THE IMPACT OF DECREASING IN SCHOOL-AGE POPULATION ON UNIVERSITY ENROLLMENT

BY

MISS PAONRAT KAMSAWAS

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER DEGREE OF ECONOMICS (INTERNATIONAL PROGRAM) FACULTY OF ECONOMICS THAMMASAT UNIVERSITY ACADEMIC YEAR 2019

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ENTITLED

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was approved as partial fulfillment of the requirements for
the degree of Master Degree of Economics (International Program)

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ABSTRACT

In recent years, the school-age population has been decreasing and contributing a critical part to the lower student flows of higher education, especially in the Bachelor's degree program. This study aims to investigate the impact of school-age population decrease on Thai universities. This study evaluates the impact in terms of student enrollment, the market share of each study field, and the number of students entering each study field in Thai universities. The estimation of the university enrollment model indicates that, student enrollment in regions is determined by the size of economic activities of the areas measured by real GRP, population aged 18, and education cost. The forecast results indicate that the amount of first-year students in a bachelor's degree program is likely to continue to decline over the next 5-10 years. The first-year students of bachelor's degree program will drop from 407,125 people in 2018 to 322,300 in 2021. This group of students will plunge to as low as 254,194 people in 2026.Although, the study results show that the school-age population significantly affects the number of students enrolled by the university. On the other hand, it does not affect the share of students in each field of study. Instead, the share of students in each field is influenced by economic trend; Real GDP and Real wage in this study. Furthermore, although the share of students in each field of study is not directly determined by the school-age population, when the number of students enrolled by the

university diminishes, it can lead to a reduction in the number of students in each field of study.

The forecast result from baseline model which assumes that real GRP, real wage and education price index are growth equal to the average numbers in 2012-2016 points out that, by the year 2026, all fields of study will lose at least 20.75% of the students. The field of Humanities and Arts gets biggest drop in terms of percent change in the number of first-year students. In 2026, this study field will lose 49.62% of the students. However, Services and Health and Welfare are likely to get lower impact than other fields. Thai universities and Thai Government can use these result for designing various strategies for their survival in the future environment of the education market. This study suggests that Thai universities should find a new market or other demand and generate other income from university services. Also, Thai universities should turn this crisis into an opportunity by deducting the number of students per classroom to increase the efficiency of the teaching process. In addition, the Thai government must adjust its policy to support national development during the skilled labor shortage period. This study recommends that the Thai government need to develop advanced technology to solve the problem of labor shortage in all production sectors. Furthermore, Thailand should promote enrollment in the fields that are important to the national development strategy.

Keywords: education, university enrollment, school-age population

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Miss Paonrat Kamsawas

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CHAPTER 1
INTRODUCTION

1.1 Statement of Problem

The education system plays an important role in producing human capital for the economy. However, in recent years, universities in some countries, such as the United States and Japan, have been affected by the demographic change. From 2011 to 2013, American colleges' enrollment of students aged between 18 and 24 plummeted by nearly one million (Tomar, 2015). Furthermore, Japanese colleges have projected that the number of college students would decrease by 40%, from 650,000 in 2018 to 480,000 in 2031 (Kazuyoshi, 2015). Many universities have either ended their curriculum or merged to cope with this situation. Thailand has also been encountering the same issue. Presently, the country is becoming an aging society. Its fertility rate per woman declined from 6.15 in 1964 to 1.5 in 2016 (World Bank, 2017). With the lower fertility rate, the number of students attending universities is also descending. German Academic Exchange Service (GAES) reported the diminishing enrollment of Thailand higher education in 2018, especially that of postgraduate, which plummeted by 60%.

Some may suspect an increasing number of students pursuing education in other countries might have caused such a decrease. However, GAES (2018) data has stated otherwise. The number of Thai students studying abroad fell from 40,000 in 2010 to 26,000 in 2017. Among those, Australia lost Thai students by thousands. Nowadays, USA and UK seem to be less popular destinations for Thai students when it comes to studying overseas while France and Germany are stable in number. Japan is the only country with a rising enrollment of Thai students. Over the years, some of primary and secondary schools in Thailand have been closed down or merged. Similarly, schools for higher education start to experience the same phenomenon. Those are signs that Thai education is approaching a critical turning point.

The decline in the school-age population contributes an important part to lower student flows of higher education, especially in the Bachelor's degree program. During 2007-2017 period, the undergraduate program were severely affected by the demographic change. In 2017, the number of admission candidates collapsed to the

lowest level in 10 years; the number of first-year students was less than that of 2007 by over 100,000. The Social Sciences, Business and Law programs were influenced the most. During 2007-2017 period, these fields of study experienced the highest decline, particularly in the number of freshmen that plunged by 40%, amounting to 134,329 students. With the implication that, in the next few years, they may face the same fate as what the primary schools and secondary schools have been encountering, it should be considered a significant warning for the universities (Thailand Ministry of Education, 2017). According to the type of institute, it is evident that, over the period of 2013-2017, the decline in school-age population correlated with the slump in enrollment of both public and private universities that reduced by 32% and 16% respectively.

Due to the situation in the higher education system in Thailand, this study aims to investigate the impact of the decrease in school-age population on Thai university enrollment. The study measures the impact in terms of the market share and number of students entering Thai universities. It focuses on Bachelor's Degree level because it has the highest number of students in Thai universities. Panel regression method is utilized to forecast the number of freshmen in the undergraduate program by setting students aged 18 as the main driving factor. This study applies the same method to forecast the market share and number of the first-year students that each field receives to identify the impact of school-age population decrease.

The next section will look into the population in each age group that enters Thai education at each level in order to understand the movement of school-age population in Thailand from one level of education to another, especially 18-year-old people. This population group is used as the main forecaster in this study because it is the school-age population that is expected to enter the undergraduate program in Thailand.

1.1.1 Thailand's Education Levels and Students' Ages

Students enrolled in undergraduate program are those who have graduated from Mathayom 6 (high school) and from vocational schools. Therefore, the school-age population that will enter the Bachelor’s degree program is the students aged 18 as shown below.

Table 1.1

Different Stages in Thailand Formal Education System

<table>
<tr><td colspan="6">Stages in the Thailand Formal Education System</td></tr>
<tr><td>Typical</td><td>Stage</td><td colspan="4">Level/grade</td></tr>
<tr><td>4</td><td rowspan="14">Basic Education</td><td rowspan="3">Early childhood (Kindergarten)</td><td colspan="3" rowspan="3">Variable (Typical Anuban1-3)</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td><td rowspan="6">Elementary</td><td colspan="3">Prathom 1</td></tr>
<tr><td>8</td><td colspan="3">Prathom 2</td></tr>
<tr><td>9</td><td colspan="3">Prathom 3</td></tr>
<tr><td>10</td><td colspan="3">Prathom 4</td></tr>
<tr><td>11</td><td colspan="3">Prathom 5</td></tr>
<tr><td>12</td><td colspan="3">Prathom 6</td></tr>
<tr><td>13</td><td rowspan="3">Lower-secondary</td><td colspan="3">Mathayom 1</td></tr>
<tr><td></td><td colspan="3">Mathayom 2</td></tr>
<tr><td>14</td><td colspan="3">Mathayom 3</td></tr>
<tr><td>15</td><td>General</td><td>Vocational</td></tr>
<tr><td>16</td><td rowspan="3">Upper-secondary</td><td>Mathayom 4</td><td rowspan="3">Vocational Certificate</td></tr>
<tr><td>17</td><td>Mathayom 5</td></tr>
<tr><td>18</td><td>Mathayom 6</td></tr>
<tr><td></td><td rowspan="3">Higher Education</td><td>Lower Undergraduate</td><td>….</td><td>Diploma</td></tr>
<tr><td></td><td>Undergraduate degree</td><td colspan="2">Bachelor's degree</td></tr>
<tr><td rowspan="2">.</td><td rowspan="2">Graduate</td><td colspan="2">Master's degree</td></tr>
<tr><td colspan="2">Doctorate degree</td></tr>
</table>

Source: National Education Information System (2017), compiled by the author

This study focuses on analyzing the impact of school-age population on the number of undergraduate students. Therefore, the following section will provide important details about higher education system in Thailand. Because the Bachelor's degree level is the main interest in this study and also a part of higher education institutes, it is crucial to understand the types of Thai universities in higher education level.

1.1.1.1 The Higher Education System in Thailand

Higher education is the education system that provides post-secondary level of education, consisting of lower undergraduate, undergraduate, and

higher Bachelor’s degree levels of education. Higher education can be divided into 3 levels (Office of the Permanent Secretary, Ministry of Education, 2018).

Level 1 is the lower undergraduate level, which is a vocational education and diploma level that takes about 2-3 years after high school to complete.

Level 2 is the undergraduate level. The Bachelor’s degree usually takes about 4 years to obtain, but some majors or programs may require 5 to 6 years.

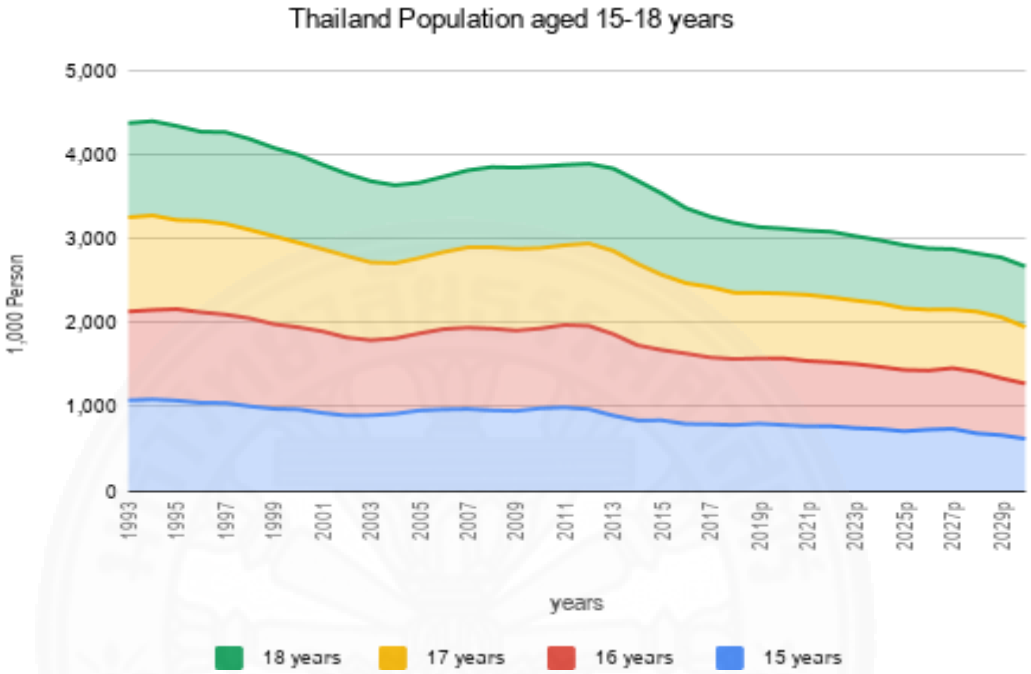
Level 3 is the higher Bachelor’s degree level or the graduate level. Bachelor’s degree or equivalent is required in order to apply for this level of study. The graduate level can be further divided into Master's degree and Doctorate or Ph.D.

Higher education institutes in Thailand are usually called "university," "college," and "institute," for example, Chulalongkorn University, Thammasat University, Mahidol University, Sukhothai Thammathirat Open University, Boromarajonani College of Nursing and National Institute of Development Administration.

