

Table 3 Extreme Observation in Gross Domestic Product

| Extreme Observations | | | | | | | |
|-----------------------------|-------------|------------------|------------|----------------|-------------|------------------|------------|
| Lowest | | | | Highest | | | |
| Value | Year | CountryID | Obs | Value | Year | CountryID | Obs |
| 23.3425 | 2004 | SLV | 31 | 24.9945 | 2017 | GTM | 59 |
| 23.4110 | 2005 | SLV | 32 | 25.0153 | 2018 | GTM | 60 |
| 23.4958 | 2006 | SLV | 33 | 25.0501 | 2016 | DOM | 13 |
| 23.5572 | 2007 | SLV | 34 | 25.1053 | 2017 | DOM | 14 |
| 23.5913 | 2009 | SLV | 36 | 25.1724 | 2018 | DOM | 15 |

Source: Compiled by the author.

The next table 4 shows the extreme observation of this explanatory variable, “Expenditure in Primary Education.” It indicates that even though the Dominican Republic presents one observation in 2004 with the lowest Expenditure in Primary Education, El Salvador have reported being constant among the countries under study with the lowest expenditure on primary education between 2004 and 2006. Since 2013, The Dominican Republic has been the country with the highest value.

Table 4 Extreme Observation in Expenditure in Primary Education

| Extreme Observations | | | | | | | |
|-----------------------------|--|--|--|--|--|--|--|
|-----------------------------|--|--|--|--|--|--|--|

| Lowest | | | | Highest | | | |
|---------|------|-----------|-----|---------|------|-----------|-----|
| Value | Year | CountryID | Obs | Value | Year | CountryID | Obs |
| 19.1878 | 2004 | DOM | 1 | 21.1949 | 2016 | DOM | 13 |
| 19.2875 | 2004 | GTM | 46 | 21.1971 | 2013 | DOM | 10 |
| 19.2887 | 2005 | SLV | 32 | 21.2431 | 2014 | DOM | 11 |
| 19.2887 | 2004 | SLV | 31 | 21.2765 | 2017 | DOM | 14 |
| 19.4161 | 2006 | SLV | 33 | 21.2921 | 2018 | DOM | 15 |

Source: Compiled by the author.

Table 5 shows the extreme observation of the independent variable, “Expenditure in Secondary Education.” The Dominican Republic and Guatemala have reported having the lowest expenditure at this educational level among the countries under the observed period. On the contrary, Costa Rica has been the country with the highest expenditure.

Table 5 Extreme Observation in Expenditure in Secondary Education

| Extreme Observations | | | | | | | |
|----------------------|------|-----------|-----|---------|------|-----------|-----|
| Lowest | | | | Highest | | | |
| Value | Year | CountryID | Obs | Value | Year | CountryID | Obs |
| 17.6245 | 2004 | DOM | 1 | 20.8734 | 2014 | CRI | 26 |
| 17.8655 | 2004 | GTM | 46 | 20.9226 | 2018 | CRI | 30 |
| 18.0655 | 2005 | GTM | 47 | 20.9841 | 2016 | CRI | 28 |
| 18.0828 | 2005 | DOM | 2 | 20.9907 | 2015 | CRI | 27 |
| 18.2878 | 2006 | DOM | 3 | 21.0331 | 2017 | CRI | 29 |

Source: Compiled by the author.

The following table 6 shows the extreme observation of the explanatory variable “Expenditure in Higher Education.” The Dominican Republic, but more El Salvador, has reported having the lowest expenditure among the four countries over the period 2004 – 2018. The lowest was reported in 2014 when the Dominican Republic expenditure was 17.4281 (US\$ 37,061 Million). On the contrary, Costa Rica has been the country with the highest expenditure, reporting in 2018 an expenditure of 20.7078 (US\$ 984,653 Million).

