The explanatory factors and outcomes of public expenditure on basic education in Thailand: a provincial level analysis

A Research Paper presented by:

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(Thailand)

in partial fulfilment of the requirements for obtaining the degree of
MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

Economics of Development
(ECD)

Specialization:
Econometric Analysis of Development Policies

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The Hague, The Netherlands
December 2022

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Acknowledgement

First, I would like to thank Dr. Elissaios Papyrakis, my supervisor who always kindly gave constructive recommendations and motivated me with his patience to develop my research paper along this journey. It was my pleasure to have him as my supervisor. I also sincerely thank Dr. John Cruzatti C. as my second reader who gave insightful comments to improve my work further.

Second, special thanks go to all staffs and professors at ISS who facilitated the courses that broadened my perspectives and open the door to the world of development for me, as well as ECD classmates who mostly shared those learning experiences with me.

Third, I might not be able to study at ISS without the Royal Thai Government scholarship who covered all the costs during my study. My gratitude also goes to my director and colleagues at State Audit Office of the Kingdom of Thailand, who gave me encouragement before and during my study at ISS.

Last, I gratefully appreciate my beloved family and friends who always supported me unconditionally. Indispensably, I thank myself for not giving up and being out of comfort zone to grasped new opportunities to master new skills and knowledge during this study.

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List of Acronyms

HAI	Human Achievement Index
ITA	Integrity and Transparency Assessment
MOE	Ministry of Education
NSO	National Statistic Office
NACC	National Anti-Corruption Commission of Thailand
NESDC	Office of the National Economic and Social Development Board Council
OECD	Organization for Economic Cooperation and Development
ONET	Ordinary National Education Test score
SAO	State Audit Office of the Kingdom of Thailand
SDGs	Sustainable Development Goals
UNDP	United Nations Development Programme

Abstract

This research paper aims to explore the explanatory factors of public expenditure on basic education per capita across 77 provinces in Thailand during the year 2018-2020 to understand budget distribution on education by the central government. The factors included in the model of this study are economic factors, demographic factors, political factor, and geographic factors which were analyzed by employing fixed effect model of panel data regressions. Moreover, the paper examined the efficiency of educational spending per capita, and the governance factors measured by Integrity and Transparency Assessment (ITA) on the educational outcomes and their improvements with the assumption that higher public education expenditure and governance level can increase the educational performances. The results showed that the unemployment rate (-), population density (-), and special land areas (+) have relationships with educational budget on basic education per student. However, the correlations between educational expenditure and governance factors (control of budget misappropriation, procedure improvement, and open data) on educational performance are ambiguous and not robust.

Relevance to Development Studies

Education is one of the key contributions to economic development since it invests in human capital. The more advance educational level of a country, the more highly skilled workers and higher productivity. Moreover, education helps reducing inequality and poverty as educated people have more life opportunities to get themselves out of poverty trap. To ensure the investment on education leads to these expected outcomes, it is important to prioritize budget allocation and control the efficiency of public education spending. The results of this study can contribute to the policy adjustments for Thai government to enhance capacity of education budget leading to higher educational performances, lower inequality, and higher economic growth in the future.

Keywords:
Public expenditure, basic education, budget allocation, explanatory factors, educational outcomes, governance, Thailand

Chapter 1: Introduction

1.1. Background

Education is one of the most important drivers of economic development as it invests in human development which in turn creates new knowledge, modern technologies, and wealth for the nation, resulting in economic growth. As more people are educated, they can escape from poverty and create higher productivity, leading to a lower inequality rate. Moreover, educated workers can generate higher incomes than those who are less educated (Bolaji and Kikelomo, 2013). The benefit of education is not limited to only higher lifetime earnings but also the overall society since educated workers possess higher professional skills and productivity leading to an increase in national income, market efficiency, and economic growth which makes a country becomes more competitive in the world markets. Moreover, education shifts the motivations and attitudes of the people that are necessary for the overall transformation of societies (Lalfakawmi et al., 2016). According to Downes (2001), education improves productivity through higher skill training of laborers to serve the demand of the market and raises awareness of people on economic, political, and social perspectives leading to the development in other fields. Most importantly, knowledge as an output of education is transferable through the dissemination of teaching and research leading to a positive spillover of human capital.

In 2015, Quality of Education (SDG4) became one of 17 Sustainable Development Goals initiated by the United Nations under the theme "No one is left behind" which raised awareness of education worldwide. Although there was an improvement in access to education at all school levels, many children were still out of school and could not meet the minimum educational proficiency standards (UN, 2020). This raised an issue of public financing for education which should be both adequate and right targeted to increase the quality of education for all. During the covid pandemic, many governments in low- and middle-income countries cut the expenditure on education to spend on other urgent issues and are more likely to slow down increases in the education budget after the crisis compared to high-income countries which can cause a detrimental impact on education out-comes and economic growth in the long run (World Bank Group Education, 2020). This also retarded the achievement of quality education globally and further widen the inequality gap. Moreover, it is important to focus not only on the amount of education financing but also

on the efficiency of public spending and the priority of the most underprivileged groups to increase the quality of education (Voigt, Thum-Thysen, and Simons, 2020).

In Thailand, the government has been spending almost 5 percent of the GDP or more than 20 percent of the public budget on education which was a very high amount compared to developed countries in OECD (Education Equity Fund, 2018). However, the outcomes were not very impressive. Thailand has been in the middle-income trap for more than 20 years due to unadvanced skilled laborers (Phongpaichit and Benyaapikul, 2012). Although the public education expenditure in Thailand has been increasing, it was not very well-targeted. The disparity of human development among provinces is larger over years and is always concentrated in the capital city of Bangkok. Recently, the Covid crisis caused an increase in the number of poor students, mostly living in rural areas, who dropped out of school since their parent could not afford their education expenses (Education Equity Fund, 2018). These groups of students should receive extra support from the government as they were in a more difficult situation and relied more on public education. The key problem in Thailand is not the lack of an education budget, but the issue of funding priority (Saengpassa, 2015). Moreover, budget mismanagement and lack of transparency after budget allocation also negatively affected educational outcomes (Krissadee, 2022). Since each province has its own administrative office, the efficiency of public spending is different resulting in varied education performance of students.

Although government expenditures are normally monitored and evaluated by the audit system, the cost of inefficient spending is higher after the budget is executed. Therefore, it is crucial to understand the factors influencing the decision of government expenditures on education before implementation to increase the efficiency and value of money. Many previous studies both at global and country levels have analyzed the factors affecting the education budget to give policy suggestions for the government on public education spending. However, studies of Thailand were rarely found, especially at the local level in a country.

This paper aims to fulfill the research gap by studying the explanatory factors of public education investment specifically on basic education per capita as a foundation across 77 provinces in Thailand using the most recent data from 2018-2020 to emphasize the key drivers of public education expenditure. The amount of education expenditure includes all educational costs (salary of teachers, facilities, school buildings, etc.) per student as shown in the report of the Bureau of Budget to reflect the real cost of basic education per capita.

Moreover, we explore the efficiency of educational expenditure (input) and the role of governance at a local level that might relate to educational outcomes. We expect that good policy analysis of government spending, especially on education, will shift a country to a higher level of economic development.

1.2 Research questions

The objectives of this study are to explore the factors relating to the government expenditure on basic education across provinces in Thailand, to understand the central government behavior in educational budget allocation to local areas, to examine the correlations between public expenditure on basic education and its outcome on education, and to explore the effect of governance factors on the basic educational outcomes across provinces in Thailand. To meet the objectives of the study, key questions are raised as follows.

1. What are the explanatory factors (economic factors, demographic factors, political factors, geographic factors) of public expenditure on basic education per capita across provinces in Thailand?
2. What is the relationships between public expenditure on basic education per capita and governance on the educational outcomes and their improvements across provinces in Thailand?

1.3 Scope and limitations

Although the source of education expenditures in Thailand are from both the public and private sectors, this study aims to focus only on public education expenditure to understand the factors related to the government budget allocation. Moreover, the basic education level is the focus as a major share of education expenditure and compulsory education in Thailand. The study uses the most recent panel data of public expenditure on education per capita from the year 2018-2020 across 77 provinces in Thailand to see the relationship between the distribution of central government spending on education in different areas within the country and the explanatory factors. Furthermore, the study explores different educational outcomes given the expenditure to see the efficiency of the public budget and the governance factors that may also relate to the quality of education.

However, the main limitations of this study are the availability of data since most of the panel data at the provincial level of Thailand is quite limited and difficult to obtain due to

unorganized data platforms. Thus, only the most recent 3 year-data can be analyzed in this study. Moreover, some explanatory variables are not included in the model due to a lack of data. The analysis would be more complete and more significant explanatory variables would be explored if the data on the longer length of periods and data on some missing variables were available. Last, the public expenditure on basic education may not represent government behavior on the overall Thai education system as tertiary education is not explored and educational expenditure in each province includes only from the central government but excludes the budget raised by the local government itself, again due to incomplete data.

1.4 Organization of the research paper

There are 6 chapters in this research paper. Chapter 2 is the literature review discussing theoretical literature and empirical evidence related to explanatory factors of public expenditure on education and governance factor relating to educational outcomes, and the conceptual framework to summarize the factors focused on this study. Chapter 3 provides a further understanding of public expenditure on education in the context of Thailand by reviewing the education system, a trend of public expenditure on education, a budget allocation on education across provinces, and evidence on public education expenditure in Thailand. Next is the methodology and data in chapter 4 where model specification, variables, and data sources are provided before going to the result discussion in chapter 5. This chapter interprets the regression results both quantitatively and qualitatively. Last, chapter 6 provides the conclusion and policy recommendations of this study.

Chapter 2: Literature review

2.1 Economic and Demographic factors

Public expenditure is economic resources collected from the citizens and allocated by the government to boost economic growth. To develop a conceptual framework for each explanatory variable of the education budget and outcomes, it is important to understand prior studies from global perspectives, theoretical backgrounds, and empirical evidence on public education spending. Therefore, this chapter provides previous literature to connect policy factors with government spending on education leading to a solid model construction that suits the contexts of Thailand.

Several theories and works related to the determinants of public expenditure have been studied for many decades. Facchini (2019) explained the theories related to determinants of public expenditure. For demand theories, public spending depends on the preferences of people. The government is a middle agent and just responds to the socio-economic changes in society. There are some well-known demand-side public expenditure theories such as Wagner's Law, Counter-Cyclical theory, and Median Voter theory (Buracom, 2011). On the other hand, the supply-side theories discuss the power of politicians and bureaucrats as they will spend more if more tax as a source of revenue can be collected from the citizens. Moreover, they actively shape the policy responding to their interests.

In practice, public expenditure cannot be explained by only a single theory but require a multidimensional approach to understand the policy comprehensively. To explore deeper how the government executes public expenditure on education, it is important to incorporate several perspectives such as economic, demographic, geographic, and political factors. Therefore, the main variables to determine government spending on education in this study are derived from different theories as follows.

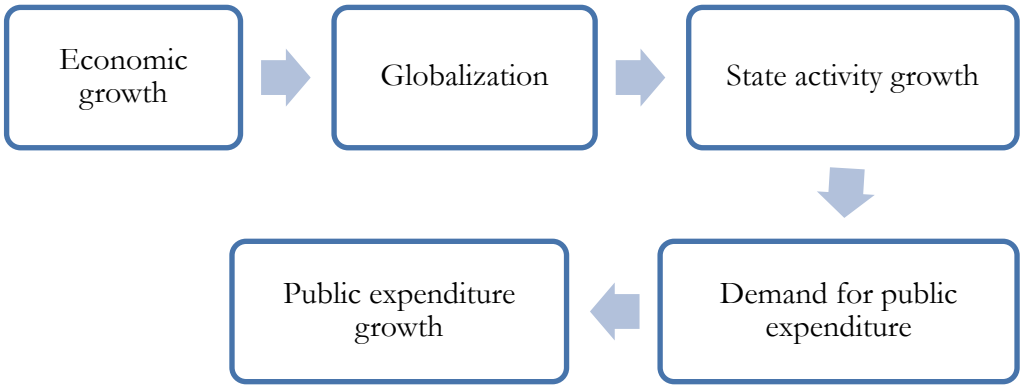
2.1.1 Wagner's Law

One of the most well-known theories to explain the higher level of public spending due to economic and demographic factors is Wagner's "Law of expanding public expenditure" (Wagner, 1958). He explained that richer countries tend to spend more than poorer countries as a percentage of GDP. This is because globalization leads to industrialization which raises higher public demand for infrastructures and a greater division of labor. Moreover, the market is more complicated as population growth increases and requires more resources to serve the needs of people. According to cost-effectiveness, it is more efficient for the welfare

sector such as education to be operated by the government rather than the private sector thanks to economies of scale. Therefore, higher economic growth increases public expenditure on education and other public facilities. In another word, the government tends to allocate a higher public budget to an area with higher GDP per capita as it signals higher potential and demand for further development.

Another explanation of Wagner's law is Compensation Theory which explains that globalization has a positive impact on public spending because a country exposed to the trade openness will experience the volatility of the global business cycle which causes internal economic and employment insecurity. The government thereby tends to increase social welfare expenditures such as education to train laborers and shift economic development (Buracom, 2011). In this manner, the measurement of economic expansion such as income per capita, GDP, industrialization, and population growth are used to test the validity of Wagner's Law.