1.2 The Impact of the Decrease in School-age Population on Thai Universities

1.2.1 The Decrease in School Population, Aged 15-18, in Thailand

Figure 1.1
The changes in Thailand population aged 15-18 years



Source: Ministry of Interior, calculated and predicted by the author.

Table 1.2

The Changes in Thailand Population Aged 15-18 years

Population age	Change in 5 years (2013-2017)		Change in 10 years (2007-2017)		Change in 5 years (2017-2022)		Change in 10 years (2017-2027)	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
15 years	-103,462	-11.55%	-181,224	-18.62%	-23,574	-2.98%	-54,411	-6.87%
16 years	-174,673	-18.01%	-172,884	-17.86%	-33,483	-4.21%	-72,802	-9.15%
17 years	-151,932	-15.34%	-117,388	-12.28%	-66,856	-7.97%	-140,609	-16.76%
18 years	-143,506	-14.64%	-80,237	-8.75%	-55,357	-6.62%	-117,807	-14.08%
15-18 years	-573,573	-14.95%	-551,733	-14.47%	-179,270	-5.49%	-385,629	-11.82%

Source: Ministry of Interior, calculated and predicted by the author.

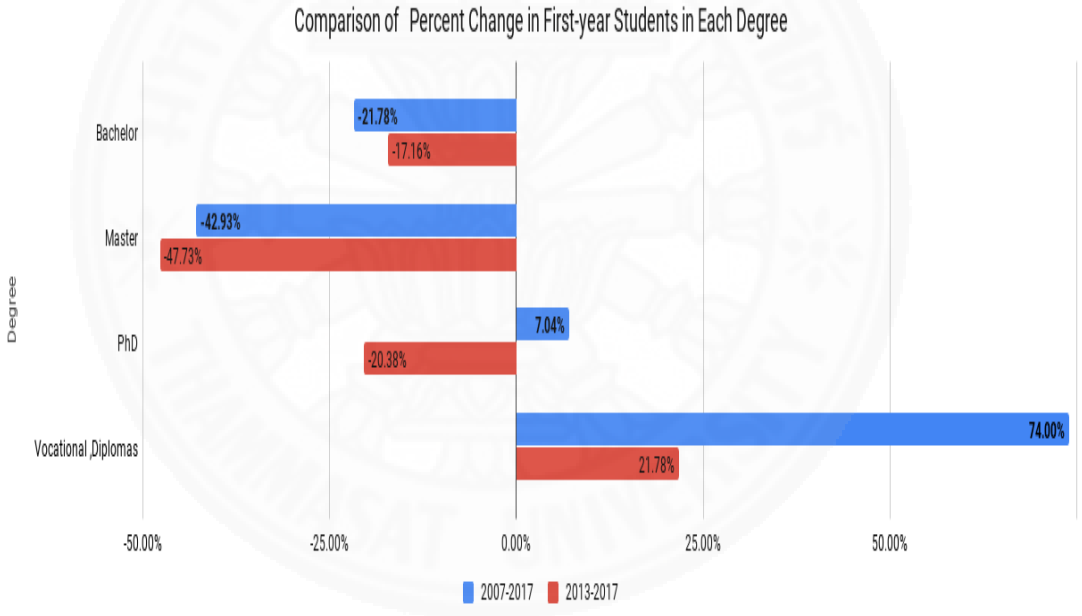
Figure 1.1 displays the changes in Thailand population aged 15-18 years old from 1993 to 2030. The changes appear in a downward trend, which is in line with the data exhibited in Table 2. Based on the historical data from 2007 to 2017 shown in Table 2, the population aged 15-18 years old reduced by 14.47%, amounting to 551,733

people. In addition, according to the author's prediction for year 2022 compared to the real data from 2017, the population of this specific group will continue to decline by 5.49% or 179,270 people. Moreover, by 2027, this group of the students is expected to fall by 11.82% or 385,629 people. This prediction is using the number of school-age population in each age as the main driver. Therefore, in the future, the population of this group will decline continuously. The size of this population is directly affecting the number of students in the higher education system.

1.2.2 The Changes in Total Number of Students Enrolled in Each Level of Higher Education System

Figure 1.2

Comparison of Percent Change in First-year Students in Each Degree



Source: Ministry of Interior, calculated and predicted by the author.

Table 1.3

The Changes in First-year Students in Each Degree

	Total number			Percent change		Number change	
Programs	**2017**	**2013**	**2007**	**2007-2017**	**2013-2017**	**2007-2017**	**2013-2017**
Bachelor	403,537	487,145	515,925	-21.78%	-17.16%	-112,388	-83,608
Master	26,263	50,248	46,017	-42.93%	-47.73%	-19,754	-23985
PhD	3,056	3,838	2,855	7.04%	-20.38%	201	-782
Vocational ,Diplomas	31,749	18,247	26,070	74.00%	21.78%	5,679	5,679

Source: Office of the Permanent Secretary, Ministry of Education, calculated by the author.

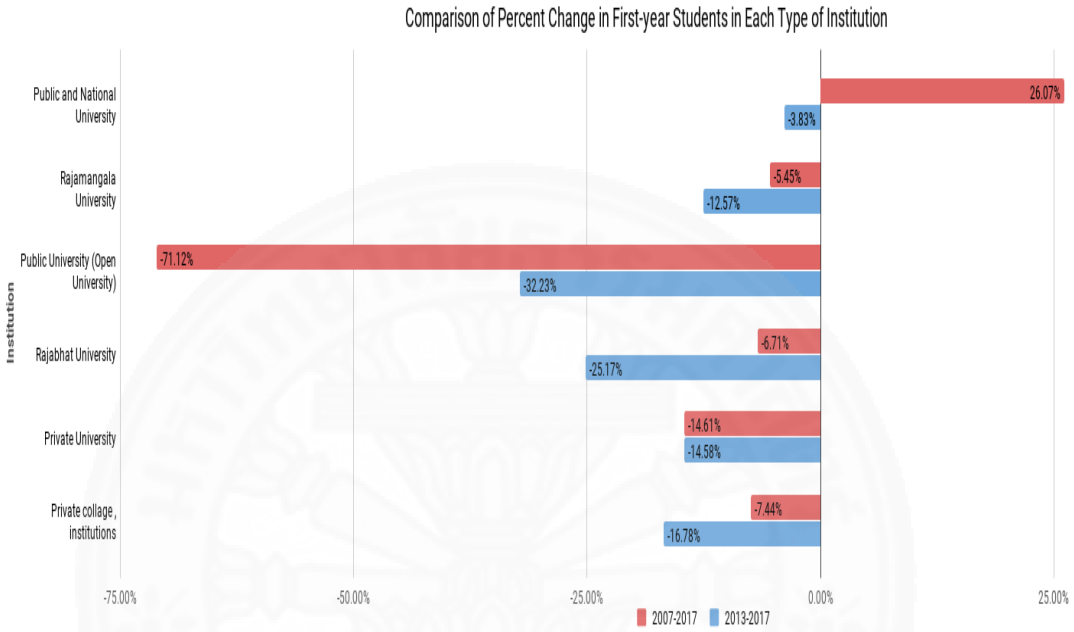
Table 1.3 and Figure 1.2 illustrate the changes in the number of first-year students in each degree program. It indicates that number of freshmen in bachelor's degree program dropped by 21.78% or 112,388 students during 2007-2017 period and by 17.16% or 83,608 students during 2013-2017 period. Master's and Ph.D. programs also struggled with the same issue. First-year students in Master's degree program plummeted by 42.93% or 19,754 students in 2007-2017 and by 47.73% or 23,985 students in 2013-2017. Even though the average number of first-year students in Ph.D. program during the 10-year period did not decline, that of the past 5-year period, from 2013 to 2017, reduced by 20.38%. On the other hand, the number in Vocational Education and Diploma programs rose in both the past 5-year (2013-2017) and the past 10-year (2007-2017), by 21.78% and 74% respectively. Even though the number of first-year students remained incremental during both periods, it increased at a declining rate, prompting a downward trend. Therefore, the demographic changes negatively affected every degree level one way or another.

Moreover, based on the data displayed in Figure 1, population aged 15-18, which is the group of students entering the universities, will keep on decreasing. Therefore, the tendency of university enrollment will continue to dwindle in the future.

1.2.3 The Impact of the Decrease in School-age Population on Students Received by University Type

Figure 1.3

Comparison of Percent Change First-year Students in Each Type of Institution



Source: Office of the Permanent Secretary, Ministry of Education, calculated and predicted by the author.

Table 1.4

The Changes in the Total Number of First-year Students in Each Type of Higher Education Institutes

Institution	Total number			Percent change		Number change	
	2017	2013	2007	2007-2017	2013-2017	2007-2017	2013-2017
Public and National University	138,358	143,870	109,749	26.07%	-3.83%	28,609	-5,512
Rajamangala University	38,686	44,247	40,916	-5.45%	-12.57%	-2,230	-5,561
Public University (Open University)	48,944	72,217	169,493	-71.12%	-32.23%	-120,549	-23,273
Rajabhat University	112,351	150,140	120,432	-6.71%	-25.17%	-8,081	-37,789
Private University	53,983	63,195	63,219	-14.61%	-14.58%	-9,236	-9,212
Private collage, institutions	11,215	13,476	12,116	-7.44%	-16.78%	-901	-2,261
Total	403,537	487,145	515,925	-21.78%	-17.16%	-112,388	-83,608

Source: Office of the Permanent Secretary, Ministry of Education, calculated and predicted by the author.

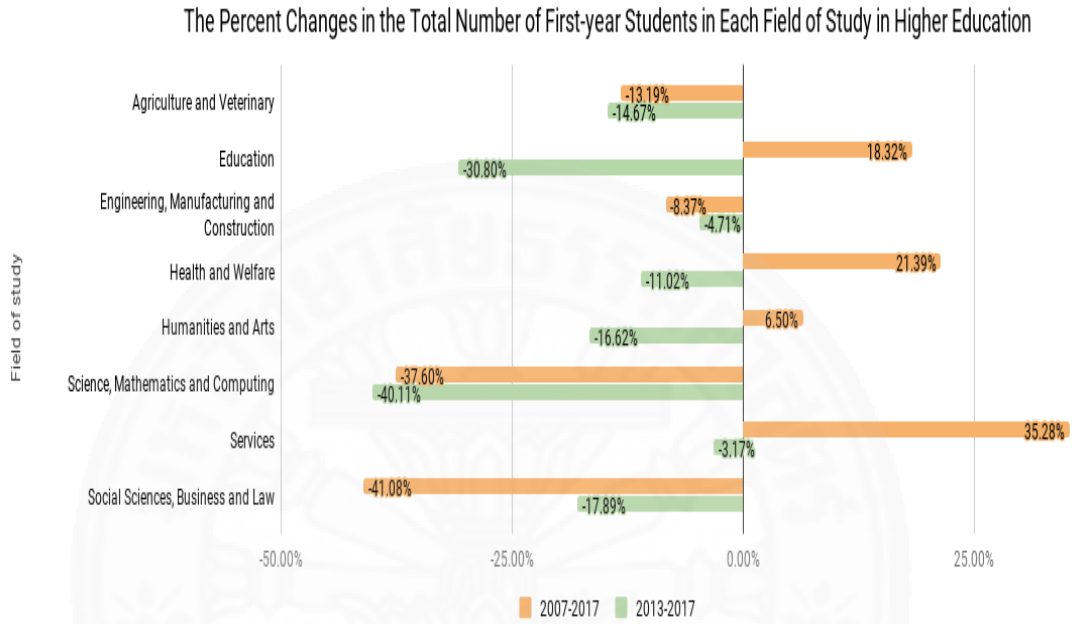
Higher education institutes in Thailand can be categorized in terms of the supervisory authorities, the objectives of the establishment and the target group of students into Public universities, National universities, Rajabhat universities, Rajamangala universities, Private Universities, Private collages, and Community Colleges. Table 1.4 and Figure 1.3 demonstrate the changes in first-year students in each type of higher education institutes. It is clear that, from 2007 to 2017, the reduction of first-year students existed in all types of higher education institutes except the Public and National University. The number of first-year students of Unlimited Public University had the highest drop at 71.1% or 120,549 students and Private University lost 9,236 students, which is equivalent to 14.6%, when the remaining types of higher education institutes experienced the slump at the rates lower than 10%.