Table 6 Extreme Observation in Expenditure in Higher Education

| Extreme Observations | | | | | | | |
|----------------------|------|-----------|-----|---------|------|-----------|-----|
| Lowest | | | | Highest | | | |
| Value | Year | CountryID | Obs | Value | Year | CountryID | Obs |
| 17.4281 | 2004 | DOM | 1 | 20.4400 | 2014 | CRI | 26 |
| 17.7682 | 2005 | SLV | 32 | 20.5763 | 2015 | CRI | 27 |
| 17.7682 | 2004 | SLV | 31 | 20.6520 | 2016 | CRI | 28 |
| 17.8129 | 2006 | SLV | 33 | 20.7078 | 2018 | CRI | 30 |
| 17.9177 | 2007 | SLV | 34 | 20.7398 | 2017 | CRI | 29 |

Source: Compiled by the author.

4.2 Regression model

The regression consists of Gross Domestic Product as the dependent variable and the expenditure in the different education levels as the independent variables; five control variables were included in the model. The data for this regression is for the period between 2004 and 2018 in 4 countries.

Tables 7 and 8 show the Breusch-Pagan test and the F test for the fixed-effect. These tests will define whether to use fixed and random effects or pooled OLS panel data model.

To interpret the Breusch-Pagan test, we need to know that the null hypothesis is that our data's residual is homoscedastic, and the alternative hypothesis is that the residual of our data is heteroscedastic. To interpret the F test for the fixed-effect, if the p-value is less than the significance level, the null hypothesis is rejected, and we may conclude that there is a significant fixed effect or a significant increase in goodness-of-fit in the fixed-effect model.

According to Park (2011), if we cannot reject both tests' null hypothesis, our data does not have fixed or random effects and is poolable, so we can proceed to use the Pooled OLS model. If we reject the F test's null hypothesis but do not reject the null hypothesis of the Breusch-Pagan test, we have to use the fixed-effect model. If we do not reject the F test's null hypothesis, but we reject the null hypothesis of the Breusch-Pagan test, we have to use the random effect model. If we reject the null hypothesis of both tests, then we need to choose between fixed and random effects depending on the Hausman test results.

As we can see from the Breusch-Pagan Test results in table 7, the null hypothesis that our data's residual is homoscedastic is rejected because the probability is 0.0344, less than the alpha selected (0.05). We conclude that there is a significant random effect in our panel data, and the random effect model can deal with heterogeneity better than does the pooled OLS.

Table 7 Breusch-Pagan Test

| Breusch-Pagan Test | | |
|---------------------------|------------------|------------------------|
| DF | Statistic | Prob > ChiSq |
| 8 | 16.62 | 0.0344 |

Source: Compiled by the author.

Table 8 shows the F-test results; our $Pr > F$ is 0.0006, less than our significance level (0.05), meaning that the data provide sufficient evidence to assume the existence of a significant fixed effect.

Table 8 F Test for No Fixed Effects

| F Test for No Fixed Effects | | | |
|------------------------------------|---------------|----------------|------------------|
| Num DF | Den DF | F Value | Pr > F |
| 3 | 47 | 6.95 | 0.0006 |

Source: Compiled by the author.

Based on the evidence of the above results, we reject the null hypothesis of both test so we can conclude that our panel data have fixed or random effects and is not poolable. This problem is handled, and it will not affect our regression results if we use the correct model. To determine whether the fixed-effects or random-effects model¹⁸ was suitable, the Hausman test was

¹⁸ The most significant difference between fixed effects and random effects models is whether the unit effect was related to the independent variables or not.

used¹⁹. If the null hypothesis is rejected, the fixed-effect model is suitable; otherwise, we need to perform a random effect model. Table 9 shows that our Pr>F is 0.9372, more than our significance level (0.05), meaning that the specific Panel data model that fits this study is the random effect²⁰.

Table 9 Hausman Test

| Hausman Test | | | |
|---------------------|-----------|--------------|------------------|
| Coefficients | DF | Value | Pr > F |
| 8 | 8 | 2.95 | 0.9372 |

Source: Compiled by the author.

Table 10 shows the Regression Results for Panel Study with random effects and values in logarithmic. Considering the dependent variable, the explanatory variables, and the control variables mentioned at the beginning of this chapter.