Figure 2.1 Wagner's Law Model



Several empirical studies supported the model of Wagner, both at cross-countries and national levels. For example, Easterly and Rebelo (1993) found a positive relationship between income per capita and government spending by using cross-countries data from 1970-1988. However, the study of Ram (1978) showed that Wagner's Law does not hold in cross-section but in time-series analysis. Another study by Shelton (2007) also supports that trade openness simply increases public expenditure in all sectors. He also concluded that higher population size leads to heterogeneity of preferences causing decentralization as central expenditure decreases while local expenditure increases. Moreover, Shonchoy (2016) used panel data from 97 developing countries during 1984-2004 and found that the real GDP per capita is significant and highly related to government consumption expenditure while trade openness has a weak relationship. The study of Hansen and Fabricant (1955) also stated

that the public expenditure in the local states of the USA was defined by income per capita, urbanization, and the number of populations.

It is also interesting to validate Wagner's Law in the case of public expenditure on education. Akanbi and Schoeman (2010) conducted a panel data analysis of African countries during the period 1995-2004 and found that higher education spending responded to an increase in real GDP per capita. Likewise, Cristobal et al. (2022) concluded that economic growth and population growth have a positive relationship with public education expenditures. Similarly, Tilak (1989) also showed that population growth in Latin American and the Caribbean region from 1965-1980 resulted in higher public education expenditure. Chatterji et al. (2015) and Roy et al. (2000) also found that richer states spend more on per capita education compared to the poorer states in India. Similarly, the study of Chakrabarti and Joglekar (2006) found a positive correlation between a state's real per capita income and real per capita public education expenditure for total, elementary, secondary, and higher education levels across 15 states in India from 1980-81 to 1999-2000. Moreover, Yun and Yusoff (2018) investigated the determinants of public education expenditure in Malaysia from 1982 to 2016 and found a long-term positive relationship between public education expenditure and the economic and demographic factors including real GDP growth, unemployment rate, inflation rate, and working age population. Meanwhile, Kemnitz (1999) used population growth to explain the public spending on education, and Sheikh (2019) used the number of populations and found a significant relationship with the public expenditure on different levels of education during the period 1980-2018 in Bangladesh.

Although Wagner's Law is popular in determining public expenditure, it does not consider other factors on public spending apart from economic and demographic factors which provide a gap for further analysis.

2.1.2 Keynesian Counter-Cyclical Theory

In contrast to Wagner's Law, Counter-Cyclical Theory (cited in Sagarik, 2013 and Burcom, 2011) explains that economic factors related to public expenditure including educational spending in opposite direction. During recessions or high unemployment periods, the government will increase social expenditure to stimulate demand and improve the economic situation. However, the government tends to decrease spending during high inflation or economic boom to avoid overheating. Mankiw (2010) explained that economic stability is the priority of the government to take responsibility so the expansion and

reduction in public expenditure is an intervention to cope with a bad economic period. To conclude, the GDP and inflation rate are negatively related to public expenditure while the unemployment rate has a positive impact on government spending.

There are several studies supporting Counter-Cyclical Theory. Fölster and Henrekson (2001) found that economic growth has a negative relationship with government expenditure from the panel data of rich countries during 1970-1995. Moreover, Huang and McDonnell (1997) investigated the growth of government expenditure in the US from 1940-1990 and discovered that a high unemployment rate increases the total government expenditure ratio. The further study focused on public expenditure on education by Sagarik (2013) also follows Counter-Cyclical Theory showing that inflation hurts the cross-sectional total public education expenditure. Similarly, Tilak (1989) found that high inflation causes the public expenditure on education to decline in the case of Latin American countries. However, he explained that economic factors tend to least influence public spending on education during normal economic conditions while it may cause adverse impacts during the economic recession. This is because the benefit from education is less visible in the short run so the government may give lower priority to the spending on education.

2.1.3 Intergenerational debate on public expenditure on education

Aside from the overall population as a demographic variable, some studies have explored further the shares of young and old populations as dependency ratio, the number of students, or school enrollment to determine the government spending on the public. However, there is a conflict between intergeneration and public education spending which is still unclear.

For the group of young population, many studies found a positive impact of more share of the school-aged population on the public expenditure on education as more resources are required to serve the higher needs of young people. Razin et al. (2002) presented that there is a strong and positive correlation between the population aged less than 15 and government expenditure as a percentage of GDP. However, Heinesen (2004) found a negative effect of the young population on public education expenditure per capita using panel data of 275 municipalities over 12 years in Denmark due to the economies of scale in a school production and administration making a large batch easier to avoid small class size. This study is also consistent with other empirical findings such as She (2004) who

explored the same relationship in the US from 1960-2000 and Chatterji et al. (2015) who also found a disadvantage of being in a large cohort when the states with higher young population received lower education expenditure per pupil in Indian states.

Nevertheless, the study of Grob and Wolter (2007) showed that the school-age population has less impact on the changes in the education budget while the elderly population significantly and negatively influences public education expenditure in Switzerland during 1990-2002. According to the median voter model, the government has limited resources and must prioritize the budget. Since the share of old people increases, the average age of decisive voters is higher, so the decision made on public spending is based on the interests of this group which is not education. Supported by Harris et al. (2001), an increase in the share of the elderly at the state level tends to decrease state education spending in the United States. These conflictual findings between different age groups and public education expenditure are also worth exploring in the case of Thailand.

2.1.4 Population Density

By taking both demographic and geographic factors into account, population density measuring the number of people in a unit of the area also affects the preference and public spending on education. As proposed by Holcombe and Williams (2008), population density and public expenditure are associated because the higher population density will not reduce government expenditure per capita when all public expenditures are considered. There were several studies have included population density in the models. For example, Fernandez and Rogerson (1997) analyzed panel data of the public expenditures of both elementary and middle education in the American states over the 1950-1990 period and showed positive effects for population density as a factor of demand congestion. Moreover, Ladd (1992) used cross-sectional data from 247 large county areas and concluded that higher density means the environment to provide public service is tougher which requires higher inputs to provide a fixed level of services. Similarly, Falch and Rattsø (1999) found that local expenditure on education in responding positively to population density in Norway. However, Verbina and Chowdhury (2004) explored the public expenditure on education during 1990-2000 across 88 regions in Russia and found a negative effect on population density. This is because regional governments can reduce the cost of educational services and infrastructure in highly concentrated areas due to the economies of scale.

Although the results from different countries demonstrated mixed findings of determinants of government spending on education, many studies confirmed that economic-demographic factors played an important role in explaining the decision-making of public education expenditure. Therefore, it is interesting to apply these factors to observe the equity of budget allocation on education across provinces in Thailand.

2.2 Political factors

To analyze the public policy on government expenditure, another factor that might be involved is the political factor. According to Median Voter Theory, the size of the government including educational expenditure changes regarding the average income of voters (Meltzer and Richard, 1983). As the politicians maximize their benefits, they tend to spend more on welfare expenditures including the educational budget to respond to the high demand for income redistribution and receive popularity from the median voters who are mostly the poor (Peltzman, 1980). In another word, higher government spending attracts decisive voters whose incomes are below the median level. Supported by the voting bias model, the politicians have to offer a social program such as free education to reduce income inequality in society and to please the voters and receive more votes. To do so, the government should earn more revenue, meaning taxes must be increased (Buchanan, 1975).

Some empirical studies have attempted to test the validity of the median voter model. For example, Dawson and Robinson (1963) used voter participation to test the impact of a pluralist political system on state welfare across American states. Similarly, Fry and Winters (1970) found that voter participation has an impact on the distribution of the local education budget. According to Bischoff and Prasetyia (2019) who used panel data of 398 Indonesian districts over the period 2005-2012, their results showed no significant impact of political factors such as Islamic parties or the number of bureaucrats on an increase in public education expenditure per capita. Another study by Buracom (2011) used the ratio of the GDP in the nonagricultural sector to the GDP in the agricultural sector to measure inequality at a national level since most of the decisive poor people work in the agricultural sector in Thailand. He found that the median voter model is valid for all public expenditures including education, health, and welfare. Moreover, Maddah and Jeyhoon-Tabar (2022) used the Gini coefficient to study the effect of income inequality on government expenditure in Iran from 2006-2018. He found a positive relationship with government expenditure meaning that the government tends to spend more the meet public needs. In the case of Thailand, Sagarik

(2013) investigated the impact of the poverty ratio to measure the share of people living under the national poverty line as a proxy of decisive voter degree on public education expenditure across provinces in Thailand during the year 2007-2010. He found that the province with a higher poverty ratio received higher public education expenditure per school, per student, and per teacher explaining the significance of political factors as the government allocates more to a higher number of the median voters to gain more votes. It is also interesting to investigate this political factor in more recent basic education expenditures.

2.3 Geographic factors

Geographic factors such as land area or distance from the capital may also reflect the needs of decisive voters and the distribution of public expenditure across different areas characteristics. As mentioned before, population density as a distribution of the population over geographic areas has also been mentioned in many studies. However, we placed it as a demographic factor since it relates more to demographic changes over fixed areas.

According to Ellis-William (1987), the larger land area of a country means a longer distance for the median voter to public services which increases demand for certain types of public services. The government thereby allocates more resources to attract these people. Moreover, de Medeiros and Barcelos (2007) explored a cross-section sample with 5,087 Brazilian municipalities and found that the distance from the state capital (the largest city) has a positive relationship with per-capita local education expenditure since the greater distance, the lower possibility of an overflow of demand from smaller cities to the state capital to benefit from a wide range of services there. Therefore, education services are produced with higher marginal costs in remote cities. All the literature reviews related to the explanatory factors of public education expenditure are concluded in table 2.1 presented below.

Table 2.1: The explanatory variables of public expenditure on education from theories and empirical studies (with related signs)

Explanatory factors	**Scholars**	**Country**	**Explanatory variables of public expenditure**
Economic factors	Wagner (1958)	-	Income per capita, GDP, industrialization (+)
	Easterly and Rebelo (1993)	Cross-countries	Income per capita (+)
	Shelton (2007)	Cross-countries	Trade openness (+)
	Shonchoy (2016) Fölster and Henrekson (2001) Akanbi and Schoeman (2010)	Developing countries Rich-countries African countries	Real GDP per capita (+)
	Sagarik (2013)	Thailand	Inflation (-)
	Huang and McDonnell (1997) Tilak (1989)	United States Latin American and Caribbean region	Unemployment rate (+)
	Yun and Yusoff (2018)	Malaysia	Real GDP, Inflation, Unemployment rate (+)
	Chatterji et al. (2015)	India	Net State Domestic Product per capita (+)
	Chakrabarti and Joglekar (2006)		State real per capita income (+)
Demographic factors	Wagner (1958) Cristobal et al. (2022)	-	Population growth (+)
	Shelton (2007)	Cross-countries	Number of population (+)
	Yun and Yusoff (2018)	Malaysia	Working age population (+)
	Sheikh (2019)	Bangladesh	Number of populations (+)
	Razin et al. (2002) Heinesen (2004) She (2004)	United States + 12 European countries Denmark United States	Share of young-age population (+)
	Chatterji et al. (2015)	India	Share of young-age population (-)
	Grob and Wolter (2007) Harris et al. (2001)	Switzerland United States	Share of elderly population (-)

Explanatory factors	Scholars	Country	Explanatory variables of public expenditure
	Fernandez and Rogerson (1997) Falch and Rattsø (1999)	United States Norway	Population density (+)
	Verbina and Chowdhury (2004)	Russia	Population density (-)
Political factors	Meltzer and Richard (1983)	-	Average income of voters (+)
	Buracom (2011)	Thailand	GDP in nonagricultural sector/GDP in the agricultural sector (+)
	Maddah and Jeyhoon-Tabar (2022)	Iran	Gini coefficient (+)
	Dawson and Robinson (1963)	United States	Voter participation (+)
	Bischoff and Prasetyia (2019)	Indonesia	Islamic parties/number of bureaucrats (+)
	Sagarik (2013)	Thailand	Poverty ratio (+)
Geographic factors	Ellis-William (1987)	-	Land area (+)
	de Medeiros and Barcelos (2007)	Brazil	Distance from the state capital (+)

2.4 Governance factors relating to educational outcomes

As the explanatory factors of public expenditure on education have been explored, it is also interesting to see its efficiency through educational outcomes. Higher spending on public education does not always lead to satisfactory expected educational performance. There might be some factors causing different educational outcomes given the same amount of public spending as an input. One of the common factors is the role of governance as the expected outcomes might not be delivered due to ambiguity or inaccurate actions by the institution. In contrast, transparency and accountability require the government sector to disclose the spending information and thus improve the effectiveness of resource management and education performance (Samer, 2013).

Many studies focused on the effect of governance structure through the education expenditure while some linked the governance directly to outcomes to understand the efficiency of the expenditure (Heller, 2002). Volkwein and Malik (1997) used cross-sectional data of the state's higher education governance structure in 1995 to predict the quality of the

public higher education institutions in the US but found no relationship between them. McLendon et al. (2005) later found the evidence from 1981-1998 state-level time-series analysis that an American state with a weak governance structure is less likely to enact financing innovations in higher education. However, Hénard and Mitterle (2010) discovered that universities with higher governance standards are more likely to have better accountability indicators, and therefore, more advanced education quality. Further supported by Gerged and Elheddad (2020), Voice and Accountability (V&A) as national governance to measure the perception of citizen participation in selecting the government and freedom of expression was significant and positively related to the quality of educational outcomes in European countries. Another cross-countries analysis showed that the impact of public education spending on primary education attainment is higher in countries with better quality governance (Rajkumar and Swaroop 2008).