However, from 2013 to 2017, the declination became consistent in all types of higher education institutes. The Unlimited Public University showed 32.2% decrease, whereas the Rajabhat University declined by 25.2%. Private University, Private College and Institute fell by 14.6% and 16.8% respectively. For Rajamangala University, the reduction was also more than 10 percent. Public and National University observed a smaller decrease than other types of institutes, reduced by only 3.8% or 5,512 students. According to the information from the Ministry of Education, we can presume that the demographic change in Thailand results in the decrease in first-year students in all types of institutes, regardless of the sizes of the effects.

1.2.4 The Impact on the Decrease in School-age Population on Students Received by the Study Field

Figure 1.4

Comparison of First-year Students in Each Field of Study



Source: Office of the Permanent Secretary, Ministry of Education, calculated by the author.

Table 1.5

The Changes in the Total Number of First-year Students in Each Field of Study in Higher Education

Field of Study	Total number			Percent change		Number change	
	2017	2013	2007	2007-2017	2013-2017	2007-2017	2013-2017
Agriculture and Veterinary	12,463	14,606	14,356	-13.19%	-14.67%	-1,893	-2,143
Education	37,600	54,339	31,777	18.32%	-30.80%	5,823	-16,739
Health and Welfare	28,875	32,452	23,786	21.39%	-11.02%	5,089	-3,577
Humanities and Arts	54,721	65,632	51,383	6.50%	-16.62%	3,338	-10,911
Science, Mathematics and Computing	40,036	66,845	64,156	-37.60%	-40.11%	-24,120	-26,809
Services	23,849	24,629	17,629	35.28%	-3.17%	6,220	-780
Social Sciences, Business and Law	192,679	234,671	327,008	-41.08%	-17.89%	-134,329	-41,992
Engineering, Manufacturing and Construction	55,687	58,438	60,772	-8.37%	-4.71%	-5,085	-2,751
Total	464,605	559,478	590,867	-21.37%	-16.96%	-126,262	-94,873

Source: Office of the Permanent Secretary, Ministry of Education, calculated by the author.

Table 1.5 and Figure 1.4 portray the changes in the number of first-year students in each field of study from 2007 to 2017. The total amount in most fields of study descended. The fields of Social Sciences, Business, and Law were the areas where it showed the most massive slump, in which the number of first-year students plunged by 41.08% or 134,329 students. Similarly, the fields of Science, and Mathematics and Computing also observed a distinctive downturn in the number of first-year students at the rate of 37.60%. For the fields of Agriculture and Veterinary, it depreciated by 13.19 %. In the same manner, the fields of Engineering, Manufacturing and Construction lost 5,085 students, which is 8.37%. However, some fields of study maintained an increasing number. These fields include Education, Health and Welfare, Humanities and Arts, and Services.

The data from 2013 to 2017 reveals a declination in all fields of study. The area of Education lost first-year students by 30.80%, when the fields of Health and Welfare shrank by 11.02%. Humanities and Arts displayed a diminishing number of students by around 16.62%, as the Services field exhibited the lowest decline by only 3.17%. Thus, from this information, it can be inferred that the decrease in school-age population will have an impact on the reduction of first-year students in all fields. In the areas of Education, Health, Welfare, Humanities, Arts, and Services, the deterioration will be slower than that in the fields of Social Sciences, Business and Law, Science, Mathematics and Computing, Agriculture and Veterinary, Engineering, Manufacturing, and Construction.

From the above information, it goes to show that Thailand's higher education was experiencing the declining enrollment in the past 5-10 years. All fields of study and all education institutes were affected by such decreases. In Public and National University, the impact was lower than in Private and Unlimited Public University, because there was a higher demand than other institutes. We can see that the effect in the past 5 years, from 2013 to 2017, is smaller than in the past 10 years, from 2007 to 2017. However, even though the number of first-year students in 2013-2017 reduced at a declining rate compared with during 2007-2017, the diminishing direction continued, leaving even bigger number of unoccupied seats each year. Therefore, in the future, all institutes will be faced with a bigger size of the impact than

in the past. The universities must prepare and adjust their operation to cope with the situation of lessening students.

1.3 Objectives

To predict the impact of school-age population decrease on Thai universities in terms of enrollment in each field**.**

1.4 Hypothesis

1. The decline in school-age population will reduce the number of students entering Thai universities.

2. The decline in school-age population will reduce the number of students entering Thai universities in each field of study.

1.5 Scope of study

This study focuses on the impact of the reduction in school-age population on Thailand Bachelor's degree programs in terms of students received in each field of study**.**

1.6 Expected Benefits

The results of this study will be useful for Thai universities in terms of planning a policy that is more suitable for the changing educational environment in the future.

CHAPTER 2
REVIEW OF LITERATURE

This chapter presents the three sections of review literature. The first part shows the reviews studies on the impact of demographics on demand for universities. The second part is showing empirical studies about the factors influencing the universities and course choices. And the final section shows the review summary.

2.1 The Empirical Study of the Impact of the School-age Population on Demand for University

The studies that intend to examine the factors affecting university demand usually use the demand theory and the investment theory to support the study analysis. The detail of the result and method of each study is as follows.

Correa (1962) study identified the determinants of the demand for education. The total population and its demographic groups classified by age and sex were among the macroeconomics determinants while the preference, income, and cost of study were microeconomics determinants. The preferences of the consumers for education were defined by intellectual capacity, vocation, parental influence, and other motivation. Correa suggested that those were the principal determinants of the demand for education. Furthermore, Correa applied the Harrod-Domar growth model that described the relationship among production, education of labor force, and educational system. The demographic variables were used in the model as the independent variables; the size of the school-age population, the number of students who graduated from secondary school, and per capita income. These variables are usually used in this type of analysis.

2.1.1 The Study of the Factors that Determine the Demand for Education.

Papi (1969) study suggested factors determining the demand for education were population, economic progress or an increase in a country's real income (income per capita) and the supply of education. However, Papi did not motivate this factor. In any event, the interplay between supply and demand factors occurred. Having reviewed

several other studies, Panitchpakdi (1974) study established that the leading theories usually used in the study of the demand for education were the demand and the investment theories. The research in Panitchpakdi (1974) suggested that among the factors that determined the demand for education were the demographic factors; these factors would affect the flows of a student from secondary schools who enrolled in the university. Other factors included the attitude towards education; different social-economic groups foster different attitudes towards education; and economic factors such as cultural living, employment. Some of these factors had an impact on the parents' and students' attitudes towards education.

Besides, UNESCO's concept is also applied to this study, using population growth to analyze the flows of students. Income is one of the factors that are mentioned in this study; it influences the demand for education the same way as it does the demand for the other goods. In general, income growth has a positive effect on the realized volume of education, even though it is not always positive. It has an impact on the supply as well. Therefore, this study considers both the demand and the supply sides and income is included in the model to forecast student enrollment.

2.1.2 The Study of the Factors Not Only Affecting University Demand but Also Being Used to Predict University Enrollment.

In the attempt to predict the university enrollment, this study utilizes the demand theory. The detail of the methods and the result in each study are as follows.

Centra (1980) study was concerned with the decline in college-age population size. This factor was the most critical factor affecting future college enrollment. The study tried to estimate the U.S college enrollment in the 1980s by separating the survey into three scenarios of estimation where each situation would have a different assumption. The prediction result showed that the total enrollment decreased by 9 percent from 1980 to1985. This study found that the decline in population affected different types of institution. The study discovered that small institutions generally had higher per-student costs and were more susceptible to diminishing enrollment.

Lapkoff et al. (2002) applied the demographic analyses and enrollment forecasts in finding the impact of the reduction in the number of births on the school

enrollment in San Francisco in the next ten years. This study adopted the time series data in order to make a forecast. The forecasting results showed that, in 2011, the total public school enrollment was between 53,000 and 55,300 students, down from their current low of 60,900 students, amounting to the overall 9 to 13 percent of reduction in enrollment. The forecasting result showed the decline in all levels of school, meaning that the public elementary schools, public middle schools, and the public high schools were affected by this demographic change.

Murdock & Hoque (2002) study was using time series data to analyze the effect of the demographic factors on higher education in the United States in the twenty-first century. This study, based on the concept of the demand theory, was linked to the change in population structure that would affect future educational needs and services. Thus, this study tried to estimate U.S. college enrollment and the percentage of college students from 1998 to 2050. The prediction results showed that the expansion of enrollment would decline in the near future. The enrollment would also move towards the opposite direction; university students would tend to be older and more various than in the past. Also, the total enrollment would recover after 2020. However, this research also recommended that higher education would need to put more effort in handling recruitment, maintenance, remediation, and fundraising, in order to ensure the high quality of the U.S. education that would produce a highly competitive population in the international economy.

Carlos & Isabel (2014) study intended to examine the factor that drove university applications and explained the total demand for higher education in Portugal. This study utilized the data on the total number of applications from 1977 to 2012 and adopted the multiple regression models to forecast the future aggregate demand for higher education. It focused on demographics as a significant driver of aggregate demand for higher education. This factor was used as a single predictor to forecast future trends. This study constructed a model by using the independent variables, which helped explain the enrollment of higher education. The contributing variables are the number of people aged 18–20 years of old, the economy's unemployment rate, and others. The result showed all variables distributed positive signs to the aggregate demand for higher education, except the economy's unemployment rate. This variable produced negative significant impact.

Ghavidel (2015) tried to predict the number of undergraduate applicants for the National Entrance Examination in Iran during the period of years 2012-2025 and identify the factors affecting the demand for higher education in Iran by using the method of the cohort, participation rate, structural regression, and time-series econometric models. The results showed that the tendency to join the university differed between males and females. Thus, the structural models of men and women were different. However, the forecasting results in structural methods supported the high effectiveness of the economic growth index. The predictions were confirmed that the number of applicants during the 2012-2025 period would decrease; men enrollment dropped more dramatically than that of the women.

Weiler (2018) aimed to forecast the short-run enrollment in higher education by using the time series data and linear regression method. The model forecast was separate into 5 models according to the specific fields of institutions including Liberal Art, Technology, Agriculture, Forestry and Economics. The number of high school students was included in the model to show the impact of the change in school-age students on number of enrollment in each filed. The result indicated that the number of high school students contributed a significant effect only on the enrollment of Liberal Art whereas demographic factors did not have such a significant effect on other fields. However, the expected return on education was still a significant factor.

For the study on the case of Thailand, Batzinger (2017) studied the impact of demographic change on the demand and supply sides of education. The study was designed to predict Thailand's total enrollment for higher education and the total number of universities in the country. Batzinger constructed a model of public and private universities enrollment by using a multiple regression model together with the time series data. The result displayed that private and public universities had positive growth. However, Batzinger mentioned that his model was not useful for forecasting the future growth of Thai education. The study also suggested using the data after 2000 to avoid the demographic change. This study not only predicted the number of the universities in Thailand but also anticipated the total enrollment of Thailand's higher education by using the demographic factor and cost of tuition as the main. The prediction results demonstrated that the total enrollment in Thailand would decline by

15 percent and 25 percent in 2020 and 2025, respectively. He suggested that 70% of the private programs would be closed down in 2025.