Table 10 Regression Results for Panel Study with Random Effects

Dependent Variable – GDP (Million USD)

| Independent Variables | Label | Parameter Estimates | | | |
|----------------------------------|--------------|----------------------------|---------------------------|----------------|----------------|
| | | Coefficient | Standard Estimates | T Value | P-Value |
| Expenditure in Primary Education | ExPE | 0.120688 | 0.0545 | 2.22 | 0.0313** |

¹⁹ Hausman test measures whether there is a correlation between the unit effect, hence the error term and explanatory variables, in other words, whether the random effects model was appropriate (Sezer & Abasiz, 2016).

²⁰ Even though we have tested and confirm that this is the appropriate model to use in this scenario we also conducted the fixed effect model for the purpose of comparison. The results from panel study with fixed effects are quite similar, with a number of 4 cross-sections and a 15-time series of length, the value of R-square is 0.9860 (98.60%), the p-value of the Expenditure in Primary education is 0.0388 and the coefficient is 0.116313; for Expenditure in Secondary Education, the p-value is 0.4670 and the coefficient is 0.03582; Expenditure in Higher Education have a p-value of 0.0004 and a coefficient of 0.253095. The results of the control variables in the fixed effect model have same level of significance as in the random effect model. If we compare these results with the results of the Table 10, in general, there is not a large discrepancy between the random effect and fixed effects results, the variables that are not significant still being not significant.

| | | | | | |
|------------------------------------|------------|----------|----------|-------|---------------|
| Expenditure in Secondary Education | ExSE | 0.041288 | 0.0473 | 0.87 | 0.3868 |
| Expenditure in Higher Education | ExHE | 0.219553 | 0.0601 | 3.65 | 0.0006* |
| Average of school enrollment | EduAv | 0.139802 | 0.0811 | 1.72 | 0.0908** * |
| Labor Force Participation Rate | LaborForce | -1.2343 | 0.4034 | -3.06 | 0.0036** |
| Gross Fixed Capital Formation | GFCF | 0.605124 | 0.0867 | 6.98 | <.0001* |
| Foreign Direct Investment | FDI | -0.01148 | 0.0262 | -0.44 | 0.6627 |
| Inflation | Inflation | 0.002027 | 0.000942 | 2.15 | 0.0362** |
| R-Square | | 0.9664 | | | |

indicates significance at a 1% level, ** at a 5% significance level, and * at a 10% significance level.*

4.3 Discussion of Findings

After conducting a panel regression, represented by the Methodology section's equation, we see some interesting results. Table 10 shows the performed regression results, with a number of 4 cross-sections and a 15-time series of length. The value of R-square indicates that 96.64% (0.9664) variation or fluctuation in the dependent variable, Gross Domestic Product, is explained by independent variables. This result allows us to interpret that at least one of the independent variables (Expenditure in Primary Education, Expenditure in Secondary Education, Expenditure in Higher Education) or control variables in the regression model explains the change, which happens in the dependent variable (Gross Domestic Product).

The first thing we notice is that Expenditure in Primary Education (ExPE) remains highly significant (a 5% level); it shows that if the countries under study increase its expenditure by 1%, that is to say, their GDP will increase by 0.12%, according to this regression, exists a positive relationship between them. The same positive relationship has been found by other researchers (Fiszbein and Psacharopoulos (1992); Keller (2006)), they corroborate that expenditures in primary education are significant; Keller (2006) argues that this highly significantly indicate the importance of improving primary education and keeping up public expenditures. Senadza & Hodey (2015) employed a random-effects estimation method for panel data, as we did in the current study, and found that public education expenditure exerts significant positive effects.

Primary education expenditure can improve educational attainment, decrease the dropout rate, and increase economic growth. A study that modeled the impact of attainment in fifty countries found that an additional year of schooling can increase a person's earnings by 10% and average GDP by 0.37% annually (Hanushek et al., 2008).

The model results showed that we do not have enough evidence to prove that the Expenditure explains the Gross Domestic Product variance in Secondary Education. Keller (2006) used a panel data analysis and found that expenditures on secondary education as a share of GDP are significantly beneficial among developed countries. However, significantly unfavorable among the Least Developed Countries and insignificantly negative globally. Likewise, it shows that expenditures in secondary appear more inefficiently utilized for economic growth.