For a state-local level, Manna (2005) investigated an institutional theory of educational performance of local schools across American states and found a clear indication of the level of democratic control on 4th and 8th grade reading and math scores from the National Assessment of Educational Progress (NAEP) as measures of the state educational outcomes. Poisson and Hallak (2013) also mentioned that unsatisfied educational outcomes would unlikely be better if public sector accountability was not improved. For example, the empirical evidence from Uganda in 1996 showed that the small budget allocation from the central government reached the local schools. Therefore, a tracking survey of public expenditure is needed. Moreover, Suryadarma (2012) used the case of Indonesia and found that a higher corruption level reduces the efficiency of public education spending on enrolment outcomes.

2.5 Conceptual framework

The conceptual framework helps to connect all aspects of multidimensional explanatory factors of public education expenditure and provides a clearer scope of this study. All variables are carefully selected to explain the provincial allocation of public expenditure on basic education in this study. For economic factors, GDP per capita, unemployment rate, and inflation rate were included in the model to examine whether the Thai government increases the educational budget based on higher economic growth or behaves as a Keynesian counter-cyclical pattern. Moreover, demographic factors such as the proportions

of the young population and old population should be considered as they were mentioned in many studies about the effect of dependency ratios on different types of public spending. The population density is also included as a demographic distribution over a land area. We also include a proportion of students living in poverty in each province to see the extra financial support from the government. According to the political factor, we selected the poverty ratio as a proxy of a political factor since most poor people have a higher demand for education subsidies which is also aligned with the median voter theory (Sagarik, 2013). Last, we noticed that many developing countries failed to provide public services to all groups of citizens including people living in remote areas which created wide inequality (Lalfakawmi et al., 2016). Therefore, we included the characteristic of a province called 'Isolated area' as a geographic factor to see the effect of expenditure distribution among provinces that have public schools located in isolated backcountry highlands or islands.

2.5.1 Defining public expenditure on education (model 1)

In general, government spending on education can be categorized by levels of education which are allocated differently each year. In Thailand, there are five main levels of education which are preschool, primary, secondary, tertiary, and non-formal education (Sagarik, 2013). In this study, we aim to examine only expenditure on basic education in terms of per capita (divided by the number of students). In this sense, the number of students as an explanatory factor is dropped. We focus on basic education because it is a compulsory education for Thai people and shares a major amount of public education expenditure in Thailand which helps to determine the competitiveness of the country. Importantly, the data on basic education expenditure is available at the provincial level during the study period of 2018-2020.

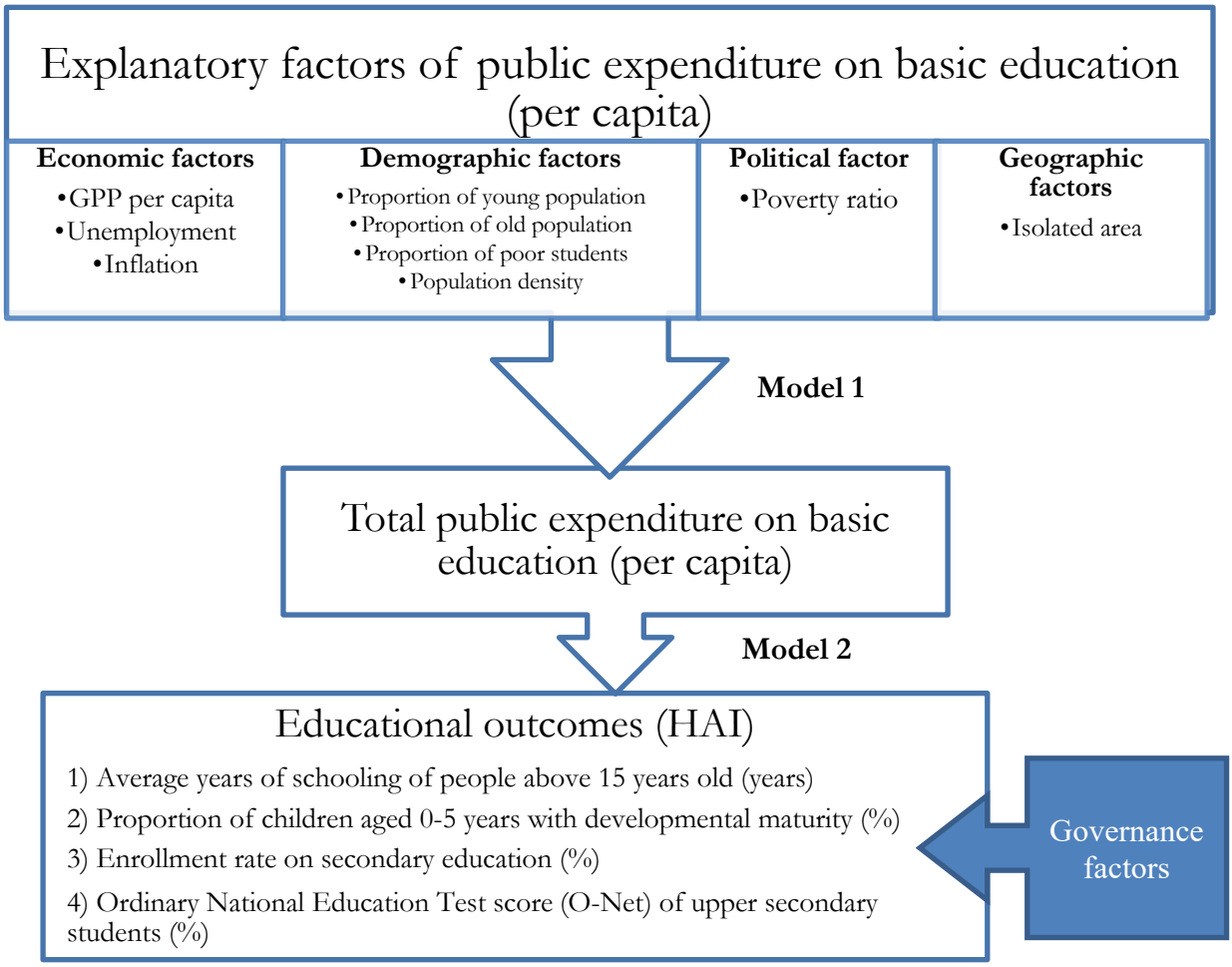
2.5.2 Defining the outcomes of basic education (model 2)

After the education budget is invested by the government, the educational outcomes are the standardized indicators to see the efficiency of public spending on education. There are many educational outcomes such as literacy rates, school enrollment, dropout rate, the score of PISA test, equity of education attainment by genders or urban/rural students, etc. (The World Bank, n.d.). However, the educational outcomes in this study are based on the Human Achievement Index (HAI) on education which has four sub-indicators including 1) Average years of schooling for people above 15 years old, 2) Percentage of children aged 0-5 years with developmental maturity, 3) Enrollment rate on secondary education and 4) Average national test score (O-Net) of upper secondary students. Moreover, the governance factors are also included in model 2 as they may also affect education performance. Although many

studies used Worldwide Governance Indicators (WGI) for cross-countries and national analyses, this study needs to find a local indicator to measure governance at the provincial level. We found the ITA (Integrity and Transparency Assessment) as a proxy of governance in Thailand (see chapter 4).

According to the conceptual framework derived from explanatory factors and the levels of public education expenditure discussed above, we can construct a multidimensional analysis of education expenditure policy as follows.

Figure 2.2: Conceptual framework of public expenditure on basic education in Thailand and the educational outcomes (developed by author)

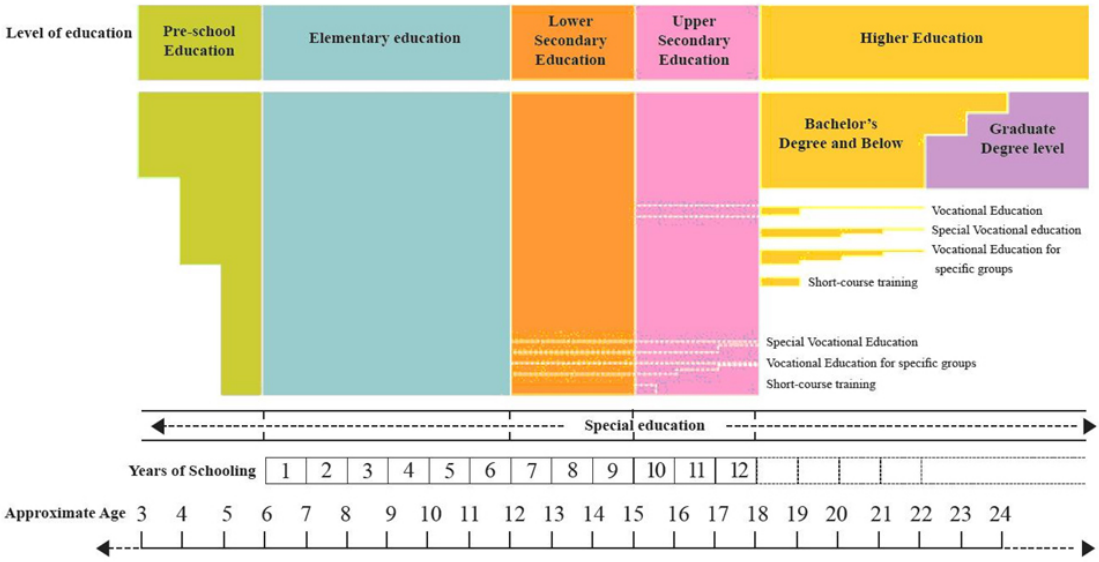


Chapter 3: Public expenditure on education in Thailand

3.1 Public education system in Thailand

Thailand was one of the countries that has never been colonized by any European countries. Thus, the public education system in Thailand has been mostly developed on their traditions with partial influence from international education. There are five levels of formal education starting from preschool education to higher education under the organization of the Ministry of Education (figure 3.1). The current education system in Thailand stemmed from the education reform in 1999 stated that all Thai students have the right to pursue 12-year free basic education for 6 years in elementary education and 6 years in secondary education with 9 years of compulsory education from elementary to lower secondary education. Later, the free basic education expanded to 15 years covering from preschool to upper secondary education. Moreover, the government promoted the decentralization of administration to the provincial level called Education Service Areas (ESA) while education planning and budgeting were still executed by the central government.

Figure 3.1: Thai Education System
(Source: The Southeast Asian Ministers of Education Organization



3.1.1 Pre-school education

This level of basic education is not compulsory and organizes for students aged 3-5 to support early childhood developments and prepare in terms of physical, emotional, and mental heaths to be ready for primary education. Kindergartens, child-care centers, or

nursery schools are considered part of preschool education under the Ministry of Education. However, the private sector takes a more active role in providing preschool education compared to the public sector.

3.1.2 Primary education

This is the first stage of compulsory education provided for children aged 6-12 administered by the Office of the Basic Education Commission as part of the Ministry of Education. It lasts for 6 years before passing into secondary education. Educational achievement for the primary level can be measured by National Education Tests of the main subjects in the core curriculum or an enrollment rate in secondary education.

3.1.3 Secondary education

Secondary education is divided into a lower and upper secondary stage which lasts for 3 years each and serves students aged 12-18. Both stages are considered basic education, but only lower secondary education is compulsory. Upper secondary education is also divided into a general academic track and a vocational and technical track. Therefore, the students can choose whether to continue which track after they finish lower secondary education. The general academic track leads to 4 years of higher education while vocational education leads to 2-year post-secondary level and 2-year university level. The educational outcome by the end of secondary education is measured by the Ordinary National Education Test (O-NET) score. This score is also part of the criteria for attending a university education and there is a significant disparity of results between the students in urban, specifically in Bangkok, and in rural areas of Thailand (Trines, 2019).

3.1.4 Higher education

Higher education can be divided into a diploma level (lower than a bachelor's degree) and a degree level. The diploma level is 2 years for students after they complete vocational education while the degree level is 2 years after the diploma level and 4 years for students completing the general academic track from upper secondary education. Both tracks equally lead to a bachelor's degree which is the first stage of higher education and a graduate degree afterward.

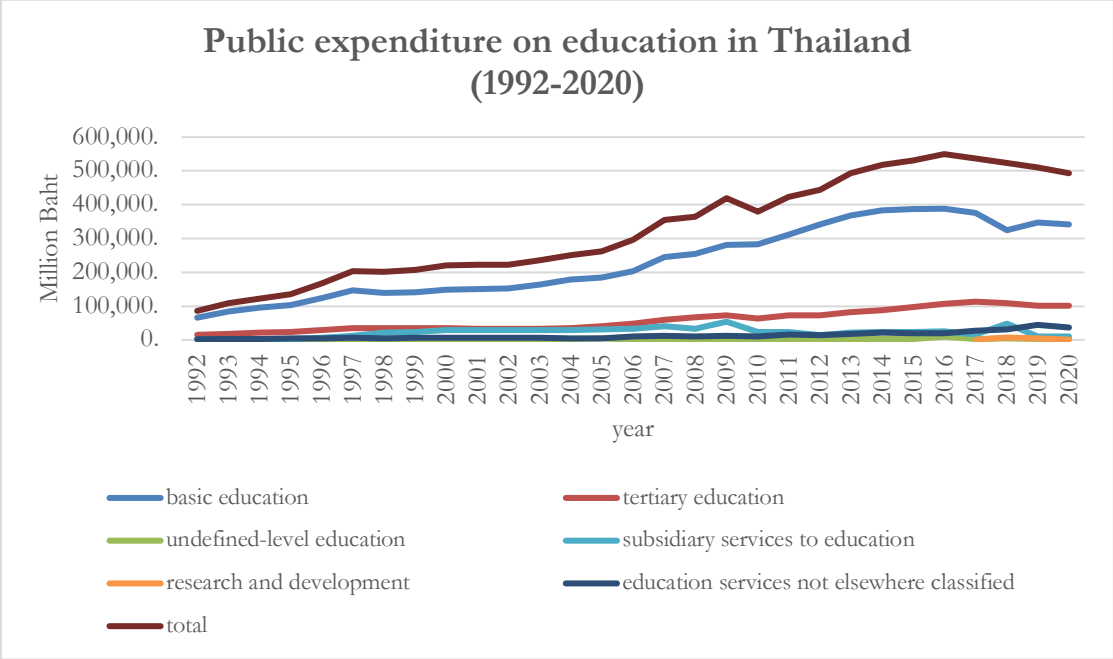
Apart from the formal education mentioned above, there is non-formal education such as lifelong learning to develop skills through distance learning and shared resources with formal education and informal education which is less structured. However, this study will focus only on the composition of public expenditure on formal basic education as it is a core of the education system in Thailand.