Suksiriserekul (2019) aimed to predict the supply of human capital in Thailand that was important to overcome the middle-income trap. He used the new growth theory to support his predictions. This study employed secondary data of the number of graduates in Thailand and economic growth in 15 sectors of industry and service between 2008 and 2016. The analysis utilized the Ordinary Least Square (OLS) model. This study also found that high skill labor had a significant effect on the economic growth of Thailand. In the next 20-40 years, the demand for high-skilled workers would likely be increase. For Thailand to achieve its goal of changing from Thailand 3.0 to Thailand 4.0, increasing the supply of high-skilled labor should increase by 0.05%, 0.04%, and 0.03% per year for the next 20, 30, and 40 years, respectively. However, the population structure would have a decrease in birth rate, resulting in the contraction of high-skilled labor in Thailand by 1%, or equivalent to 765 people, per year. His study established that the bachelor's degree graduates accounted for 89 percent of the high-skilled labor in Thailand. These students who graduate with a bachelor's degree are essential for the future development of Thailand. Therefore, my study focuses on only the enrollment in bachelor's degree programs because this group of students will be the leading group of high-skilled labor crucial for Thailand development.

2.2 The Empirical Study of the Factors Influencing the University and Course Choices.

This section is a review of the factors affecting the university selection and course choice. The first study group is the studies that focused on the factors affecting university selection and course choice. The final part is a review of factors that affected the university selection and course choice in Thailand.

The study that focused on the factors affecting university selection and course choice is Sabir et al. (2013). This study researched on factors affecting university selection and course choice: comparison of undergraduate engineering and business students in central Punjab, Pakistan. The study looked at the number of undergraduate engineering and business students from five universities in Lahore, Faisalabad, and

Sahiwal as the focus group. The study utilized a stratified random sampling technique and plied structured questionnaire based on 10 points Likert scale. The study also employed simple descriptive statistics to verify the importance given to these factors by the students. Findings of the study illustrated that higher education commission ranking, institutional reputation, employment, and career prospects were the most critical factors influencing the university and course selections. The prominence of the university, tuition fee, and educational personnel were the most important factors for a student's consideration.

Waseem & Zarif (2012) studied the factors that affected the students' choice. The focus group was the students who attended the Business Administration Degree program in Pakistan. This study was conducted to explore the core reasons and factors behind the students' attitude while selecting management course as their study option. The field survey data was utilized in the research. The data was collected from 210 students studying management science in 10 different private, semi-private, and public sector universities of Karachi. ANOVA regression and Correlation tests were applied for the data analysis. The outcomes showed that most of the students enrolled in management sciences programs based on their interest. In addition, the employment opportunities did have a significant impact on the students' choice. However, the students' choice did not vary by the market trend.

Ali & Tinggi (2013) conducted a research on 25 factors influencing the students to choose accounting as their field of study. The objective was to identify the factors influencing the students' decision to accept the offer of accounting as a major. The findings indicated that the past achievements, personal interests, the job prospects, family members, friends, and social media were the significant factors influencing the students' choice to accept the offer of accounting as a major.

Khurram et al. (2013) did a research on the factors that affected a student's selection of a business school. The purpose of this study was to analyze, evaluate, and identify the factors affecting the students' decision to choose the specific campus. The outcome revealed that students were likely to enroll in a university that had a good ranking and good job popularity, which could help students achieve their future goals.

Rika et al. (2016) conducted a research on the factors affecting the choice of higher education intuitions by the prospective students in Latvia. The research

objective was to investigate what factors affected the decision of secondary school leavers in choosing a higher education provider and the variables that might predict a student's choice. The study used the data collected through a survey distributed among final year students of Latvian secondary schools while spearman correlation and stepwise regression were used in the data analysis. The analysis of four major factor groups; including cultural, social, psychological, and organizational; demonstrated that organizational and psychological factors were the best predictors of the choice of higher education. The psychological factors were the most significant independent variables. These factor groups included career development, role in the future life, and individual's attitude towards higher education.

There was a research on the factors that affected Thai university selection and course choice; Agrey & Lampadan (2014) intended to find what factors influenced students' decision of Thai university. This study mentioned various factors that influenced the decision on the university choice. The data was collected through a questionnaire; the sample included 261 students from central Thailand. This study was conducted through small group discussions about the important factors in choosing their university of choice. The study revealed five factors that significantly influenced the decision on which institution of higher learning to attend. Job prospect was one of the significant factors along with the support systems, modern learning environment and facilities. Other factors included excellent sporting facilities, healthy student life programs, e.g., healthcare services, residential accommodation, and activities with a wide range of extracurricular activities, a safe and friendly environment safe campus, as well as supporting faculty.

Oyer & Lazear (2003), Karanassou et al. (2006), Haraldsen et al. (2015), aimed to identify the factors influencing the demand for education by using macroeconomic factors and labor demand in the analysis. The study considered panel data and macroeconomic factors as the independent variables, e.g., Employment, Wage, Unemployment Rate, Real GDP, and Consumer Price Index. They found that the economic growth, wage, employment, and cost of study were the factors significant to determine the demand for education. This study allocated the number of first-year students based on the macroeconomic theory, which is mentioned in the next chapter. Thus, the student allocation of this study is based on the analyses of Oyer & Lazear

(2003), Karanassou et al. (2006), Haraldsen et al. (2015). Furthermore, according to Weiler (2018) study, the school-age population was a significant effect on the enrollment of liberal art. Therefore, this study has included the population aged 18 in the analysis in order to examine the impact of the change in school-age population on the number of students received.

Reviews Summary

All of the above-mentioned studies intended to predict the number of first-year students in Thai universities by using the school-age population as the main driver. However, from the reviews, most studies that tried to predict the university enrollment used the time series data or panel data with multiple regressions to conduct the analyses. In the first part of the review, it was found that real national income, the cost of education, unemployment, social-culture, and family factors also affected the demand for university. Therefore, in this study, not only school-age population factor but other elements are also applied to the model for forecasting the number of first-year students of the Thai universities. In the second section of my reviews, there is a study of the factors influencing the university selection and course choice. Most of the studies found that future growth in the career path, the employment opportunity, net cost, and university type were the factors that influenced students in choosing the university and course. Oyer & Lazear (2003), Karanassou et al. 2006), Haraldsen et al. (2015) also aimed to identify the factors influencing demand for education by using macroeconomic factors. They found that economic growth, wage, and employment had significant effects on the demand for educations in each study field. Therefore, the above-mentioned studies provided the basic support to this study which uses the macroeconomic factors as the influencing factors on the student share each field will receive. This student share prediction will be used to allocate first-year students to each field of study.

CHAPTER 3
RESEARCH METHODOLOGY

This section will explain the theoretical concept that is related to this study and links the theoretical background to the methodology. This study is designed to utilize the consumer demand's theory for the prediction of higher education enrollment. It links the concept of population structure to the student flow in the education system and uses this concept to construct the model. The macroeconomic theory is applied to construct the prediction of student share each field receives.

3.1 Theoretical Background

3.1.1 The Demand Theory

In general, the demand for a normal good is determined by cost, income, preference, expectation, and demographic changes (Preedasak, 2015). This study applies consumer demand's theory to determination of the demand for higher education. The factors that determine the demand for education are the attitude towards education, the change in population (the flow of pupil from lower levels), the income growth, the degree of utilization of educating capacity, and costs of education. Different socioeconomic groups possess different attitudes toward education; in other words, different preference in different societies. The elements typifying each group include the economic factors such as the standard of living and the kind of employment. Some of these factors have an impact on the parent's and the student's attitudes toward education. The demographic changes affect the student flow in the education system. An increasing birth rate will cause the school-age population to expand in the future, which will also lead to higher total student enrollment. Therefore, this factor has a positive relationship with the demand for education. The cost of study, representing the education cost, includes not only the tuition fee and cost of study equipment but also the opportunity cost of getting the wage in the labor market or the foregone earning. It is clear that, by the Law of Demand, this factor has a negative relationship with the demand for education. Income can also influence the demand for education in the same

manner as it influences other goods. Therefore, income has a positive effect on the demand for education (Tuckman&Ford, 1972).

3.1.2 Macroeconomic Theory and the Labor Market

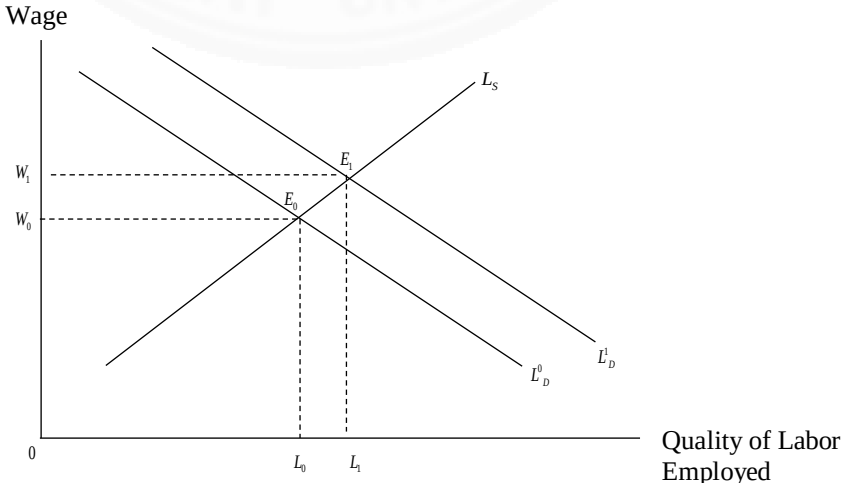
The production function is as follows;

$$Y=f(K,L)$$

From the production function, labor is an input of the production process, so we can consider the labor demand as a derived demand. The demand for all input factors, including labor, is derived demand, i.e., its demand depends on the demand for the products its produces. When the economy in each production sector expands, we see a rise in demand for labor provided that the increase in output is higher than the increase in labor productivity. During a slowdown in some sector of the economy, the aggregate demand for labor in that sector will decline as businesses look to cut their operations costs and scale back on production. In an economic downturn period, business failures, plant closures, and short term redundancies lead to a reduction in the derived demand for labor. In the fast-growing sectors, there is often a strong rise in demand for labor. For example, an increase in demand for health care services causes an increase in labor demand in the health and services sector.

Figure 3.1

Labor Market



Source: Compiled by the author.

The study is assuming that labor market will keep adjusting until labor demand is equal to labor supply. The labor supply will adjust to meet the demand for labor. If the students joining the university are the future labor supply for the labor market, the student might consider the economic growth, and labor market demand in each product sector when selecting their field of study. Under macroeconomic theory and the labor market equilibrium, it is assumed that the students take the labor demand into consideration when they choose a university field. Thus, we can deduce that the factors affecting the student share of each study field are economic growth , the number of employment , and wage . In addition, according to a study of Weiler (2018), it is found that the population factor has a significant effect on students applying for the liberal art program, therefore adding population factor to the student share of each study field model.

From all the reasons mentioned above, this study focuses on the impact of the decrease in the school-age population, which is one of demographic changes that influence the number of students received in each field of study. Because students aged 18 partially determine the amount of first-year students. This study concentrates on the number of first-year students entering the Bachelor's degree programs. While the population aged 18 are the future first-year students of Bachelor's degree programs. The decrease in the number of 18-year-old student group will result in a drop in Bachelor's degree enrollment in Thailand in the future. To show how each field of study is affected by the school-age population reduction, this study also investigates the share and the number of students received in each university type and each study field while the school-age population is dropping. This study applies the theories of market structure, macroeconomic theory, and the labor market theory to the analysis.