This not significant relationship may be related to some researchers results (Webb et al. (2013); Jiménez et al. (2015)) they have found in their study that secondary education is not significant for the creation of informal firms²¹,

²¹ Informal Firms are defined by the International Labour Organization (ILO), as organizations in the informal sector (i.e., those not registered with a local authority and

and according to the International Monetary Fund, Latin America and the Caribbean are among the regions with the highest share of informality with 34 percent of the GDP²². According to Mapp and Moore (2015), the region experienced its highest informality levels in 2008, with the global economic crisis. To be more specific, about the size and development of the informal economy as a share of the GDP of the countries under study, according to Medina & Schneider (2019), the Dominican Republic has 31.1%, Costa Rica 23.5%, El Salvador 44.2%, and Guatemala 50.3%.

These results correspond with previous studies, Self & Grabowski (2004) examined the impact of education on categorizing primary, secondary, and tertiary education levels. Their outcomes show that primary education has a strong causal impact on growth than the impact of secondary education.

Expenditure in Higher Education (ExHE) is the most significant among the explanatory variables (1% level), this result confirms what all previous researchers so far have done, according to this regression, this is a strong positive relationship between them, it shows that if the countries under study increase its expenditure by 1%, that is to say, their GDP will increase by about 0.22%. Similar to other studies (Ararat, 2007; Tilak, 2003; Ali, Hakim, & Abdullah, 2016; Bils & Klenow, 2000) that their empirical results also indicate that higher or tertiary education has a significant positive impact on the GDP, the previous investigations have shown that an increment of the investment in higher education leads to economic growth. Tilak (2003) also showed that the proportion of the adult population with higher education (a measure of human capital stock) is an essential indicator of development level. The larger the adult population's stock with higher education levels, the higher the potential for economic growth (Tilak, 2003).

not paying taxes), and the activities of firms in the formal sector that employ informal workers.

²² From the first version of a paper called “Shedding Light on the Shadow Economy: A Global Database and the Interaction with the Official One”, presented at the 7th IMF Statistical Forum “Measuring the Informal Economy”, November 14 – 15, 2019, IMF-Headquarters, Washington, D.C.

Invest in higher education also benefit the government; However, these benefits are less well studied; some evidence links a higher educated population with higher productivity and output per worker, higher net tax revenue leading to less reliance on government financial support (Psacharopoulos, 2006).

Among the control variables, the average school enrollment used as a proxy for human capital is significant by 10%. Other studies (Barro (1991); Keller (2006)) also found a significant positive relationship between school enrollment and economic growth.

The Gross Fixed Capital Formation used as a proxy for physical capital also has a significant positive relationship by a 1% significant level with Gross Domestic Product. Likewise, Gylfason & Zoega (2003) find that education boosts economic growth by rising and improving human capital and physical capital. More and better education financed by public investment can boost economic growth and decrease the disparity in income distribution.

Other research (Ali, Hakim, & Abdullah (2016); Abugamea (2017)) has corroborated the finding relating to Labor Force Participation Rate with the same negative and the unidirectional causality between Gross Domestic Product (GDP) and the labor force.

The regression results suggest that inflation has a significance of 10% (P-Value=0.0362), meaning that if inflation increases by 1%, the GDP will increase by about 0.002%. Pollin & Zhu (2006) used fixed- and random-effects models and found that inflation is associated with moderate GDP growth gains; they argue that this may be related to the degree of macroeconomic policy the government is focused, using demand management as a stimulus to growth.

4.4 Hypothesis Testing

From the performed regression, Expenditure in Primary Education has a coefficient of 0.120688, and this is statistically significant at 0.05 (5%) because the p-value is equal to 0.0313. Thus, we have enough evidence to reject the null hypothesis.

Expenditure in the Secondary Education regression coefficient equals to 0.041288 but not statistically because its p-value is 0.3868, higher than the significance level. In this case, there is not enough evidence to reject the null hypothesis.

Expenditure in Higher Education scored a regression coefficient of 0.219553 and a statistically significant at 0.01 (1%) level because of its p-value equivalent to 0.0006. Therefore, we have enough evidence to reject the null hypothesis.