3.2 A trend of public expenditure on education in Thailand

Before analyzing the factors related to public expenditure on education, it is important to understand the trend of education expenditure to link the conceptual framework with the real context of Thailand. The perspectives from both national and local provincial spending on education are provided in this section.

In general, public expenditures on education collected from the Budget Bureau of Thailand across provinces in Thailand are classified into 6 types including basic education (pre-primary, elementary, secondary), tertiary education, undefined-level education (miscellaneous expenditure related to education such as milk for students, sports activity, etc.), research and development on education, subsidiary services to education, and education services not elsewhere classified. This total amount also includes subsidies to the education expense of the local administration offices in each province.

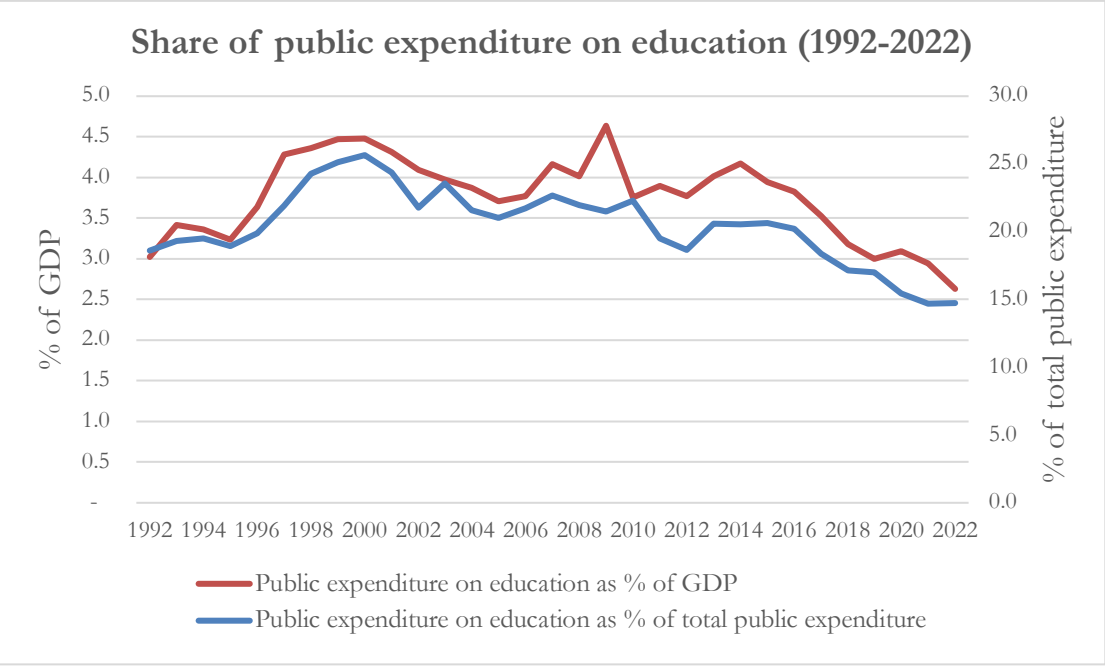
Figure 3.2: Nominal public expenditure on education in Thailand year 1992-2020
(Source: Budget Bureau of Thailand)



Overall, the change of each type of public education expenditure moved in the same direction but by a different magnitude. According to figure 3.2, the public expenditure on education started to significantly rise from 1992 due to the educational development plan to expand basic education as a compulsory education from 6 to 9 years. However, it slightly slowed down in 1998 because of the Asian Financial crisis in 1997. The government began to increase spending on education again from 2003 to 2007 under the political power of prime minister Thaksin Shinawatra according to his populist policy (Sagarik, 2013).

Moreover, the National Education Act in 1999 led to education reform which extend free basic education to 12 years. This shift caused the public expenditure on education in Thailand to rise sharply and has maintained a major share over years (UNICEF, 2011). Another surge in education spending started from 15-year the Free Education Programme with Quality Policy (FEP) during 2008-2009 by prime minister Abhisit Vejjajiva who focused on education development to stimulate the economy (ibid, 2011). Under FEP, the government extended free education covering additional three years at the pre-schooling level, and supported free textbooks, free school uniforms and learning materials, and additional school expenses for all students including those who are poor, disabled, and ethnic minorities to improve equity in education. This caused basic education expenditure to drastically increase. It was clear that the Thai government spent more on education over the past 20 years. However, the recent expenditure on education has been slowed down since 2015 due to a lower birth rate causing the number of students to decline. During 2019-2020 when the COVID pandemic happened, many governments in developing countries further cut the education budget (World Bank, 2022). Thailand was one of them and this widened the inequality gap between the rich and the poor in the country since the students still need financial support regardless of the pandemic.

Figure 3.3: Public education expenditure as a percentage of total expenditure and GDP respectively from 1992-2022 (source: Budget Bureau of Thailand)



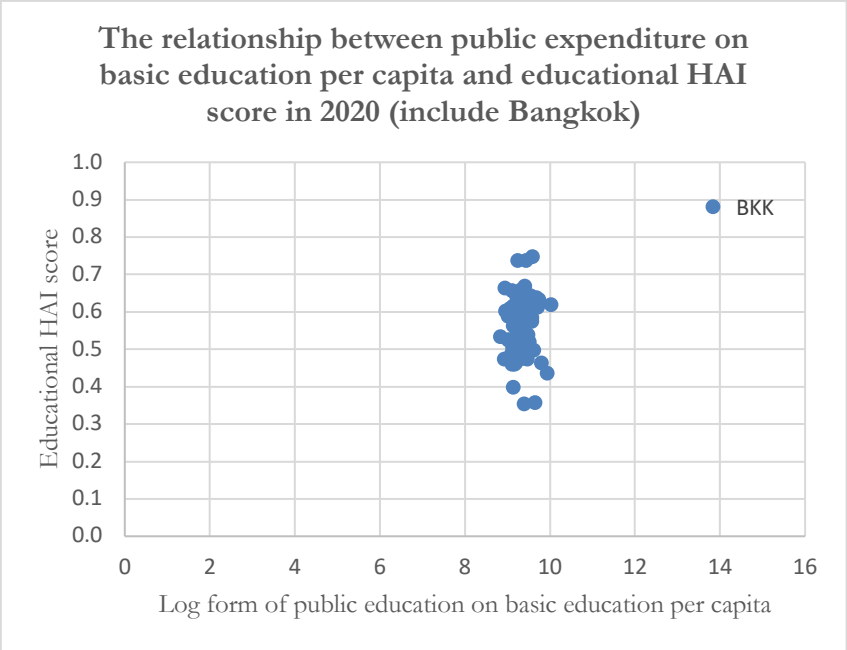
In terms of the amount of public expenditure on education relative to total expenditure, the government paid attention to the education sector compared to other expenditures (figure 3.3). Although the Asian Financial crisis in 1997 caused education expenditure to be lower but still earned the largest share of overall public spending, accounting for 22% of total expenditure or 4.3% of GDP. Due to the education reforms in 1999, an increasing period of basic education led to the peak of the education budget at 25.1% of total expenditure or 4.5% of GDP. However, the government lowered the share of the education budget after 2015 compared to other sectors, the lower birth rate was also part of the reason. During the COVID pandemic in 2019-2020, it was clear that the government reduce its share of the education budget and might spend more on other urgent sectors such as public health. Moreover, it has decreased relative to the economic size as a percentage of GDP showing that the government might gave lower priority to education as the economy grew over time. This was also evidence to reflect the behavior of the government toward education budget allocation.

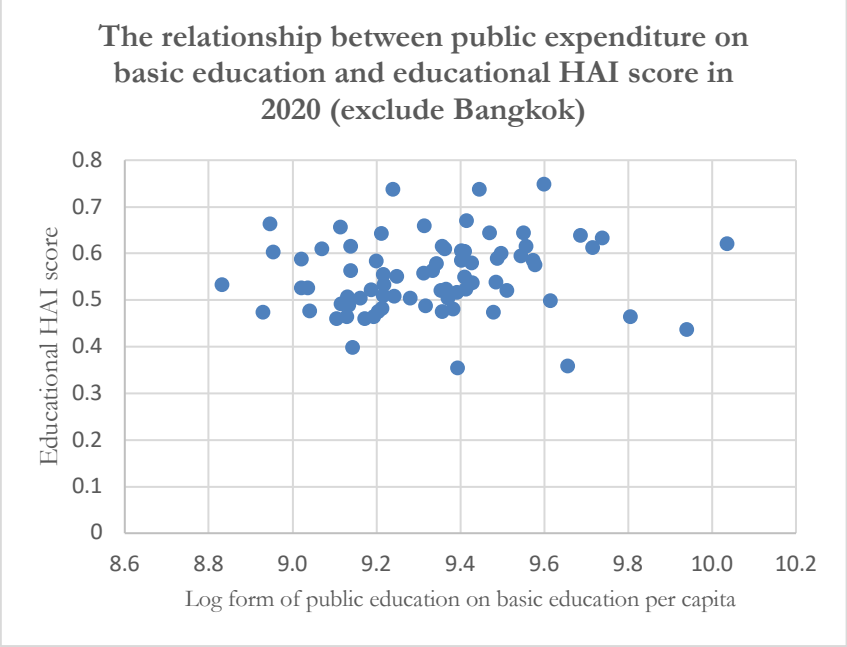
3.3 The budget allocation on education across provinces in Thailand

3.3.1 The recent local educational expenditure and outcomes

In the past, the public education expenditure in Thailand was not very well-targeted. We explore further at the provincial level to see the pattern of budget expenditure on education in a micro-view. According to figure 3.4 (top), Bangkok is an outlier as it always received the highest average per capita budget on basic education in 2020 and performed the best measured by the education indicator of the Human Achievement Index (HAI). After Bangkok is dropped from the graph (figure 3.4 bottom), we can see that the amount of budget received and educational outcomes in other provinces are irrelevant and unclear. Many provinces received a higher budget on basic education per capita but per-forms lower, and vice versa. It is interesting to know which factors affect the decision of government spending and its effects on educational outcomes to understand the reasons behind them.

Figure 3.4: Log form of education expenditure per capita (Baht) and educational outcome (education HAI score) across provinces in Thailand in 2020
(Source: processed by the author)





According to the most recent data from Human Achievement Report in 2020 in table 3.1, there was a wide gap in educational performance between the top-five lowest and top-five highest provinces measured by the educational HAI as mentioned earlier. Among 77 provinces in Thailand, the HAI score of Mae Hong Son province was only 0.354 compared to 0.8812 in Bangkok or 0.7483 in Chon Buri province. However, the educational outcomes were relevant to GPP per capita as the provinces with low HAI on education also

have poorer economic conditions. When we look deeper at the education budget, the link between educational performance and the budget for basic education was quite ambiguous. For example, Phuket as a top-5 performer received a lower education budget but had more students than Mae Hong Son. By comparing within the same performance group, the budget received by the top-5 highest performers was closely related to the number of students while this was not the case for the low-performance provinces. Pattani received a budget almost 3 times higher than Nong Bua Lam Phu although the number of students and the economic development level was not very different.

Table 3.1: GPP per capita and budget on basic education (millions) of top-five lowest and highest educational performance provinces in 2020 (Source: UNDP Thailand)

Top-5 lowest educational performance	**GPP per capita (Baht)**	**Budget (millions of Baht)**	**Number of students**
Mae Hong Son	63,419	523	43,795
Narathiwat	55,417	1,577	101,550
Tak	118,508	893	95,916
Pattani	75,779	1,530	74,166
Nong Bua Lam Phu	59,157	581	60,618
Top-5 highest educational performance	**GPP per capita (Baht)**	**Budget (millions of Baht)**	**Number of students**
Bangkok	585,689	260,500	254,645
Chon Buri	471,723	2,614	178,086
Phuket	226,158	509	49,667
Nonthaburi	193,682	1,355	107,589
Nakhon Pathom	288,232	1,311	107,427

The amount of educational budget allocated to provinces were very varied. The poorer provinces did not receive higher educational budget when the government used "one size fit all" standard to allocate budgets for all provinces without considering different needs

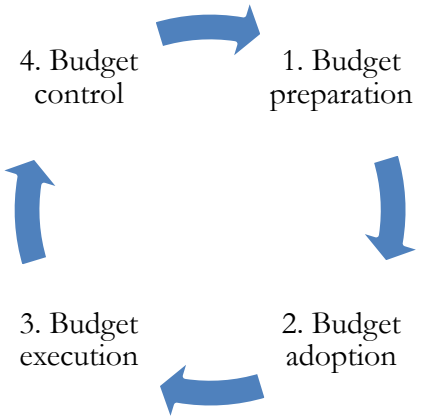
of students in each area (Education Equity Fund, 2018). This might widen the inequality gap between provinces. Therefore, multidimensional factors should be considered in budgeting process to ensure the efficiency and inequality reduction throughout the country.