3.2 Methodology

From a literature review, forecasting university enrollment consists of 2 approaches; multiple regression and exponential smoothing model. Multiple regressions are commonly used to analyze factors that affect demand in higher education. Because the available information in Thailand is limited to only the number of years and the admission system of higher education systems are not consistent, time

series multiple regressions are not appropriate for this research. Since the panel data can solve the problem with time-series data, this study uses panel and multiple regression models to predict first-year students in Thai universities. For the student share prediction, this study applies the same method to the first-year student prediction.

3.3 The Study Process

3.3.1 The Population Aged 18 Prediction

For this prediction, the panel data of 7 regions in Thailand during 2008-2016 is employed. This study chooses the student aged 18 years old to be the main predictor because the students aged 18 years old will be the future population of the first-year students in a Bachelor's degree program. A reference from Thailand data provided by the Ministry of the Interior is used in the prediction of the population aged 18. This study assumes that the death rate for each population age is equal to Thailand's average death rate of 0 .759 percent during 2011 to 2016 (World Bank, 2018) and most of student likely to select the top university in there region, because it is lower cost. The population aged 18 years old in the next "h" years is as follows.

$$age18_{(t+1)} = age(18\text{-}1)_t \bullet (1\text{-}0.00759)$$
$$age18_{(t+2)} = age(18\text{-}2)_t \bullet (1\text{-}0.00759)^2$$
$$age18_{(t+3)} = age(18\text{-}3)_t \bullet (1\text{-}0.00759)^3$$
$$\vdots$$
$$age18_{(t+h)} = age(18\text{-}h)_t \bullet (1\text{-}0.00759)^h$$

For example

$$age18_{2018} = age(17)_t \bullet (1\text{-}0.00759)$$
$$age18_{2019} = age(16)_t \bullet (1\text{-}0.00759)^2$$
$$age18_{2020} = age(15)_t \bullet (1\text{-}0.00759)^3$$
$$\vdots$$
$$age18_{(t+h)} = age(18\text{-}h)_t \bullet (1\text{-}0.00759)^h \qquad \text{(eq.1)}$$

3.3.2 The First-year Student Prediction

All studies mentioned above try to predict the number of first-year students for Thai universities by using the school-age population as the main driver. However, from the reviews, most studies that try to predict the university enrollment are using the time series data or panel data with the multiple regressions in the analysis. In the literature review, it was found that, in addition to school-age population factor, other factors also affect the demand for university. The real national income, the cost of education, the unemployment rate, the social-cultural factor, and the family factor are other factors that influence university demand. Therefore, in first-year student prediction model, this study does not only use to school-age population factor but also includes other elements. It uses the panel data with a panel regression model. The model is as shown below.

$$\ln\text{First years student}_{it} = \alpha + \beta_1 \text{Populaionage18}_{it} + \beta_2 \text{RealGRP}_{it} + \beta_3 \text{Unemployment}_{it} + \beta_4 \text{EducationPrice}_{it} + (u_i + v_{it}) \quad \text{(eq.2)}$$

$\ln\text{First years student}_{it}$ is ln first-year students in Bachelor's degree program in year t of each i region. The reason that we use the term In instead of level is to avoid negative prediction.

$\text{Populationage18}_{it}$ is population aged 18 years old in year t of each i region. This variable is included in the model on demand theory and reviews. Population structure is one of the factors determining the demand of goods. According to Thai education system shown in Table 1, this group of students is the future first-year students in Thai universities. Thus, the expected sign of this variable is positive relation with the number of student enrollment.

RealGRP_{it} is gross reginal product in year t of each i region. This variable is included in the model based on demand theory and reviews. Income is one of factors determining the decision of consumer. However, the university students in Thailand still rely on the income of their parents. During the economic upturn, it is more likely for parents in labor force to be employed and gain more income. During such times, parents tend to be able to encourage their children to join the university. Therefore, the expected sign of this variable is positive relation with the number of student enrollment.

$Unemployment_{it}$ is unemployment in year t of each i region. This variable is included to the model based on demand theory and reviews. When students decide to go to a university, they forgo their chances of working. During the time of difficulty in finding a job, or high unemployment rate, students are more likely to decide to study at university level than when unemployment rate is low. Therefore, this variable has an expected positive relation with number of enrollment.

$EducationPrice_{it}$ is education price index in year t of each i region. This variable was introduced into the model based on demand theory. The price of the product is an important factor affecting the decision to buy the product. If university education is viewed as a product, the increased cost of education inevitably decreases the decision to study at the university level. Therefore, this variable has a negative relation with university entrance.

After forecasting the number of first-year students in Bachelor's degree programs, in the next step, the researcher will predict the share of the first-year students in each field of study that Thailand universities have received in order to allocate the number of students to each study field. This process is to show the impact of the reduction in school-age population on each field of study in Thai universities.

3.3.3 The Prediction of Student Share Which Each Field Receives

In the prediction process, this study employs the panel regression method. The model to predict the share of each field of study is constructed based on the macroeconomics theory and the market structure theory. This study adopts the classification criteria into 9 fields of study applied by the Ministry of Education of Thailand, which the Ministry of Education refers to as the UNESCO allocation guidelines. The detail of each field of study classification is as follows.

I. The Social Sciences, Business, and Law field that includes Accounting, Business Administration, Law, Management Science, Economics, and Political Science Programs.
II. The Humanities and Arts field comprising Humanities, Arts, Digital Media, and Fine Arts Programs.

III. The Science, Mathematics, and Computing field consisting of Science, Mathematics, Computing, Science and Technology, and Animation Programs.

IV. The Agriculture and Veterinary field including Agriculture, Veterinary, Agro-Industry, Agricultural Technology, Agricultural and Food Technology Programs.

V. Engineering, Manufacturing, and Construction field that consists of all branches of Engineering, Science and Engineering Programs, Architecture, and Design Programs.

VI. Services field that comprises Hotel and Tourism Management Programs, Hospitality and Tourism, Management Science Department of Hotel and Tourism, Liberal Arts Tourism, Transportation and Logistics Programs.

VII. Health and Welfare field, inclusive of Physical Therapy, Medicine, Physical Education Programs, Pharmacy, Health and Sports Science, and Public Health Programs.

VIII. Education field comprising all Education Programs.

IX. General and Other Programs consisting of the Programs ,about General Management, Interdisciplinary, and Other Programs that cannot be classified as a specific field because the content is related to many fields.

To assign the number of students to each study field, this study used panel regressions method to predict the share of the first-year students entering each study field. The models utilized in the analysis are shown below.

1. Model for student share in each field

$$ThaiStudentShare_{jt} = \alpha + \beta_1 RealGDP_{jt} + \beta_2 RelativeRealWage_{jt} - \beta_3 educationprice_{jt} + \beta_4 Populationaged18_{jt} + \beta_5 DummytypeL_{jt} + (u_j + v_{jt}) \quad \text{(eq.3)}$$

$RealGDP_{jt}$ is real GDP in year t classified by production sector, according to the macroeconomic theory and the labor market, the sector of product with high growth will demand more labor, students joining the university tend to select the field

of study in which they expect to work and get job after they graduate. So this variable is expected to have a positive relationship, yielding a positive number.

$RelativeRealWage_{jt}$ is relative real wage in year t classified by careers, that are expected to have a student selecting to study in field "j" and becoming labor in the production process after they graduate. The student tends to consider the return on education in the field that he chooses to study. Based on the labor demand theory, the field of study in which the student can get the job with more wages after they graduate will attract more students than the fields of study that are expected to provide lower wages. Therefore, this variable is expecting a positive sign.

This study classifies Real Wage by careers, which are expected to have a student selecting to study in field “j" and becoming labor in the production process after they graduated. For example, the field of Social Sciences, Business, and Law includes the Real Wage of the labor who graduate with Bachelor’s degree and hold a career in Accounting, Business Administration, Law, Management Science, Economics, and Political Science, etc.

$Educationprice_{jt}$ is the consumer price index of goods and services in the education sector in year t. This is the course of study that affects the student’s selection. During the period of low educational costs, people tend to make a decision to pursue an education at the university level more easily than the higher education prices. Therefore, this variable is expected to be a negative sign.

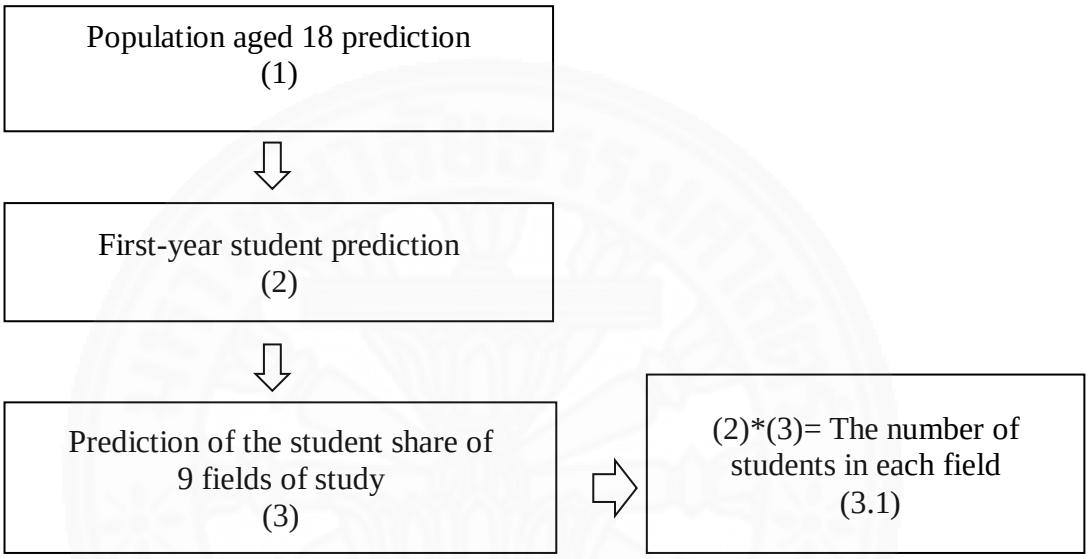
$Populationaged18_{jt}$ is included in the model according to the study of Weiler (2018) which shows that the impact of population change varies according to the specific field of study. Therefore, this study is also interested in the impact of this factor on each study field. Therefore, instead of including only economic and labor factors, we also include demographic factors in the model and expect a positive relation.

$DummytypeL_{jt}$ is the term dummy added in this study for each field of study to shift the projection line of each study field that has different size of share. DummytypeL is the dummy variable of the study field that gets more than 50 percent student share over the years. The variable DummytypeL is equal to 1 for the field for Social Sciences, Business and Law while it is equal to 0 for other areas.

In this prediction, the number of students that each study field Thai universities receive will be calculated by multiplying the proportional share of each study field with the total number of the first-year students in year t in process 2. Therefore, this study process complies with the main 3-prediction process, as shown

Figure 3.2

The Study Process



Source: Compiled by the author

3.4 Data Sources

This study uses data between 2008 and 2017 for analysis. The detail of data summary is shows in appendices B and data sources are as follows.

1. The number of the first-year students of Thai universities are from Thailand's Ministry of Education.

2. The total number of Thailand population classified by age is from Thailand's Ministry of Interior.

3. Thailand's death rate and fertility rate are from the data bank of World Bank.

4. Wages by career , unemployment in each region, and education price index in each region are from Bank of Thailand. The classification of wages for all 9 fields are based on the opportunity that a student in study field j will work in that field after he graduates. The details are listed below.