Table 11 Hypothesis Testing

| Hypothesis | Results |
|--|----------------|
| The Public Investment in education, as a whole, has a positive impact on the economic growth of the countries under study. | Confirmed |
| The Public Investment in Primary education has a positive impact on the countries' economic growth under study. | Confirmed |
| The Public Investment in Secondary education has a positive impact on the countries' economic growth under study. | Non confirmed |
| The Public Investment in Higher education has a positive impact on the countries' economic growth under study. | Confirmed |

Source: Compiled by the author

Based on the regression results mentioned above, we can confirm our primary hypothesis that the Public Investment in education, in general, has a positive impact on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala because two (Expenditure in Primary and Secondary Education) of three allocations of the investment in education have a positive impact on the Gross Domestic Product.

Chapter 5. Conclusion and Recommendations

5.1 Conclusion

This study was conducted to determine the impact that the public investment in education, as a whole, and in their different levels has on the economic growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala.

To achieve the purpose mentioned above, we chose the Gross Domestic Product as a dependent variable of the study. As was suggested by the literature revised, the expenditure in primary, secondary, and higher education was chosen as the independent variables to test if they produce any change on the dependent variable GDP. To avoid a specious variable which can explain the change in the Gross Domestic Product, we include five control variables in the panel data regression model: average enrollment in Primary, Secondary, and Higher Education as a proxy for Human Capital, Gross Fixed Capital Formation to represent physical capital, labor force participation rate, Foreign Direct Investment, and Inflation.

For testing our hypotheses, which stated that each independent variable positively impacted the dependent variable, a panel data regression model with random effects was conducted, not without first performing some tests to confirm the data's suitability.

The regression analysis results show that our main hypothesis and two of the three sub-hypotheses were confirmed. The public investment in Education, as a whole, have a positive impact on economic growth. The variation or fluctuation in the Gross Domestic Product is explained at 96.64% by the regression model's explanatory variables. From the performed regression results, we have enough evidence to say that Expenditure in Primary Education has a significant positive effect on a 99% confidence level, and Expenditure in Higher Education has a significant positive effect on a 95% confidence level.

However, we do not have enough evidence to do the same with the Expenditure in Secondary Education.

Thus, Public Investment in Education matters for Economic Growth as a whole. Evidence confirms that Expenditure in Primary and Higher Education matters more for the Economic Growth of the Dominican Republic, Costa Rica, El Salvador, and Guatemala.

5.2 Policy Implication and Recommendation

It is essential to understand the implications of policies designed to enhance Economic Growth through investment in education to provide recommendations. To better understand the impact of a better investment in education, it is useful to relate policy reforms directly to the pattern of outcomes.

According to the statistical analysis, we have evidence supporting that the Public Investment in Education positively affects the Gross Domestic Product. However, that does not imply that this investment should be divided equally among the different levels of education or political will as it have been done in the past. Thus, priorities must be settled, this study will provide a General and an individual country-level policy recommendation.

General Policy Recommendations

The present study results call for valuable recommendations for the countries examined in their plan and action in Public investment in the Education sector. It calls the necessity of having a national plan for a better allocation of the amount invested in education instead of ministries or agencies willing to improve separately led by their individual interest. The political rationale is needed; an agreement of wills between the policymakers should go further than just expressing their willingness.

Policy reforms should be favorable to raise student enrollment rates; it has been demonstrated in this study, and in many others that allocate the public investment with this objective is has a positive influence on economic growth. The expenditure of education needs to be kept high at the primary level while

increasing enrollment rates from the bottom up to benefit most students and make the next education level beneficial to growth.

Even though Expenditure in secondary education was none significant according to the results of the current study, this should also be one of the main concerns of government, planners, policymakers, and any other stakeholder in the process of economic growth because we cannot ignore the suggestions made by the literature that investment in secondary education can provide a boost to the economy (IIASA 2008).

Because of the government's timing and the necessities, educational reform should be structured efficiently; stakeholder has to re-examine what has been done in the past to improve efficiently, an increment in the GDP will not be achieved instantaneously. The countries under study have different behaviors regarding educational reforms. They either do reforms every short period, without a given space for results or do reforms within such a long period that become inefficient and unrelated to the country's needs.