3.3.2 Thailand's budgeting process in education

Every fiscal year, the education budget is allocated across provinces to both the central administration office in each province and its own local administration office. Although Thailand has been decentralized since the political reform in the 1990s, a major amount of the budget spent by each province has been distributed by the central government, not by the local government (Dufhues et al., 2014). This is because the education curriculum and activities still rely on central educational policy although the local governments know more about the contexts of local students. On average, the public expenditure on basic education is accounted for 70% of the total expenditure on education. These significant amounts cover education expenditures from pre-school education to upper secondary education composed of both capital and current expenditures. According to the statistic year 2013-2016, 74% of the budget for education were spent on the educational staff (Education Equity Fund, 2018).

To understand which factors may influence the public expenditure on education provincial level, it is also important to know the budgeting process of the Ministry of Education and Budget Bureau. In Thailand, there are four main stages of the budgeting process including budget preparation, budget adoption, budget execution, and budget control (Senarith, 1995).

Figure 3.5: Budgeting process of Thailand (Senarith, 1995)



For budget preparation, the Budget Bureau firstly set the budget constraint while the Ministry of Education must estimate the total amount they need based on policies and annual proposals. Once the minister approves the annual budget, the Office of the National Primary Education Commission (ONPEC), the Department of General Education (DGE), the Department of Vocational Education, and other offices related to basic education indicate the guidelines and budget planning for the Provincial Primary Education Committee (PPE), Provincial Secondary Education Offices (PSEO), the Provincial Vocational Education Committee (PVEC) to survey the needs of people on education and estimate the capacity of the province. These agencies are the connection between the agenda of the central government and the local needs. After that, they propose annual budgets back to the Policy and Planning Office for preliminary review before sending them to the minister to approve and forward to Budget Bureau.

The next step is budget adoption in which the offices at the provincial level prepare information for preliminary review by the Policy and Planning Offices and submit it to the Ministry of Education and the Parliament Secretary for the consideration of Parliament. Moreover, the additional budget can be requested through the Policy and Planning Office to propose to Budget Bureau. After the departments under the Ministry of Education are notified by the minister for budget execution, they shall prepare the plan of budget allocation to the implementing local offices. The execution plan is used as an implementation guideline and for approval of the allocation by the Budget Bureau. By the end of the year, budget control is the last step and is performed by the Policy and Planning Office to monitor and evaluate the performance of the public expenditure to improve the efficiency of budget allocation in the future.

The budgeting process helps to understand the cycle of public expenditure on education from the beginning to the end. There are many stakeholders engaged in the process, but the final decision on the budget is still made by the central government. In theory, the local government agencies survey the local needs to ensure that the budget allocation serves the actual demand of people and reduces inequality. However, there are external factors in practices that the underprivileged people are not targeted. Moreover, the complicated budgeting process allows bureaucrats to corrupt and enjoy benefits from hidden budgets. If the budget control process was inefficient, the government would spend excessively but result in less expected outcomes. Thus, the education budget should concern all relevant factors before allocation to maximize to benefit of money spent.

3.4 Multidimensional settings of public expenditure on education

Some insights of Thai contexts from many perspectives are also useful in quantitative analysis of the factors relating to public expenditure on basic education. Hence, the facts about settings of budget allocation to local areas in Thailand are provided in this section.

3.4.1 Economic-demographic settings

According to the report "Provincial and Regional Budget Allocation process in 2017" (Parliamentary Budget Office, 2016), the budgets distributed to each province depend on the income of the household, size of the population, GPP, and the equal amount received by all provinces. Similarly, the educational budget also takes these factors into account and mostly follows the education policy. Since 2018, the central government has supported basic needs in education under the 15-year Free Education Program including teaching expenditure (per capita), textbooks, school equipment, uniforms, and student development activities. Apart from general expenditure, the teaching expenditure per capita can be decomposed into financial support for a small school with special needs, low-income students, school lunches, etc. This means the government also concern with socioeconomic and demographic factors before distributing the budget to provinces. However, a recent study found that many schools in rural areas also depend on an external budget such as donations or household out-of-pocket money due to insufficient amount received (Office of the Education Council, 2021).

3.4.2 Political setting

Different political periods have a different focus on the educational policy which shifted the public budget on education from time to time. According to median voter theory, the pro-poor government policy aims to reduce inequality by attracting more votes from poor people. This was part of the populism concept in Thailand started in 2001 during the political era of Thaksin Shinawatra whose populist policies reduced the power of elites and supported the poor people resulting in higher government expenditure (Phongpaichit and Baker, 2008). As the Ministry of Education is one of the major ministries and directly invests in human capital, the government usually gave priority to increasing the educational budget. However, the scale of impact from education expenditure may be smaller compared to other expenditures such as transportation and infrastructure which is more visible to the voters.

Although the government aimed to reduce the inequality gap between provinces, the evidence showed that more developed provinces still practically received higher education budgets than less developed provinces in Thailand due to the higher demand for skilled labor

(Sagarik, 2013). Moreover, the educational budget during the period of study has been under the control of the Military government led by prime minister Prayut Chan-o-cha who seized the power from a military coup in 2014. It is interesting to see whether the median voter theory also affects the public expenditure on education during this period since the government was dictatorship rather than democratic, so the votes may be less important for them.

3.4.3 Geographic setting

In general, the students in schools located in special areas such as backcountry highlands and isolated islands usually face difficulties in accessing the quality of education due to higher traveling costs and poorer socioeconomic status (Ministry of Education, no date). By definition, a school in a backcountry highland is under the administration of the Office of the Basic Education Commission that is located in hilly areas (150-600 meters), mountains (600 meters and above), or mountain ranges either from 500 meters above sea level, or higher than the average height of the province, or located in a valley between the mountains with a route from the city hall to schools which have difficulty in organizing education regarding geography, characteristics, and distance of transportation, public utilities, student information, and other administrative difficulties. Moreover, the island schools also have similar problems to the schools in highland areas. According to its definition by the Office of the Basic Education Commission, an island school means a school located in an island area, surrounded by water, and separated from the land all year or only reachable by boat. In addition, schools in three southernmost border provinces also have many educational disadvantages since they have experienced the risks of terrorist insurgency-related to language and religious conflicts for a long time (Arphattananon, 2011).

Due to the additional needs of the schools in special areas across Thailand, the Ministry of Education is also concerned about the additional budget for basic education to reduce inequality and raise opportunities for students to equally access the quality of education (Ministry of Education, no date). Therefore, the different geographic area is one of the factors linking to public expenditure on basic education allocated across the country.

3.4.4 Role of governance and education performance

Corruption has been one of the main problems obstructing the development of Thailand for a long time. According to the Corruption Perception Index (CPI) as a measurement of the international transparency level in a country (scale 0-100), Thailand's

CPI score have a minor change over the past 10 years with relatively low scores of about 35-38 implying low transparency and high corruption rate (UNDP and NACC, 2021). In the Thai education system, corruption also leads to poor quality of education. The budget allocation from the central government to provinces is a complicated procedure involving many stakeholders. This increases risks of corruption such as bribery, budget misappropriation, or ineffective public spending exploited by politicians and educational staff along the process which is also difficult to detect without an efficient monitoring system. For example, school supplies cost only 5,000 Baht while they ask for a bill of 50,000 from the supplier and share the rest benefit instead of spending on other educational purposes (Thai education system: Completely corrupt, 2016). As a result, the educational budget is not fully beneficial to the students or is very costly without improving the educational outcomes. According to the Program for International Student Assessment (PISA) scores in 2018, the share of low-performance students in reading is 60% compared to only 23% in OECD countries although the amount of public education expenditure in Thailand is sufficient to achieve high education competencies and economic growth (Krissadee, 2022). Good governance and fiscal budgetary transparency in education are required to enhance educational performance.

In general, the Ministry of Education has an internal monitoring system to evaluate public expenditure on education. However, there may be a conflict of interest as it is also part of the ministry. Hence, the external auditor and relevant stakeholders are also important in evaluating the public budget related to educational performance. The State Audit Office (SAO) of Thailand is another key organization playing an important role in auditing public budget expenditure (Blazey et al., 2020). SAO performs oversight financial audit, compliance audit, and performance audit at the end of a fiscal year to ensure transparency, accountability, and good governance of public spending by public agencies including the Ministry of Education. Moreover, the economy, efficiency, and effectiveness of the expenditures or value-of-money are also tackled through performance audits (OECD, 2016). According to the role of external audit, the educational outcomes can be improved with the efficient use of money under the policy recommendations by SAO.

Chapter 4: Methodology and data

This chapter contains the model specifications, data collection, descriptive variables, and the correlations detection between independent variables respectively. During the estimation procedure, some variables are omitted to avoid multicollinearity problem and some models are adjusted. The final variables are summarized at the end of the chapter.

4.1 Model specifications

To explore the explanatory factors of public expenditure on basic education across provinces, the annual data of the basic education budget were obtained from the Bureau of Budget as a credible source of data. From the conceptual framework in chapter 2, some variables used at the national level must be adjusted to suit the provincial level. The panel data analysis for 77 provinces from the year 2018-2020 is used. There are 2 models in this study, one to explore factors related to public educational expenditure and another to see its efficiency on educational outcomes.

To decide whether to use fixed effect or random effect, the Hausman test is employed to examine the appropriate model. The null hypothesis indicates no difference between fixed and random effects. According to our test result, the null hypothesis is rejected implying that random effect is inconsistent and fixed effect is preferred (see appendices table I, II). Therefore, we use a fixed effect to estimate the change within a province (entity) over time by controlling for unobserved heterogeneity of individual provinces as it may affect or cause bias on the dependent variable (Wooldridge, 2001). This effect helps to observe the pure effect of each predictor in the model. However, fixed effect omits time-invariant variables which are unique in each province and should not be correlated with other individual characteristics. In this case, the random effect may also be used to see the effect of geographic factors as a time-invariant variable in this study.

Moreover, we test for a time-fixed effect to see whether the dummies for all years are equal to 0. As the result rejects the null hypothesis, the time dummies are required meaning that the change in variation in public expenditure on basic education can be explained by overall time trends (two-way fixed effect). In another word, change within provinces (cross-sectional variation) is captured by provincial fixed effect while a change in between provinces (time-series variation) is captured by time-fixed effect. Time dummies also control for the specific event that happened in each year that may influence the outcome variable. This is also reasonable as the public expenditure on basic education in Thailand during 2018-2019 in this study may be affected by shocks from both the covid pandemic and

Thailand's general election in 2019. The model specifications for the provincial allocation are as follows.

Model 1

$$lnGPEDU\_CAP = \alpha_0 + \alpha_1 ECON_{it} + \alpha_2 DEMO_{it} + \alpha_3 POLI_{it} + \alpha_4 GEO_{it} + \rho_i + \tau_t + \varepsilon_{it}$$

The first model examines the multidimensional factors of the public expenditure on basic education per capita (GPEDU_CAP). These factors are represented by the vectors of economic variables (ECON), demographic variables (DEM), political variable (POLI), and geographic variable (GEO). Economic variables contain Gross Provincial Product per capita, inflation rate, and unemployment rate (GPP, INFL, UNEMP respectively). Demographic variables include the proportion of young population, elderly population, share of poor students, and population density (YPOP, EPOP, STU_POV, POP_DEN respectively). Political variable is poverty rate (POV) while geographic variable is a dummy isolated area (ISOA). ρ_i is entity fixed effect and τ_t is time fixed effect.

Model 2

$$\text{Yearschooling} = \beta_0 + \beta_1 lnGEPDU_{it} + \beta_2 ITA_i + \pi_i + \eta_t + \epsilon_{it}$$

$$\Delta\text{Yearschooling} = \beta_0 + \beta_1 lnGEPDU_{it} + \beta_2 ITA_{it} + \beta_3 \text{Yearschooling}_{i,t-1} + \varphi_i + \vartheta_t + \nu_{it}$$

$$ONETscore = \gamma_0 + \gamma_1 lnGEPDU_{it} + \gamma_2 ITA_{it} + \omega_i + \iota_t + \mu_{it}$$

$$\Delta ONETscore = \beta_0 + \beta_1 lnGEPDU_{it} + \beta_2 ITA_{it} + \beta_3 ONETscore_{i,t-1} + \varsigma_i + \chi_t + \varpi_{it}$$

$$HAI\_ED = \delta_0 + \delta_1 lnGEPDU_{it} + \delta_2 ITA_{it} + \rho_i + \lambda_i + \theta_t + \sigma_{it}$$

$$\Delta HAI\_ED = \beta_0 + \beta_1 lnGEPDU_{it} + \beta_2 ITA_{it} + \beta_3 HAI\_ED_{i,t-1} + o_i + \partial_t + \kappa_{it}$$

The second model investigates the effect of gross public expenditure on basic education (GEPDU) on different educational outcomes including average years of schooling (YRSCH), Ordinary National Education Test score of upper secondary students (ONET), and total Human Achievement Index on education (HAI_ED) which are presented in different equations. The governance vector (ITA_i) is also included as it may also relate with the education performance in each province. Moreover, we also examine these factors on a change in educational outcomes (ΔYRSCH, ΔONET, ΔHAI_ED) while control for the outcome on previous year (t-1). This may help to understand whether the budget and governance factors relevant to an improvement in educational outcomes.

Although there are other educational outcomes such as percentage of children aged 0-5 years with developmental maturity and enrollment rate on secondary education as sub-indicators in HAI_ED, they are not included in the model 2 due to unavailability of data. All equations in model 2 also include both entity and time-fixed effects.