I. The Social Sciences, Business and Law field that includes the wages in the areas of Business Administration, Financial and Insurance Activities, Real Estate Activities, Public Administration and Defense.

II. The Humanities and Arts field that comprises the wages in the areas of Digital Media and Art, and International Activities.

III. The Science, Mathematics and Computing field consisting of the wages in the areas of Professional, Scientific and Technical activities.

IV. The Agriculture and Veterinary field comprising the wages in the areas of Agriculture, Veterinary, Forestry and Fishery Activities.

V. The Engineering, Manufacturing and Construction field that includes the wages in the areas of Engineering, Electricity, Gas, Steam, and Manufacturing.

VI. The Services field comprising the wages in the areas of Hotel and Tourism Activities, Food, Transport Information and Communication Service.

VII. The Health and Welfare field that consists of the wages in the areas of Health Professional and Social Work Activities.

VIII. The Education field that includes the wages in the area of Education activities.

IX. The General and Other Programs field that comprises the average wages in the remaining areas.

5. Real GDP by sector and Real GRP are from the Office of National Economic and Social Development Council, Thailand. For the GDP by sector grouping, this study is classified by using the Real GDP that Bank of Thailand has classified by sector of the production. However, we need to group them together by using the same concept as the classification of wages by careers. The detail is as follows.

I. The Social Sciences, Business and Law field that comprises the Real GDP of the sectors of Financial and Insurance Activities, Real Estate Activities, Public Administration and Defense.

II. The Humanities and Arts field that includes the Real GDP of the sectors of Arts, Entertainment and Recreation.

III. The Science, Mathematics and Computing field that consists of the Real GDP of the sectors of Science and Technology, Environment and Resource, Technology and Environment.

IV. The Agriculture and Veterinary field that comprises the Real GDP of the sectors of Agriculture, Forestry and Fishing.

V. The Engineering, Manufacturing and Construction field that consists of the Real GDP of the sectors of Electricity, Gas, Steam, Manufacturing and Construction Sectors.

VI. The Services field that comprises the Real GDP of Services sector.

VII. The Health and Welfare field that includes the Real GDP of the sectors of Human health and Social Work Activities.

VIII. The Education field that consists of the Real GDP of Education sector.

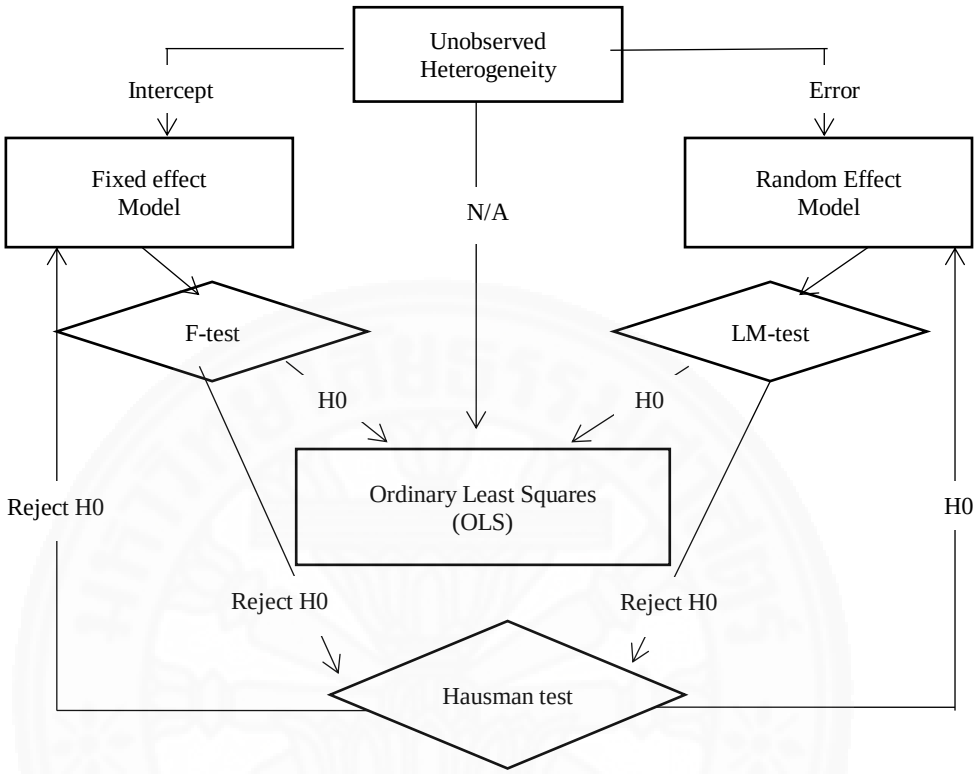
IX. The General and Other Programs field that includes the average Real GDP of all sectors.

3.5 The Panel Regression Model in the Selection Process

For all the models in this study, except the forecast of the school-age population, the panel regression method is employed. Because this study utilizes the panel data in the analysis, the panel regression is the most suitable to this study. This method has the best selection process for each prediction. The detail of the model selection process is as follows.

Figure 3.3

The Panel Regression Model Selection Process



Source: HM Park ,2011

3.5.1 Pool OLS

If an individual effect u_i (cross-sectional or time-specific effect) does not exist (u_i = 0), ordinary least squares (OLS) produces efficient and consistent parameter estimates.

$$y_{it} = \alpha + X_{it}\,\beta + \varepsilon_{it}\ (u_i = 0)$$

OLS consists of five core assumptions (Greene, 2008: 11-19; Kennedy, 2008: 41-42) including the following;

1. Linearity Assumption: the dependent variable is a linear function of a set of an independent variable and the error term.

2. Exogeneity Assumption: the expected value of disturbances is 0, meaning that the error terms do not correlate with any independent variables.

3. The Homoscedasticity Assumptions: the error terms have the same variance and they are do not related to one another (non-autocorrelation).

4. The observations of the independent variables are not stochastic but fixed in repeated samples without measurement errors.

5. The Full Rank Assumption: there is no multicollinearity among independent variables, or there is no exact linear relationship among independent variables.

If an individual effect is not 0, heterogeneity may influence assumptions 2 and 3. Particularly, the error terms may differ in variance and vary by the different units and/or are related to each other. This assumption is an issue of the non-spherical variance-covariance matrix of the error terms — the violation of assumption 2 causes random effect estimators biased. Thus, the OLS estimator is not best unbiased-linear estimator. Then panel data models provide the way to deal with these problems by using linear fixed and random effect models as they are more suitable.

3.5.2 Linear Fixed and Random Effect Models

3.5.2.1 Random versus Fixed Effects

Panel data models examine random and/or fixed effects of individual or time. The core difference between fixed and random effect models lies in the role of dummy variables. A parameter estimate of a dummy variable is a part of the intercept in a fixed-effect model and an error component in a random effect model. Slopes remain the same across group or period in either fixed or random effect model. The functional forms of one-way fixed and random effect models are shown below.

Fixed effect model: $y_{it} = (\alpha + u_i) + X_{it}\beta + v_{it}$

Random effect model: $y_{it} = \alpha + X_{it}\beta + (u_i + v_{it})$

Where u_i is a random or fixed effect explicit to individual or time that is not included in the independent variables. And errors are independent identically distributed $v_{it} \sim IID\left(0, \sigma_v^2\right)$. A fixed group effect model examines the individual differences in intercepts, assuming constant variance across the unit and the same slopes. OLS assumption "2" is not violated since an individual specific effect is time-invariant, and considered a part of the intercept, and allowed to be correlated with other independent variables.

A random-effect model assumes that special effect is not correlated with any independent variables and then estimates error variance specific to groups or times. The intercept and slopes of the independent variables are indifferent across the individual. The difference among individuals displayed their specific errors of individual, not in their intercepts. (Greene, 2008: 200-201).

3.5.2.2 Fixed and Random Effect Testing

This is in case that fixed and/or random effects exist in panel data which we need to find out. A fixed-effect is tested by F-test, while Breusch and Pagan's (1980) Lagrange multiplier (LM) test examines a random effect.

Then compare a fixed-effect model and OLS to see how much the fixed effect model can improve the goodness-of-fit, whereas the latter contrasts a random effect model with OLS. Hausman test is employed to examine the similarity between random and fixed effect estimators.

I. F-test for Fixed Effects

This test will compare between unrestricted and restricted models by using F-test.

Unrestricted model: $y_{it}=u_i+\beta_1 x_{1it}+...+\beta_k x_{kit}+\nu_{it}$

Restricted model: $y_{it}=u+\beta_1 x_{1it}+...+\beta_k x_{kit}+\nu_{it}$

Null hypothesis: $u_1=u_2=u_3=...=u_n=0$

$$\text{F-statistic} = \frac{(SSR_R - SSR_{UR})}{SSR_{UR}/(N-k-1)}$$

If at least one group/time-specific intercepting the null hypothesis is rejected, we can conclude that there is a significant fixed effect or a significant increase in goodness-of-fit in the fixed-effect model. Therefore, the fixed-effect model is better than the pooled OLS.

II. Breusch-Pagan LM Test for Random Effects

The Lagrange multiplier (LM) test was used in Breusch and Pagan's (1980) to examine if an individual or time-specific variance component are 0, H0: $\sigma^2_u=0$. The LM statistic follows the chi-squared distribution with the degree of freedom is equal to one.

$$LM_n = \frac{nT}{2(T-1)}\left[\frac{T^2\bar{e}'\bar{e}}{e'e} - 1\right]^2 : \chi^2$$

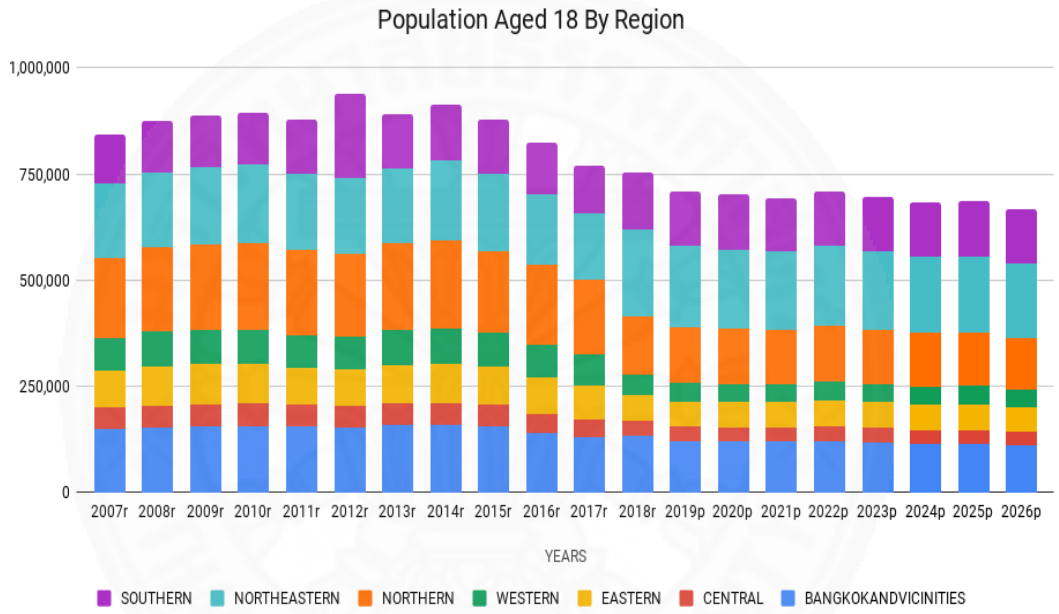
where e' is the n × 1 vector of the group means of pooled regression residuals, and e'e is the SSE of the pooled OLS regression.