Education expenditure can create better human capital, which can accommodate the use of modern technology in the production process, leading to economic growth. Governments increase the education expenditure of their respective nations. However, at the same time, educational quality should be made affordable for all by granting education.

Finally, education is a cycle; without investment in primary education, the students and future human capital will not reach secondary or higher education. It should also be remembered that investment in education is not just about the allocation of resources but also about the quality of the implementation.

Policy recommendations for Dominican Republic

The Dominican Republic has managed to unite all the aspects that are necessary to implement and achieve the reform that the educational system requires. The country has a set of norms and programs destined to strengthen and positively revolutionize the educational system; this is seen with the 4% of GDP that the country has allocated since 2013 to education. However, a

consistency of interest and political will is necessary to be implemented with full responsibility.

First, policymakers need to focus on the quality of education, make system quality a national priority. For this, it is necessary to begin to improve the physical conditions of schools, ensure electricity in the facilities, help teachers improve their teaching skills and provide principals with tools for better management of the schools.

Second, increase public coverage especially in primary and secondary education. It is necessary to focus attention on these levels, primarily in rural areas and the provinces close to the borders, as well as to develop special policies so that young people continue to study at the intermediate level.

Third, develop comprehensive, integrated, and coherent financial policies for higher education consistent with the objectives and national priorities. With this, strengthen the competitive grant program for research. Increase the number of public resources dedicated to higher education according to the provisions of article 19 of the Law of Higher Education, Science and Technology, to reach at least the level of other countries in the region of approximately 1% of GDP, compared to current level of 0.3% of GDP.

Increase in a sustained and progressive way the public investment in education because it is the basis of the country's development, in addition to being a national commitment raised in multiple sector agreements.

Policy recommendations for Costa Rica

Two policy recommendations are proposed for improving the Education investment in Costa Rica.

First, adjust spending on education towards early childhood and secondary education. Strengthen specific support for disadvantaged students, and teachers training. Costa Rica has increasingly recognized the importance primary education for a range of educational, economic, and social goals. Despite the efforts to improve access to and quality of early education, the sector remains considerably underdeveloped. Only 63% of children attend two

years of pre-school and less than 10% of children under 4 years of age benefit from care services (Schleicher, 2017).

Second, carry out a comprehensive educational reform to the higher education. Currently, the government has no mechanisms to increase science, technology, engineering, and mathematics graduates, collect data on student enrollment, or take measures against poor quality universities.

The rapid expansion of university education in recent decades reflects its vital role for Costa Rica in a global economy determined by knowledge. The country has 5 public universities, the gross enrollment rate doubled to 51% and new universities were created in the middle of weak regulation and licensing. This has raised the need of a reform that considers this new reality and responds to the country's aspirations. The reform should lead to a more solid administration of the sector, to a more equitable and strategic financing, and to greater transparency and quality assurance. In this way, the results obtained from spending on higher education could lead to a higher economic growth.

Addressing these changes will require a more strategic and systematic approach to governance of education and funding. With 8% of GDP, which is more than what any Latin American country spends on education, the country can show more in terms of the quality of education, ensuring student learning and school completion. If education is to remain an engine for development, a significant change in policy design, financing and implementation is needed.

Policy recommendations for Guatemala

Advances in educational sector in Guatemala have been mixed. Despite the improvements in education indicators over the last decade, many of them differ from the average of Latin America and the Caribbean countries, due to slower progress.

Three recommendations are proposed to be taken in consideration in an educational reform, in aimed to improving the Education investment in Guatemala.

First, strengthening the institutional framework of the national educational system to obtain a quality system with political, technical, and

financial viability. In this aspect, the participation from not just the central but the local level to ensure quality, coverage (for vulnerable and indigenous population) and relevance social, cultural, and linguistic at all levels with transparency and long-term vision.

Second, increase in educational investment until reaching what is established in Article 102 of the National Education Law (7% of GDP), through a sustained growth of the budget in correspondence to the increment in the school population and the permanent improvement of the educational system.

Third, achieve the decentralization of the educational sector, this will not only help a higher quality and scope of education, also, in the effective and more transparent use of public resources and accountability to society, this is fundamental for the achievement of these policies.