4.2 Data and Variables

The secondary data of each variable is obtained from different sources, mainly from government databases. The descriptive statistics, variables, and data sources are presented in this section. There are 231 observations derived from 77 provinces over 3 years (2018-2020) for variables in model 1. However, the total scores of HAI on education as a dependent variable in model 2 have only 154 observations because the provincial data are available from 2019-2020. The mean, standard deviation, minimum, and maximum are also provided in table 4.1.

Table 4.1: Descriptive Statistics

Variable	Obs	Mean	S.D.	Min	Max
GPEDU_CAP	231	24886.82	117390.5	2624.975	1082826
GPP	231	167461.36	151919.68	55416.869	1067449.4
INFL	231	0.419	0.587	-4.223	2.759
UNEMP	231	1.21	0.9	0.067	6.988
YPOP	231	16.719	2.603	11.616	25.885
STU_POV	231	23.114	10.87	1.77	57.045
POP_DEN	231	243.627	480.492	22.282	3618.61
ISOA	231	0.468	0.5	0	1
POV	231	9.777	8.231	0	49.13
Yearschooling	231	8.221	0.89	5.95	11.26
ONETscore	231	32.795	2.89	25.291	42.51
HAI_ED	154	0.4931383	0.1273739	0.1531	0.8812
Budget_control	230	77.084	8.499	46.215	87.15
Procedure_improve	230	76.189	5.363	49.133	93.82
Open_data	230	60.332	14.824	27.06	100

4.2.1 Variables: Model 1

4.2.1.1 Dependent variable

Gross public expenditure on basic education per capita (GPEDU_CAP) is the total amount of basic education expenditure including preschool, primary education, and secondary education divided by the number of total students in basic education (computed by the author). It is a real value measured in Thai currency (Baht). Both capital and current expenditures are included in this amount. As basic education is a core of education system in Thailand, expenditure per capita is appropriate to capture the budget each student received

which also reflect the government reaction on actual needs in a province. The data are obtained from the Budget Bureau during the year 2018-2020.

4.2.1.2 Independent variables

In this study, the independent variables are the multidimensional explanatory factors including economic, demographic, geographic and political factors used to analyze the relationship with public expenditure of basic education in Thailand. Most of these variables are time-variant meaning they change across time and different among provinces.

1) Gross Provincial Product per capita (GPP)

According to the conceptual framework, GPP per capita is an economic factor modified from GDP in national level to suit the context of provincial level. This factor represents income per capita (Baht/person) or the economic performance of each province that may relate to the amount of basic education budget received from the central government. It is expected to have positive relationship to public education expenditure following Wagner's law as higher economic performance signals higher demand of human capital investment. The GPP data is obtained from Office of the National Economic and Social Development Council (NESDC).

2) Inflation (INFL)

Inflation is one of the key factors in economic activities and can be calculated from a change in consumer price index (CPI) over one year in percentage. This variable reflects the economic performance in each period, for example, the economic boom raises market price level causing people to spend more on the same product. As each province have different economic levels and living expenses, the inflation may be one of the factors the government concern before allocating education budget. It is expected to have a positive sign as the government may allocate more educational budget according to higher living cost in a province. The inflation data is also obtained from NESDC.

3) Unemployment rate (UNEMP)

Unemployment rate is measured as a share of unemployed people per total people in labor market measured in percentage. It also captures the economic situation in each province as higher unemployment signals weak economy. The government may consider raising education expenditure to help people during hard time by reducing their burden on education expenses. So, the unemployment variable is expected to be positive. Again, the data of unemployment rate is retrieved from NESDC.

4) Proportion of young population (YPOP)

This is a percentage of school-age population (age 0-14) which is an important demographic factor to measure the demand of education. As a share of young population is higher, the education budget tends to increase to serve the higher needs on education. However, it can be perceived as a dependency ratio implying that the government can collect less tax from those provinces and put pressure on lower overall budget, including education budget. This data is obtained from the National Statistical Office of Thailand (NSO).

5) Proportion of elderly population (EPOP)

The elderly people can also be both demographic factor and political factor represent older median voters. A province with high share of elderlies may prefer the government to spend on other expenditures such as healthcare, not education. Therefore, it is possible that this dependency ratio has negative relationship with the public expenditure on basic education unless they favor education expenditure for their younger generation. The data is attained from the NSO.

6) Proportion of poor students in each education level (STU_POV)

Another interesting demographic variable that will be included in this study is a proportion of students living in poverty measured as a percent of cumulative poor and extremely poor students in each province. Since these group of students have faced many difficulties in accessing quality of education, this variable is expected to be positive as they may need additional financial support from the government to cover transport, food, and student activities costs (Kertbundit, 2020). The educational subsidies help to reduce burden of family and students to catch up the standard of national education which helps to reduce inequality and ensure that no child is left behind. The data is attained from the Equitable Education Fund (EEF) of Thailand.

7) Population Density (POP_DEN)

The population density is a demographic factor measuring number of populations in a unit of area (square kilometers). We expect negative sign as it is possible that the government spent lower in a highly populated province since the educational facilities and educational staffs are shared by many students in the same area (the economies of scale). The data of population density is obtained from the NSO.

8) Isolated area (ISOA)

The dummy variable called 'Isolated area' is a geographic factor representing characteristic of a province. It is included to see the effect of expenditure distribution among provinces that have public schools located in special areas such as backcountry highlands,

islands, or three southernmost provinces of Thailand (equal to 1 or vice versa). Students and teachers living in these areas are facing difficulties accessing the schools and may need more support from the government in terms of traveling cost to school, educational materials, cost of preparation, etc. Therefore, this variable is expected to be positive. The data is retrieved from the Ministry of Education (MoE).

9) Poverty ratio (POV)

This is a percentage of people living below the national poverty line in each province in Thailand. It represents a median voter theory as the government may allocate more educational budget to the province with higher share of poor people to attract decisive voters and gain popularity. Therefore, we expect poverty ratio to have positive relationship on public education expenditure. The data of this variable is obtained from the NSO.

4.2.2 Variables: Model 2

4.2.2.1 Dependent variables

1) Average years of schooling of people aged 15 years old and above (Yearschooling)

This educational outcome is a sub-indicator of Human Achievement Index (HAI) on education measuring an average length of time that a population aged 15 years and above spent on education. It is computed from the number of years that the population aged 15 years and above spent studying divided by the total population aged 15 years and above. Higher average years of schooling means people in a province spent longer time at school implying more chance to access education system. The data is collected in yearly basis and available in provincial level and can be obtained from Ministry of Education during the year 2018-2020.

2) Ordinary National Education Test score of upper secondary students (ONETscore)

An average score of national tests (O-NET) is also a sub-indicator of HAI on education to measure quality of education or the knowledge of students at the last stage of basic education. The test covers 5 core curriculum subjects including Thai Language, Social Studies, English, Mathematics, and Science. The average score of O-NET is calculated from the total score divided by the number of upper secondary students who take the exam and measured in 100-point scale (%). The average ONET score is available on a yearly basis in provincial level. This data is also collected from National Institute of Educational Testing Service (NIETS) under Ministry of Education during period 2018-2020.

3) Total score of Human Achievement Index on education (HAI_ED)

This is the composite index of 4 sub-indicators including average years of schooling for people above 15 years old, proportion of children aged 0-5 years with developmental maturity (%), enrollment rate on secondary education (%) and Ordinary National Education Test score (O-Net) of upper secondary students (%). The score of HAI on education is calculated from the sum of the sub-indicator scores divided by 4. Each sub-indicator score is computed by using the formular *(Sub indicator value-min value)/(max value – min value)*. The higher value of HAI on education implies higher education development in each province. Since the data of sub-indicators in some year is missing, we can obtain for only 2 years period (2019-2020).

4.2.2.2 Independent variables

1) Gross public expenditures on basic education per capita (GPEDU_CAP)

This is the real basic education expenditure per capita as in model 1 but it is perceived as an educational input in model 2 to see its relationship with educational outcomes. If the public expenditure on education per capita increases each educational sub-indicator, it implies that the efficiency of budget spent on educational purposes. So, it is expected to be positive. The data of public expenditures on basic education are obtained from the Budget Bureau from the year 2018-2020.

2) Governance factors

In this study, we use data from selected sub-indicators of Integrity and Transparency Assessment (ITA) as proxy variables to measure good governance. The ITA is initiated by The Office of the National Anti-Corruption Commission of Thailand as part of the National Anti-corruption Strategy – Phase 3 (2017 - 2021) since the government has aimed to develop and strengthen proactive anti-corruption mechanism in public sector. The ITA was developed as a monitoring tool to tackle corruption leading to the organizational improvement and the implementation of strategies to maintain good governance and corruption prevention among participating government agencies. It is also internationally recognized by UNDP Thailand as an excellent Anti-Corruption indicator initiative that can be used to evaluate the public performance, paper-based evidence, and relevant to the source of Corruption Perception Index (CPI) assessment (UNDP and NACC, 2021). Moreover, ITA is an effective self-assessment used to prevent corruption risk and should be promoted more by the government to gain benefit from it (OECD, 2021). Therefore, it is interesting to use ITA score as a governance factor in this study.

The ITA data in provincial level is collected every fiscal year from Provincial Administrative Organizations and Local Administrative Organizations in public sector. The data are collected by using online questionnaires, interviews, or emailing and evaluating by the consultants. There are 10 indicators composing of bribery fraud (ITA1), budget misappropriation (ITA2), power distortion (ITA3), asset misappropriation (ITA4), and anti-corruption improvement (ITA5), service quality (ITA6), communication efficiency (ITA7), and procedure improvement (ITA8), open data (ITA9) and anti-corruption practice (ITA10). These governance indicators are assessed by internal stakeholders, external stakeholders, and transparency level of data. Each indicator uses 100-point scale and signals higher governance level when the score is close to 100. They can be used to reflect the level of good governance in public sector across provinces in Thailand and might relate to the efficiency of public expenditure on basic educational outcomes. We expect that the high level of these governance factors increases the level of local educational outcomes as measured by sub-criterion HAI on education. However, we cannot include all indicators in the model due to multicollinearity problem. The selection of the most appropriate governance indicators will be discussed in the next section.

Correlations and multicollinearity

After the data of all variables is collected, the correlations among each pair of independent variables are detected to select the most appropriate models and avoid multicollinearity problem. From the correlation table of model 1 (see appendices table III), we realized that the correlation between proportion of young population (YPOP) and elderly population (EPOP) is very high (-0.8142). Thus, we drop EPOP from the model and keep YPOP as young population is more important to directly reflect the demand of basic education. The proportion of students living in poverty (STU_POV) is also highly correlated with both GPP per capita (lnGPP) and poverty ratio (POV) with the correlation of -0.7216 and 0.5981 respectively. However, the correlation of lnGPP and POV are in acceptable level. We decide to keep all since they are our interested variables by including lnGPP with POV in the same model but run STU_POV separately. Other variables have moderate correlations and can be included in all models. Therefore, the final functions of model 1 are as follows.

$$lnGPEDU = f(\boldsymbol{lnGPP}, \boldsymbol{POV}, INFL, UNEMP, YPOP, lnPOP\_DEN, STU\_POV, ISOA)$$

$$lnGPEDU = f(INFL, UNEMP, YPOP, lnPOP\_DEN, ISOA, \boldsymbol{STU\_POV})$$

According to the model 2, we try to find the governance variables that are not highly correlated to avoid multicollinearity (see appendices table IV). These governance factors and public expenditure on education are the independent variables of each educational outcome. Finally, we select a control of budget misappropriation (ITA2), procedure improvement (ITA8), and open data (ITA9) as their correlations are acceptable and appropriate to measure the educational outcomes in provincial level. For convenience, we named these governance factors **"Budget_control", "Procedure_improve", and "Open_data"** respectively.

$$YRSCH, \Delta YRSCH = f(lnGPEDU, \text{Budget\_control, Procedure\_improve, and Open\_data})$$
$$ONET, \Delta ONET = f(lnGPEDU, \text{Budget\_control, Procedure\_improve, and Open\_data})$$
$$HAI\_ED, \Delta HAI\_ED = f(lnGPEDU, \text{Budget\_control, Procedure\_improve, and Open\_data})$$

According to the Integrity and Transparency Assessment score, a **control of budget misappropriation** reflects the corruption perception of the provincial government officers such as the efficiency of public spending, the acknowledgement of annual budget plan, the public spending on private purposes, or the internal engagement on public audit. The appropriate budget spending (higher value of ITA_2) should increase the educational outcomes as the input is utilized on the right purposes. Next, **procedure improvement** measures the perception of external stakeholders such as citizens who contact with the government on the working procedure of the public sector such as the administration and services improvement, the use of technology for efficiency enhancement, the external participation on procedure improvement, and the transparency improvement. This indicator may also link to educational outcomes since better working procedure (higher ITA_8) increase efficiency of the budget and being monitored by external stakeholders. Last, **open data** indicator is surveyed from the perception of organizations or government agencies themselves to evaluate the level of public data disclosure including basic information, administration, budget appropriation, human resource management, human resource development, and transparency promotion to enhance transparency and data accessibility by people. Since it is more difficult to do corruption when all transactions and responsible persons are trackable (higher ITA_9), this governance factor may raise the performance of students because the budget is fully spent on educational purposes. All final variables in this study are summarized in the table 4.2 below.