CHAPTER 4
RESULTS AND DISCUSSION

4.1 The Population Aged 18 and First-year Students Prediction Result

4.1.1 The Population Aged 18 and First-year Students by Region

Figure 4.1
The Population Aged 18 by Region Prediction Result

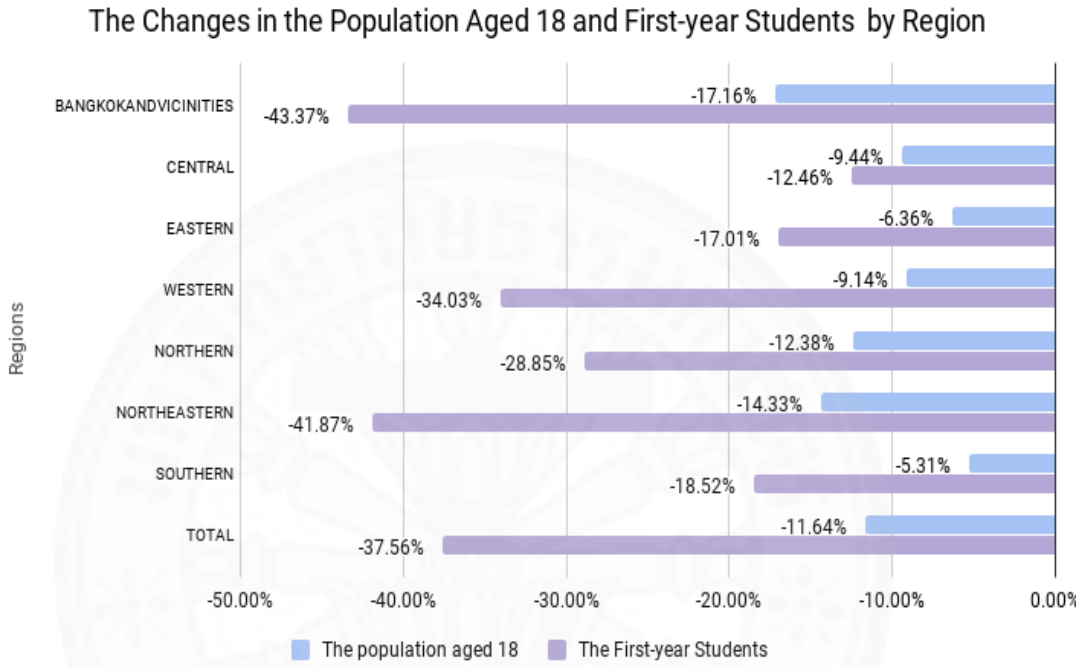


Source: Calculated and predicted by the author.

Figure 4.1 displays that, during 2014 and 2018, Thailand's overall population aged 18 years decreased in all regions, resulting in the lower number of people entering the universities. After 2014, this population group has declined drastically. It dropped from 913,025 people in 2014 to 770,098 people in 2017. In addition, the prediction result of population aged 18 illustrates that this population group continues to shrink further after 2017. With the continuing the downward trend, it is expected to fall to 693,947 people in 2021 and reaches as low as 665,534 people by year 2026. This prediction using a number of the school-age population in each age as the main forecaster, the detail of this prediction is shows in chapter3.The reduction of the 18 year-old population in Thailand directly affects the number of first-year students of Thai universities as shown in the first-year student prediction result in the

next section. However, in the year 2022 and 2025, the number of population aged 18 in Thailand tends to increase slightly, as the reason of, the increased in the number of school-age population thirteen years old and ten years old in 2017.

Figure 4.2
The Changes in Population Aged 18 and First-year Students by Region



Source: Ministry of Interior, calculated and predicted by the author.

Figure 4.2 displays the change in population aged 18 and the first-year students by region. It reveals that, when comparing year 2018 to year 2026, Thailand's overall population aged 18 will decrease across the board in every region. In 2026, the total population aged 18 will be 11.64% lower than that of the year 2018. This reduction will result in lower total number of students entering Thai universities. The first-year student prediction result of the baseline scenario in table 4.3 indicates that the total number of students entering Thai universities in 2026 will shrink by 37.56%, or 152,931 students, compared to 2018. Therefore, the population aged 18 directly affects the number of students entering Thai universities.

In addition, the prediction result illustrates that, in all regions of Thailand, the population aged 18 will decline when comparing year 2018 to year 2026. Bangkok and Vicinities, Northeastern and Northern are the regions that will experience the biggest drop in population aged 18. By the year 2026, this group of population in

Bangkok and Vicinities will decrease by 17.16%, compared to the year 2018. In the same period of time, the population aged 18 of the Northeastern region will fall by 14.33% while that of the Northern region will shrink by 12.38%. These reductions will result in the lower student enrollment. As portrayed in the Figure 4.2, the student enrollment in Bangkok and Vicinities in 2026 will decrease by 43.37% from its 2018 level. The Northeastern region will also lose 41.87% of the student enrollment. In the same manner, the student enrollment of the Northern region will be lower by 28.85%. For other regions, the population aged 18 will also fall but the change percentage will be lower than 10%.

The prediction result illustrates that, by the year 2026, the population aged 18 of the Central region will reduce by 9.44% and student enrollment in this region will drop by 12.46%, compared to 2018. As for the Western Region, its population aged 18 and number of student enrollment in 2026 will be 9.14% and 34.03%, respectively, lower than in 2018. In 2026, the population aged 18 in the Eastern region will also decline by 6.36%, leading to the 17.01% lower number of student enrollment, compared to 2018. The population aged 18 of the Southern region will likely decrease less than in other regions; by the years 2026, the population aged 18 of the Southern region will be 5.31% lower and its student enrollment will fall by 18.52%, compared to 2018.

The decline in this population group will cause the number of students in each region of Thailand to decrease. However, the size of the decrease will depend on the real GRP growth and education price index. Bangkok and Vicinities, Northeastern, Western and Northern are the regions that will experience the biggest drop in student enrollment, because they are the regions was faced with the real GRP growth decline and the Education price index increased with lager size than other regions from 2012 to 2016.(Bank of Thailand, 2017).Therefore, from the above prediction results, it can be concluded that, in the future, the population aged 18 of Thailand inclines to decrease both in the overall picture and by region. If the economic environment does not change, the decline in this population group will cause the number of students in each region of Thailand to decrease. As a result, universities in all regions of Thailand will be affected by the decrease in the number of students.

4.1.2 The First-Year Student Prediction

4.1.2.1 Fixed and Random Effect Test Result

Table 4.1

The Fixed and Random Effects Testing

Model	Method	Fixed Effect F-Test (1)	Random Effect LM-Test (2)	Hausman Test chi2-Test (3)
Student Enrollment	RE	0.000*** (12.86)	0.0003*** (11.62)	0.2025 (4.61)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Estimated by the author.

Table 4.1 exhibits the result from fixed and random effect testing. At the significance level of 0.05, the result states that the model yields significant effect to reject null hypothesis H0, meaning that fixed and random effects do exist. When compared the fixed and random effects by using Housman test, the result indicates that it accepts H0 so the coefficients of fixed and random effects are a symmetric difference. Therefore, random effect model is more preferable than fixed effect model.

4.1.2.2 The First-year Student Model Estimation Result

Table 4.2

The First-year Student Model Estimation Result

Dependent variable	Coefficients	Standard Error (Robust)	Z-Statistic	P-value(Z)
Populaionaged18	1.07216***	0.4479929	2.39	0.017 **
RealGRP	0.50193***	0.0489472	10.25	0.000 ***
EducationPrice	-0.02213***	0.0058216	-3.80	0.000 ***
Unemployment	0.15417	0.1764227	0.87	0.382
Constant	10.69752 ***	0.6812108	15.70	0.000***

Robust standard errors in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

Source: Estimated by the author.

Table 4.2 presents the first-year student model estimation result. At the significance level of 0.05, the result from random effect model points out that population aged 18 has a positive significant effect on the first-year students in bachelor's degree program in different regions of Thailand. If other factors remain

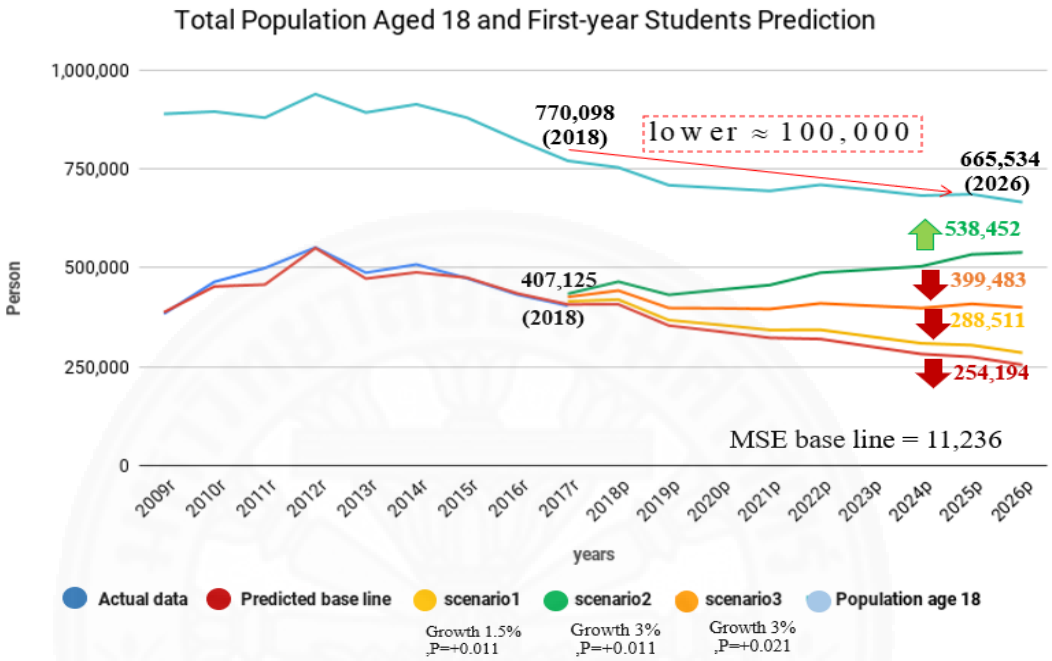
constant, when Populaionaged18 increase by 1 hundred thousand people, then first-year students in bachelor's degree program in each region i will increase by 1.07216 percent. It means the hypothesis that "the decline in this population aged 18 years old directly affects the number of students entering Thai universities" is true.

Real-GRP also has a positive significant effect on the first-year students of a bachelor's degree program of Thai regions, if other things are held constant, when Real-GRP rises by 1 million baht, then the first-year students of bachelor's degree program in each region i will rises by 0.50193 percent. The education price index has a negative significant effect on the first-year students in a bachelor's degree program in different regions in Thailand. If other things stay constant, when education price index increase by 1 percentage point, the first-year students of bachelor's degree program in each region i will decrease by 0.02213 percent. Unemployment is insignificant but has a positive relationship with the first-year students in a bachelor's degree program. For a constant that has a positive significant effect, if another variable is equal to zero, then the first-year students of bachelor's degree program in each region i will be equal to 44,246 students (Infirstyearstudent= 10.7). The results of this study correspond to those achieved by some other studies including Centra (1980), Murdock & Hoque (2002), Carlos & Isabel (2014) and other, in a way that the outcomes indicate that the school-age population, economic growth, and education cost are the significant factors to determine the university enrollment. This model is R-sq 0.9025, meaning that this model can explain 90.25 percent of the students enrollment behavior.