Policy recommendations for El Salvador

The interest of each government in creating its own education programs has not allowed achieving agreements that build a long-term vision regarding education in El Salvador, the last educational reform was 22 years ago.

There are different factors affect the efficiency of education and its development. First, the government needs to work on the living conditions of individuals and of society as a whole. From a socio-economic perspective, mere investment in education cannot solve, by itself, what the country is facing right now, structural, and multifactorial problems such as poverty, marginalization, and unemployment need a work of cooperation and collaboration between the private and public sector.

Second, the coverage of education must be increased, but must go hand in hand with quality, thus increasing the average years of schooling of the population. When observing the data of the different educational levels; primary, secondary, and higher, it is important to identify external reasons that affect the system, primary education must be prioritized to increase the average enrollment rate. It is necessary to invest to increase the rate of skilled labor, create more qualified students with global capabilities and skills.

Third, opportunities must be generated at the same pace to have a satisfactory development in the labor market, this means that quality jobs must be generated, and foreign investment must be attracted to take advantage of the knowledge of human capital.

The sustained economic growth of the country will be achieved through joint work between the government and society. The educational system in the long run translate into an improvement in the individual's standard of living, greater investment, and greater economic growth.

5.3 Limitation of the Study

The significant limitations of this research are, the analysis of the public investment in education was made on the assumption of the efficient resources allocation of resources to be invested on the main needs of the countries, due to its dependence on the implementation of the policies and public investment in each country. An increase in the expenditures may not necessarily improve education quality, as they may be inefficiently spent, e.g., on administrative stuff, few students, inadequate allocation, corruption, among others. Nevertheless, improving education is usually considered to require increased resources.

Countries of Central America and the Caribbean suffer from weak institutions and poor implementation of public policy²³. In this sense, this study will not focus on the efficiency of implementing public investment, but the consideration of the number of resources invested in education.

Regarding the control variable, the average of school enrollment derived from the number of students enrolled in the different levels of formal education and census data may provide poor proxies for the human capital stock within a particular nation. Also, Delgado, Henderson & Parmeter (2014) argue that school enrollment may have little or no significance for workers'

²³ Central America: Global Integration and Regional Cooperation; Markus Rodlauer and Alfred Schipke; Chapter 1: Introduction; IMF Occasional Paper 243; July 1, 2005

productivity compared to studies that use vocational education, on the job training, or inherent ability as a measure.

5.4 Areas for Further Research

This study was focused on the Dominican Republic, Costa Rica, El Salvador, and Guatemala. A panel data analysis was conducted to verify if the Expenditure in Education divided into three different levels impacted the Economic Growth, measured by the GDP. Further research might also analyze the number of resources invested in education and the quantity and quality. Additionally, researchers can also include a more significant number of countries to obtain a global view and enhance the findings' strength.

Moreover, researchers should look at others control or dummy variables that can vary the influence that public investment in education has on economic growth, like investment disaggregated per student, gender, public-private, among others, there exist different approaches to the calculation of human capital stock, and it might be worth of comparing the results with a different approach to calculations. The current study used a panel data analysis; future studies may use other econometric models and a qualitative case study approach to test if these studies' results remain constant.

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국문초록

교육에 대한 공공투자가 경제성장에 미치는 영향 : 중앙 아메리카 4 개국을 중심으로

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글로벌행정전공

본 연구는 2004 년부터 2018 년까지의 패널 자료 분석을 통하여 교육 전반에 대한 공공투자가 도미니카 공화국, 코스타리카, 엘살바도르, 과테말라 경제 성장에 미치는 영향을 파악하고자 하였다.

국내총생산(GDP)가 경제성장을 측정하기 위한 변수로 활용되었으며 초등, 중등, 고등 교육에 대한 지출을 독립변수로 설정하였다. 또한 5 개의 통제 변수가 모형에 포함되었다. 여러 기간에 걸쳐 여러 현상을 관측할 수 있는 패널 분석 모형을 활용하여 분석한 결과 초등 교육과 고등 교육의 지출이 분석 대상 국가의 경제 성장에 상당히 긍정적인 영향을 미치는 것으로 나타났다.

주제어: 경제성장, 공공투자, 교육, 중앙아메리카

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