Table 4.2: Variables and Data sources

Factors	Variables	Expected sign	Description	Data sources
Dependent variables (LHS)	GPEDU_CAP	+/-	Gross public expenditure on basic education per student	Bureau of Budget, EEF
Economic factors (RHS)	GPP	+	Gross Provincial Product per capita	NESDC
	INFL	+	Inflation (%) or a percent change of consumer price index	NESDC
	UNEMP	+	Unemployment rate (%)	NESDC
Demographic factors (RHS)	YPOP	+	Proportion of young population (age <15)	NSO
	STU_POV	+	Share of students living in poverty (%)	EEF
	POP_DEN	-	Population Density (number of populations per a unit of area)	NSO
Political factor (RHS)	POV	+	Poverty rate (%) or the proportion of people living under the national poverty line in each province	NSO
Geographic factor (RHS)	ISOA	+	Isolated Areas (Dummy, =1 if the province has public schools located in special areas)	MOE
Educational outcomes (LHS)	Yearschooling	+/-	Average years of schooling for people aged above 15 years old	MOE
	ONETscore		Ordinary National Education Test score of upper secondary students (O-NET)	MOE
	HAI_ED		Aggregate education index of each province (Human Achievement Index on education)	MOE
Governance factors (RHS)	Budget_control	+	Control of budget misappropriation	NACC
	Procedure_improve	+	Procedure improvement	NACC
	Open_data	+	Open data	NACC

Chapter 5: Result discussion

This chapter will examine the results of two models including the explanatory factors of public expenditure on basic education (model 1) and the educational outcomes based on budget and governance factors (model 2) as discussed in the last chapter. After using fixed effect model with time dummies to run regressions of both models, the results are discussed as follows.

5.1 Model 1

As discussed in the previous chapter, our focused equations are equation 1 and 3 using entity and time fixed effect model to investigate the explanatory factors such as economic factors (lnGPP, INFL, and UNEMP), demographic factors (YPOP, lnPOP_DEN, STU_POV), and political factor (POV). The only difference between these two equations is that we run lnGPP and POV (equation 1) separately from STU_POV (equation 3) to avoid multicollinearity problem. However, we also run random effect model (equation 2 and 4) to learn about the time-invariant geographic variable (ISOA) and to check robustness of other variables. As we also found the presence of heteroscedasticity by using Wald test, a robust standard error is applied in model 1. The regression results and analysis are as follows.

Table 5.1: Regression results of Model 1

	(1) **FE**	(2) RE	**(3)** **FE**	(4) RE
lnGPP	**-0.0688**	0.0247		
	(0.158)	(0.0895)		
INFL	**-0.0198**	-0.0247	**-0.0236**	-0.0290*
	(0.0165)	(0.0175)	**(0.0157)**	(0.0169)
UNEMP	**-0.0430***	-0.0474**	**-0.0376***	-0.0473**
	(0.0248)	(0.0227)	**(0.0205)**	(0.0210)
YPOP	**-0.0249**	-0.0264	**-0.0384**	-0.0307
	(0.0501)	(0.0276)	**(0.0491)**	(0.0304)
lnPOP_DEN	**-5.587****	0.353	**-5.363****	0.384
	(2.367)	(0.247)	**(2.205)**	(0.258)
STU_POV			**0.00266**	0.00399
			(0.00259)	(0.00279)
POV	**0.00370**	0.00308		
	(0.00400)	(0.00363)		
ISOA		**0.368****		**0.396****
		(0.158)		**(0.158)**

_cons	**37.53*** **	6.983***	**35.82*** **	7.133***
	(12.42)	(12.42)	**(12.42)**	(12.42)
Time-fixed effect	**yes**	yes	**yes**	yes
Entity- fixed effect	**yes**	yes	**yes**	yes
Hausman test	**0.0000**		**0.0000**	
N	**231**	231	**231**	231
R^2- within	**0.929**		**0.927**	
R^2- In between	**0.1179**		**0.1168**	
adj. R^2	**0.899**		**0.900**	

Note: Robust standard errors clustered by provinces is in parentheses
Significance level $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$
(N=77 provinces*3 years)

5.1.1 Economic factors

From the fixed effect model in equations 1 and 3 in table 5.1, the adjusted R-square is as high as 0.899 meaning that almost 90% of public education expenditure per capita can be explained by the independent variables in the models. The within R-square is 0.929 which is significantly higher than the in-between R-square (0.1179) showing that the change in public spending on basic education is mostly explained by the change within the provinces over years, not the difference among provinces. The only significant economic factor is the unemployment rate (UNEMP) at 10% level of significance with negative signs meaning that a 1% increase in unemployment rate is negatively associated with about 4.3 and 3.76 percentage change in the public expenditure on basic education per capita (equations 1 and 3 respectively), holding other variables constant. After we run the random effect in equations 2 and 4 to check the robustness, the unemployment rate is still significant with the same sign as our focused equations confirming that the unemployment rate is negatively related to basic education spending per student during the study period. In another word, the government allocated less expenditure for basic education per capita when the unemployment rate increased. The result is consistent with Wagner's Law as the government spends less when the demand in the economy is reduced while it is opposite the Keynesian Counter-Cyclical theory as the government should spend more during economic decline to raise the economy.

To explain this effect, the government might not choose to increase the basic education budget to stimulate the economy during a recession or high unemployment rate. Moreover, there was shock by the Covid pandemic during the study period of 2018-2020 leading to an economic downturn and a higher unemployment rate in all regions of Thailand. According to Kaendera and Leigh (2021), Thailand's GDP fell by 6.1 percent in 2020 and many workers especially in the tourism sector accounted for 20% of employees who lost their jobs. The low-skilled workers, informal workers, and migrant workers have been affected by the

unstable market. Moreover, the fiscal deficit widened from -0.06% of GDP in 2018 to -0.81% and -4.7% of GDP in 2019 and 2020 respectively as the government spent more than the tax collected to stimulate the economy (ibid, 2021). Under the budget constraint during the crisis, they might consider reducing the education budget and investing more in budget with emergency needs such as the public health sector (treatment, vaccines, laboratories, and vaccination services), social protection, and tourism sector as main income of the government to mitigate and prevent the infection and stimulate the economy in short term.

Other economic factors including lnGPP and INFL are negative in fixed effect models (equations 1 and 3) but are insignificant implying that the income per capita and inflation rate were not relevant to the public expenditure on basic education per student. The government might not consider allocating the education budget based on economic development or price level in each province during the study period.

5.1.2 Demographic factors

The only significant demographic factor is population density (lnPOP_DEN) at a 5% level of significance in our fixed effect models with a negative sign. However, it is less robust than the unemployment rate as it turns insignificant in random fixed effect models. As population density increases 1%, the public expenditure on basic education per capita reduces by 5.59% and 5.63% in equations 1 and 3 respectively. This is relevant to most empirical studies as the government can reduce the cost of educational services and infrastructure in the highly populated area due to the economies of scale. It also implies the disadvantages of living in a congested province as a student at a basic education level received a lower budget and share educational facilities with other students. It could lead to an unequal distribution of resources and utility level per student across provinces which might widen the learning gap between students across provinces, especially in poor provinces. However, it is interesting that the population density is also related to the budget allocation on basic education from the central government to the provincial level.

YPOP has a negative sign, but it is insignificant meaning that the proportion of the young population (less than 15 years old) or school-aged population has no relationship with the amount of basic education budget received per capita. Moreover, STU_POV has a positive sign in equation 3 reflecting that the government increases the education budget per student in a province with a higher share of students living in poverty and extreme poverty to support their additional needs in underprivileged contexts. However, it is also insignificant implying

that a province with more poor students may not practically receive higher public education expenditure per capita.

5.1.3 Political factor

According to equations 1 and 2, the poverty ratio (POV) as the only political factor has no significant relationship with basic education expenditure per capita although it has a positive sign. This means Median voter theory was not valid in the case of basic education expenditure allocation as the factor of decisive voters who are mostly poor was not relevant to the government's decision on the allocation of educational budget per capita. From the evidence, more than 65,000 students dropped from the education system during the covid-19 period as they became suddenly poor (Equitable Education Research Institute, 2022). Thus, their priority was not studying but working to support their families. In the meantime, the government might invest more in other expenditures such as social security or cash payment to the poor to serve urgent needs and be more visible outcomes (Sagarik, 2013). Another interpretation is that the Median voter theory in Thailand might be valid under populist policies in the past but not under non-democratic government during this study period. However, this was not a good sign since the government should take the poverty ratio into account while deciding on education budget allocation even during the crisis to reduce inequality among provinces in the long run.

5.1.4 Geographic factor

The random effect models allow us to learn about a time-invariant geographic variable. From equations 2 and 4, ISOA representing the characteristics of a province that has schools located in hardship areas is significant with an expected positive sign. The provinces that have public schools located in special areas such as backcountry highlands, islands, or three southernmost provinces of Thailand received higher public expenditure on basic education per capita for about 36.8 and 39.6 percentage points respectively. The government seemed to give high weight to the geographic area in educational budget allocation. This was a good sign as most schools in highlands and islands are small which require higher cost per capita to organize education. In general, teachers and educational staff are exposed to higher risks and have a higher cost to travel to school or to visit students' houses (Ministry of Education, no date). Moreover, the students in backcountry highland areas are mostly ethnic groups having their rituals, languages, and cultural diversity causing them difficulties to study the national curriculum in Thai (ibid.). Therefore, additional financial support per student is required to prepare a special curriculum for these groups of students who are unable to communicate in Thai and have a developmental delay.

Overall, the unemployment rate (-), population density (-), and provinces with schools located in isolated special areas (+) are important explanatory factors of public expenditure on basic education per capita during the period 2018-2020. Next, model 2 will explore different educational outcomes given the educational input and selected governance factors.

5.2 Model 2

There are 6 equations in model 2 exploring whether educational expenditure per capita (input) and governance factors including a control of budget misappropriation, procedure improvement, and open data relate to different annual educational outcomes (equations 1,3,5) and their improvement (equations 2,4,6). We also add lag educational outcomes to control a change in educational outcomes. As we found the presence of heteroscedasticity by using Wald test, a robust standard error is applied in model 2. The provincial and time fixed effect model is applied in all equations except equation 6 using OLS technique since there is only 1 year period left.

Table 5.2: Regression results of Model 2

	(1)	(2)	(3)	(4)	(5)	(6)
	Yearschooling	ΔYearschooling	$ONETscore$	$\Delta ONETscore$	HAI_ED	ΔHAI_ED
lnGPEDU_CAP	-0.0248	**0.527****	0.359	0.554	0.0184	0.0101
	(0.0813)	**(0.210)**	(0.232)	(0.610)	(0.0888)	(0.00772)
Budget_control	0.00182	0.0115	**0.0112****	0.00570	-0.00105	-0.00154
	(0.00185)	(0.0106)	**(0.00481)**	(0.0303)	(0.00444)	(0.00175)
Procedure_improve	-0.00258	-0.00372	-0.00260	0.000260	**0.00182***	**-0.00145***
	(0.00270)	(0.00288)	(0.00723)	(0.00909)	**(0.00103)**	**(0.000870)**
Open_data	0.000676	-0.000349	-0.00442	-0.00469	0.000591	0.0000582
	(0.00138)	(0.00160)	(0.00328)	(0.00497)	(0.000527)	(0.000297)
$YRSCH_{t-1}$		-1.352***				
		(0.0933)				
$ONET_{t-1}$				-1.427***		
				(0.101)		
HAI_ED_{t-1}						-0.396***
						(0.0328)
_cons	8.331***	5.421**	30.60***	40.50***	0.172	0.440***
	(0.761)	(2.579)	(2.090)	(7.916)	(1.084)	(0.166)
Time-fixed effect	yes	yes	yes	yes	yes	-
Entity- fixed effect	yes	yes	yes	yes	yes	-
Hausman test	0.0206	0.0000	0.0000	0.0000	0.0000	-
N	230	154	230	154	154	77
R^2	0.455	0.741	0.914	0.984	0.833	0.742
adj. R^2	0.441	0.731	0.911	0.983	0.827	0.724

Note: Robust standard errors clustered by provinces is in parentheses
(Significance level $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$)

The results in table 5.2 are quite ambiguous and show a mixed picture of each variable on different educational outcomes and its improvement. For equation 2,4,6, we control the improvement of each educational outcome by adding its outcome in the previous year. The lag values of outcomes (Yearschoolingt-1, ONETscoret-1, HAI_EDt-1) are significant and negatively correlated to an improvement in each educational outcome. This means the higher outcomes in the previous year, the lower progress of educational outcomes. It is reasonable that an improvement in educational performance is more obvious in the following year when the earlier performance is worse compared to the one that already has a good performance. For example, an increase in education expenditures per student during 2018-2019 caused only 0.5% higher average years of schooling of Chonburi as the top-5 best performer (from 9.69 to 9.74 years) while it showed a 2.65% increase for Tak as a top-5 lowest performer (from 6.79 to 6.97).

5.2.1 Educational expenditure per capita (input)

The public expenditure on basic education per student (lnGPEDU_CAP) is positively related to an improvement in the average years of schooling of people aged 15 and above (ΔYearschooling) showing 5% level of significance because the contribution of educational input is more observable for one-period improvement of years of schooling compared to cumulative years of schooling (Yearschooling) which may take a longer time to see significant change. However, the size of the correlation is small as 1% higher in basic education expenditure per capita, only 0.00527 years or 2 days increase in a change of average years of schooling implying that the higher educational input did not significantly reflect an improvement in access to basic education. Moreover, public investment in education shows no relationship with either quality of education (ONET score), aggregate education index (HAI_ED), and their changes in each province. The government might spend money inefficiently or spend excessively on low priorities that were not directly transferred to the students and educational outcomes. According to the National Education of Account of Thailand (NEA), more than 70% of the recent average education budget was contributed to the cost of hiring public educational staff. This amount of educational burden included not only the real operating cost such as the salary of public-school teachers but also remuneration of their academic standing levels and pension for retired teachers which contributed less to the performance of students. Since teacher performance appraisal is based on paperwork, most teachers paid more attention to preparing their academic papers to earn a higher position and receive more income, but the students were not a priority (Pimpa, 2005). Another

possible reason is there are other sources of education expenditure excluded in this study due to the limitation of provincial data but also contribute to educational outcomes. For example, NEA also stated that the private sector and Local Administrative Organizations accounted for 40.3% while the central government contributed 59.7% of total public expenditure on basic education in 2018. We might see clearer correlations if these amounts of education budget were included in the model.

5.2.2 Governance factors

According to the governance factors, Budget_control is only significant and positively related to the average O-NET score of secondary students at 5% level of significance meaning a higher control level of budget misappropriation, and a higher average O-NET score. In other words, the average ONET score in each province can be 0.0112*(87.15-46.215) = 0.458 points higher as the budget control score increases from minimum to maximum (see table 4.1). We can explain that a province where academic performance is higher tends to have better control of educational expenditure since the budget is spent appropriately and efficiently on purposes to fully support the learning of the students. Some local areas may spend less on education per student but have better educational outcomes because of more efficient use of resources (Samer 2013: 10). However, the correlation is quite small and not robust as it has neither relationship with other educational outcomes nor their improvements.

Moreover, Procedure_improve is significant and positively correlated to the total HAI on education but not for sub-indicators of education. A province with better procedure improvement also has a higher overall education index although the relationship is not strong. In other words, the aggregate education performance is improved by 0.00182*(93.82-49.133) = 0.0813 points while the procedure improvement score of a province increased from minimum to maximum (see table 4.1). Since this governance indicator is obtained from the external perception, we estimate that a higher score means the outsiders who have contacted the local administrative offices were satisfied with the services which represents the efficiency of the internal operating system. As provincial offices improve the operational process and involve external stakeholders to monitor the education system, the efficiency of public spending tends to be higher which in turn increases the total quality of education. Nevertheless, it shows a negative association with the change in the aggregate education index meaning a province with better procedure improvement has a smaller change in total educational outcomes. It may be expected that the change in the

education index is less noticeable for a province with a previous high level of procedure improvement (Samer 2013: 56).

Last, Open_data are surprisingly not significant in all equations. This implies that the open data does not link with the educational performance as we expected and contradicted to previous studies (Krissadee, 2022; Samer, 2013; Meijer, 2009) as transparency should improve the quality of education. When exploring deeper from the Integrity and Transparency report, we found that the disclosure data on provincial government websites to the public is not very interactive and have systematical errors (Office of the National Anti-Corruption Commission of Thailand 2022: 31-32). The open data available on the websites may not be utilized much by stakeholders; thus, it is just a checklist for the local organizations to do but has not improved the budgeting system. Sometimes, the data was unreachable to external people as it required a password.

Overall, the educational expenditure and governance factors gave unclear relationships with educational outcomes and their improvements in our study. Although some independent variables are statistically significant with expected signs, they do not address strong correlations. The change in the governance of each province may take time for the budgeting process to be improved and contribute to better educational performance over a longer period (Samer, 2013) which cannot be covered in this study. Another possible reason is the governance factors (ITA) of each province are based on a 100-point scale, not ranking or clustered score range, so a change of 1 point may not strongly correlated or show only minor changes in the educational outcomes.

Chapter 6: Conclusion and policy recommendations

In Thailand, the inefficient budget allocation of public education has been criticized for a long time. Although the amount of education expenditure has been significant and sufficient, the distribution to the provincial level was not well-targeted and could not remarkably improve the educational outcomes of the students as expected. First, this study explored the explanatory factors of the recent public expenditure on basic education across 77 provinces in Thailand during 2018-2020 to understand the decision-making of the central government before distributing the budget to different local areas. The factors included in the model of this study are economic factors, demographic factors, political factor, and geographic factors obtained from various theories. Second, we examined the efficiency of public spending and the governance factors on the educational outcomes measured by the sub-indicator of the Human Achievement Index (HAI) on education. The relationships of interested variables were analyzed by employing a fixed effect model for panel data regressions.

From the results, we can answer the research questions that the public expenditure on basic education per capita was partly explained by some factors but several theories are invalid. We found that the unemployment rate (economic factor) and population density (demographic factor) were negatively correlated with the public expenditure on basic education per student while provinces with schools located in isolated special areas (geographic factor) showed a positive relationship. Other factors such as inflation, GPP, the proportion of the young population, ratio of students living in poverty, and poverty rate (political factor) were neglected although they should be considered as part of educational policy to reflect the real needs of people in different provinces.

After the budget was allocated across the country, the educational outcomes were also examined as they should be positively related to the educational input and good governance reflecting how efficiently the budget was spent. We could not confidently conclude that the expenditure per student on basic education contributed to educational performance as expected since only the change in years of schooling of people aged above 15 was significant with a positive relationship, but not for ONET score and composite educational index (HAI on education). Moreover, the relationship between governance indicators measured by Integrity and Transparency survey (ITA score) and educational outcomes were quite ambiguous. Higher control of budget misappropriation was positively linked with higher ONET scores while an improvement in procedure changed in the same direction as total educational performance. Open data indicator as part of fiscal transparency

had no relationship with any educational outcomes. All coefficients were also small and not robust. However, it is worth exploring why each governance factor is linked with only some educational sub-indicator in the future.

For policy recommendations, the criteria of public education expenditure should be improved at the first stage of budget planning. First, the government should consider raising the budget on basic education per capita instead of reducing it in a province where unemployment rises during the recession, as parents with lower income still need to spend on their children's education and to prevent students from dropping out due to lack of financial supports. Basic education should not be ignored but prioritized in the urgent budget planning to maintain students in poor areas in the education system and not deteriorate their learning abilities in the long term. Second, the educational cost per capita should not be reduced in different density areas to ensure that the students living in both highly populated and low-density areas receive the same quality standard of basic education. Third, the government should consider distributing more budget per student in a province where a ratio of poor students and poverty ratio are higher because they experienced financial hardship more. Therefore, per capita expenditure between the provinces should not be equal and equity-based budgeting should be adopted to reduce inequality throughout Thailand. To have all information before executing the educational budget, the information system of the education sector in each province should be set up and directly linked with the central database under efficient quality control. This required strong corporation among the Budget Bureau, the Ministry of Education, and Local Administrative Organizations.

Though fiscal decentralization was introduced in Thailand in 1997, the budget implementation in the education sector has still relied on the decision of the central government. To ensure that the expenditure is efficiently spent to raise educational outcomes at the local level, the Ministry of Education should reduce top-down educational projects in the national curriculum because "one size does not fit all" and focus more on directing overall educational policy and monitoring system, such as improving teacher's appraisal to base on students' performance rather than paper works. The power and educational resources should be requested and responsible by the local government and schools in that province since they know more about contexts and special needs. Moreover, the Ministry of Education Budget Bureau, State Audit Office, and National Anti-Corruption Commission should collaborate to actively promote good governance in the education sector at every step of the budgeting process to minimize the risk and cost of corruption resulting in underestimated educational outcomes. Last, the open data should be effectively communicated,

easy to reach by the public, and fully disclosed to efficiently boost citizen participation in monitoring public spending on education.

There are some rooms for future improvements according to the limitations of this study as discussed in the introduction. Although data-driven is important, future research should also consider using a qualitative approach such as dept interviews of relevant stakeholders to understand the untold story and challenges of educational budget allocation. Other explanatory factors such as marginalized and ethnic people, gender issues, etc. could also be included in the model to see the relationships with the education budget if the data was available. Moreover, other sources of education expenditure (from the private sector and local government) and tertiary educational level can be explored to understand a comprehensive picture of the educational budget in Thailand.

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Appendices

Table I: The Hausman test of model 1

	Coefficients (b) fixed	(B) random	(b−B) Difference	sqrt(diag(V_b−V_B)) Std. err.
lnGPP	.9068012	−.0903272	.9971285	.3297211
POV	−.0323246	−.0396774	.0073527	.
YPOP	−.7620687	−.0774452	−.6846235	.0827937
UNEMP	−.0907022	.0671901	−.1578924	.028643
lnPOP_DEN	4.399	.2915816	4.107419	3.648352
INFL	−.109652	−.2104492	.1007972	.

b = Consistent under H0 and Ha; obtained from **xtreg.**
B = Inconsistent under Ha, efficient under H0; obtained from **xtreg.**

Test of H0: Difference in coefficients not systematic

chi2(**6**) = (b−B)'[(V_b−V_B)^(−1)](b−B)
= **62.80**
Prob > chi2 = **0.0000**
(V_b−V_B is not positive definite)

Table II: The Hausman test of model 2

	Coefficients (b) fixed	(B) random	(b−B) Difference	sqrt(diag(V_b−V_B)) Std. err.
lnGPEDU	.040675	.1099776	−.0693026	.017172
ITA2	.0057653	.0059159	−.0001507	.
ITA8	.0063242	.0055661	.0007581	.
ITA9	−.0006402	.0018726	−.0025127	.0002819

b = Consistent under H0 and Ha; obtained from **xtreg.**
B = Inconsistent under Ha, efficient under H0; obtained from **xtreg.**

Test of H0: Difference in coefficients not systematic

chi2(**4**) = (b−B)'[(V_b−V_B)^(−1)](b−B)
= **11.58**
Prob > chi2 = **0.0207**
(V_b−V_B is not positive definite)

Table III: Correlation table of independent variables in model 1

(obs=231)

	STU	lnGPP	YPOP	EPOP	POV	STU_POV	UNEMP	lnPOP_~N	ISOA	INFL
STU	1.0000									
lnGPP	0.0532	1.0000								
YPOP	0.0690	-0.0407	1.0000							
EPOP	-0.2018	-0.0233	-0.8142	1.0000						
POV	-0.0859	-0.5226	0.3400	-0.2290	1.0000					
STU_POV	0.0712	-0.7216	0.3056	-0.2541	0.5981	1.0000				
UNEMP	0.0477	-0.0029	0.3507	-0.1661	0.1658	0.0670	1.0000			
lnPOP_DEN	0.3066	0.4709	0.0201	-0.0560	-0.2781	-0.4488	0.1790	1.0000		
ISOA	-0.3702	-0.0013	0.1282	-0.0094	0.0893	-0.0165	0.0522	-0.3768	1.0000	
INFL	0.0587	0.1093	-0.0207	-0.0296	-0.0303	-0.1130	-0.0819	0.1228	-0.0675	1.0000

Table IV: Correlation table of independent variables in model 2

(obs=230)

	ITA1	ITA2	ITA3	ITA4	ITA5	ITA6	ITA7	ITA8	ITA9	ITA10
ITA1	1.0000									
ITA2	0.2298	1.0000								
ITA3	0.2249	0.9956	1.0000							
ITA4	0.2376	0.9952	0.9959	1.0000						
ITA5	0.2307	0.9935	0.9955	0.9960	1.0000					
ITA6	0.0307	0.3201	0.3371	0.3382	0.3554	1.0000				
ITA7	0.0333	0.2181	0.2315	0.2314	0.2565	0.8459	1.0000			
ITA8	0.0390	0.3309	0.3490	0.3509	0.3655	0.8421	0.8462	1.0000		
ITA9	-0.0661	-0.2953	-0.3082	-0.3201	-0.2951	-0.0958	0.0342	-0.1086	1.0000	
ITA10	-0.0661	-0.0591	-0.0730	-0.0737	-0.0669	-0.0046	0.0574	-0.0010	0.8050	1.0000

Note: Each ITA indicator is described in chapter 4.

For more information, please see https://itas.nacc.go.th/file/download/113259.

Table V: Lists of 77 provinces in Thailand (Source: Ministry of Interior)

1	Bangkok	39	Phang Nga
2	Amnat Charoen	40	Phatthalung
3	Ang Thong	41	Phayao
4	Bueng Kan	42	Phetchabun
5	Buriram	43	Phetchaburi
6	Chachoengsao	44	Phichit
7	Chainat	45	Phitsanulok
8	Chaiyaphum	46	Phra Nakhon Si Ayutthaya
9	Chanthaburi	47	Phrae
10	Chiang Mai	48	Phuket
11	Chiang Rai	49	Prachinburi
12	Chonburi	50	Prachuap Khiri Khan
13	Chumphon	51	Ranong
14	Kalasin	52	Ratchaburi
15	Kamphaeng Phet	53	Rayong
16	Kanchanaburi	54	Roi Et
17	Khon Kaen	55	Sa Kaeo
18	Krabi	56	Sakon Nakhon
19	Lampang	57	Samut Prakan
20	Lamphun	58	Samut Sakhon
21	Loei Province	59	Samut Songkhram
22	Lopburi Province	60	Saraburi
23	Mae Hong Son	61	Satun
24	Maha Sarakham	62	Sing Buri
25	Mukdahan	63	Sisaket
26	Nakhon Nayok	64	Songkhla
27	Nakhon Pathom	65	Sukhothai
28	Nakhon Phanom	66	Suphan Buri
29	Nakhon Ratchasima	67	Surat Thani
30	Nakhon Sawan	68	Surin
31	Nakhon Si Thammarat	69	Tak
32	Nan	70	Trang
33	Narathiwat	71	Trat
34	Nong Bua Lamphu	72	Ubon Ratchathani
35	Nong Khai	73	Udon Thani
36	Nonthaburi	74	Uthai Thani
37	Pathum Thani	75	Uttaradit
38	Pattani	76	Yala
		77	Yasothon