4.1.2.3 The First-year Student Prediction Result

Figure 4.3

Total Population Aged 18 and First-year Student Prediction



Source: Ministry of Education, calculated and predicted by the author.

As shown in Figure 4.3 and Table 4.3, from the forecast of baseline model which assumes that GRP and Education Price Index are growth equal to the average numbers in 2012-2016, the decline in the population aged 18 directly affects the number of students entering Thai universities. The forecast result points out that the number of the first-year students of a bachelor's degree program is likely to continue to decline over the next 5-10 years. It will drop from 407,125 people in 2018 to 322,300 in 2021. This group of students will plunge to as low as 254,194 people in 2026. However, the severity of the impact depends on the assumptions in each scenario portrayed in Table 4.3.

Table 4.3

The Population Aged 18 and First-year Student Prediction Result

Year	Population aged 18	The First-year Students				
		Actual data	Predicted base line GRP and P are equal to average numbers in 2012-2016	Scenario1 (GRP + 1.5%, P+1.1)	Scenario2 (GRP +3%, P+1.1)	Scenario3 (GRP +3%, P+2.1)
2009r	888,846	383,453	387,029	N/A	N/A	N/A
2010r	894,597	464,029	452,355	N/A	N/A	N/A
2011r	879,163	498,784	457,042	N/A	N/A	N/A
2012r	938,860	550,958	549,509	N/A	N/A	N/A
2013r	892,251	487,145	472,251	N/A	N/A	N/A
2014r	913,025	508,037	488,104	N/A	N/A	N/A
2015r	879,234	473,088	474,655	N/A	N/A	N/A
2016r	822,877	431,771	434,654	N/A	N/A	N/A
2017r	770,098	403,537	406,942	414,687	433,852	425,799
2018p	753,247	N/A	407,125	419,129	464,493	441,983
2019p	708,387	N/A	353,407	367,096	431,191	397,885
2020p	701,300	N/A	338,332	355,281	443,963	397,100
2021p	693,947	N/A	322,300	342,274	455,874	395,289
2022p	709,442	N/A	319,429	342,755	487,186	409,569
2023p	696,768	N/A	300,274	325,522	495,046	403,398
2024p	682,194	N/A	281,544	308,542	503,302	397,530
2025p	685,555	N/A	274,106	303,900	533,369	408,297
2026p	665,534	N/A	254,194	284,713	538,452	399,483

Note : The number of the population aged 18 and first-year students of Thailand in year t are the summation of population aged 18 and first-year students in all regions in year t:

Source: Calculated and predicted by the author.

Based on the prediction result in Table 4.3, at 95% confidence level, it is found that, if each region in Thailand has real GRP growth equal to the average growth from 2012 to 2016 and the educational price index has changed equally to the average value in the years 2012-2016, the total number of first-year students entering a bachelor's degree program in 2021 is likely to be 322,300. By the year 2026, it will plunge to 254,194 students. However, the number of first-year students may increase,

if the real GRP growth of each region grows by 3 percent per year. However, the size of the increase will depend on the education price index.

In case GRP grows 3 percent and the education price index increases as much as the consumer price index at 1.1 points, the number of first-year students entering the bachelor's degree program in 2021 will rise to 455,874 people, and reach 538,452 people in 2026. However, if the real GRP growth in each region expands by 3 percent, while the educational price index surges twice as much as the consumer price index, or by 2.1 points, the number of first-year students entering the bachelor's degree program in the year 2021 and the year 2026 will rise to 395,289 and 399,483 respectively. Notably, the increasing size is less than the case in which the education price index grows only 1.1 points. Based on the results of this study, it can be concluded that the change in the number of first-year students entering Thai universities is not only affected by the change in population aged 18 but also driven by the real income growth and the cost of education. The results of this study correspond to the projection of Murdock & Hoque (2002), Ghavidel (2015), and Batzinger (2017) which stated that, in the next century, the university enrollment is likely to follow the same trend as the school-age population.

4.1 The Student Share Which Each Field Received Prediction

4.2.1 Fixed - Random Effects and Hausman Test Result

Table 4.4

Testing Fixed - Random Effects and Hausman Test

Model	Method	Fixed Effect F-Test (1)	Random Effect LM-Test (2)	Hausman test chi2-Test (3)
Share of Each Field	RE	0.3160 (0.23)	0.0000*** (0.00)	N/A

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Estimated by the author.

Table 4.4 illustrates that, at the significance level of 0.05, the Fixed Effect does not exists in the Share of Each Field model, while Random Effect exists. Therefore, Pool OLS cannot be applied and the Random Effect is preferable.

4.2.2 Estimation Result of the Student Share of Each Field of Study in Thai Universities

Table 4.5

Estimation Result of the Student Share of Each Field of Study

VARIABLES	(1) Rea l GDP by Sector	(2) Relative Real wage	(3) Education price	(4) Population Aged 18	(5) DummyL	(6) Constant
Share of Each Field	0.0091*** (-0.0034)	0.0665*** (-0.0254)	-0.0211 (-0.0168)	-0.0064 (-0.0205)	0.4281*** (-0.0143)	0.0915 (-0.179)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Estimated by the author.

Table 4.5 indicates the estimation result of the student share of each field model. At the significance level of 0.05, the significant variables to explain the student share received in each field of study in Thai universities are Real GDP by sector and Real wage by careers. These two variables show positive correlation to the student share in each field of study. In contrast, the constant has a negative significant effect. However, the Population aged 18, and change in education price index have no significant effects on the student share of each field of study in Thai universities. It means the hypothesis that "the decline in this population aged 18 years old directly affects the number of students entering Thai universities in each field of study" is not true. This model is R-sq 0.8331, meaning that this model can explain 83.33 percent of the share of each study area in Thai universities behavior. This result can imply that the students select the fields of study by considering expected return on education (Relative Real wage) and economic change. The growth of the economy in each sector can be used for anticipating future job. The results of this study correspond to those produced by some other studies including Oyer & Lazear (2003), Karanassou et al. (2006), and Haraldsen et al. (2015) in a way that the outcomes indicate that the economic growth and wages are the positive significant factors to determine the student choice.

4.2.3 Prediction Result of the Share of First-year Student Model

Table 4.6

Prediction Result of the Share of Each Field of Study

Field of study	The share of first-year students Historical data			The share of first-year students Predicted data		
	2016	2017	$\Delta share$	2018	2026	$\Delta share$
Education	7.00%	6.54%	-0.46%	5.75%	5.46%	-0.29%
Humanities and Arts	19.31%	18.43%	-0.88%	10.99%	8.87%	-2.12%
Social Sciences, Business and Law	68.49%	61.27%	-7.22%	51.89%	50.96%	-0.93%
Science, Mathematics and Computing	14.32%	12.69%	-1.63%	9.99%	12.04%	2.06%
Agriculture and Veterinary	3.86%	4.02%	0.16%	1.46%	1.28%	-0.18%
Health and Welfare	8.44%	8.68%	0.24%	5.79%	6.32%	0.53%
Services	8.90%	21.94%	13.05%	8.71%	11.05%	2.34%
Engineering, Manufacturing and Construction	17.15%	17.94%	0.79%	11.60%	11.64%	0.04%

Source: Calculated and predicted by the author.

Table 4.6 describes the percentage change in the share of the first-year students in each study field in 2018, compared to 2026. GDP, cost of study, and relative real wage are assumed to be equal to the average numbers in 2012-2016. The population aged 18 is based on the prediction result in table 4.3. The result states that, by the year 2026, the fields of Education; Humanities and Arts; Social Sciences, Business and Law; and Agriculture and Veterinary; will lose at least 0.18% of student share whereas the fields of Health and Welfare; Services; Science, Mathematics and Computing; and Engineering, Manufacturing and Construction; will gain more student share. Humanity and Arts will be faced with the highest percentage of the decline in student share at 2.12%. Because this field of study was faced with the real GDP decline from 2012 to 2017, and the relative real wage reduced by 4.04% from 2016 to 2017 (Bank of Thailand, 2017). On the other hand, the field of Services will get the highest student share increase of 2.34% in 2026 due to the increase in the real GDP of the service sector from 5,200 billion baht in 2012 to 6,300 billion baht in 2017. The relative real wage of workers in service sector in 2017 was 1.13% above that of 2016 (Bank of Thailand, 2017). The results of this study correspond with the information collected from the last

two years (2016-2017) which revealed that the fields of Education; Humanities and Arts; and Social Sciences, Business and Law; were experiencing the decrease in the student share. On the other hand, the fields of Health and Welfare, and Services experienced the increase during that period of time which is also consistent with the results of this study. However, the change in student share of each study field in the future depends on the economic condition, information perception and adjustment of students through the information received.

Science, Mathematics and Computing; and Agriculture and Veterinary are the fields where the predictions conflict with the trend of the last two years. From the data in 2017, the student shares of these study fields were 0.16% above 2016. According to data of Science, Mathematics and Computing from 2016-2017, there was a decrease in the student share, whereas the forecast results show that, by 2026, this branch will increase its share from 2018 onwards. The explanation for this conflicting result is that, in 2016, the relative real wage increased by 2.17% from 2012 and real GDP in this sector rose from 201,072 million baht in 2012 to 207,159 million baht in 2016. These two factors are the forecasters in the prediction model, under the same education price and the same population environment. As a result, the predicted student share of this study field expanded.

In the field of Agriculture and Veterinary, the prediction also conflicts with the historical data. In 2017, the share of this study field rose by 0.16%, compared to 2016. However, the prediction result indicates that this field will experience a reduction in the student share, because its relative real wage in 2016 shrank by 4.83% from that of 2012 and the real GDP in this sector fell from 656,000 in 2012 to 630,730 million baht in 2016. If population aged 18 and education price remain the same for all fields of study, while the relative real wage and real GDP reduce, this particular field of study is predicted to have lower student share in the future. According to the theory of macroeconomics and labor market equilibrium, those students are future workers in the labor market. The students decide to select the study fields from labor market economic information. The student can consider the information about the market to make their decision when the information is clear and reliable. However, it would take a while for the students to adjust their decision making behavior. Thus, in a short run, if the information in the market regarding the wage trend and the growth rate of each

production sector is unclear and unreliable, it may cause the students to hesitate and slow down their decision making process even more.

Table 4.7

Prediction Result of the Number of First-Year Students in Each Field of Study

Field of study	The number of first-year students (people)				The number of first-year students (people)			
	baseline result (decreased)				scenario 2 result (Increased)			
	2018	2026	Δ*number*	%Δ*number*	2018	2026	Δ*number*	%Δ*number*
Education	23,390	13,867	-9,523	-40.71%	26,686	29,375	2,689	10.07%
Humanities and Arts	44,732	22,536	-22,196	-49.62%	51,035	47,737	- 3,298	-6.46%
Health and Welfare	23,572	16,066	-7,506	-31.84%	26,893	34,032	7,139	26.55%
Services	35,457	28,098	-7,359	-20.75%	40,453	59,519	19,066	47.13%
Agriculture and Veterinary	5,931	3,245	-2,686	-45.29%	6,766	6,873	107	1.58%
Social Sciences, Business and Law	211,263	129,542	-81,721	-38.68%	241,032	274,405	33,373	13.85%
Science, Mathematics and Computing	40,652	30,616	-10,036	-24.69%	46,380	64,854	18,473	39.83%
Engineering, Manufacturing and Construction	47,216	29,579	-17,638	-37.35%	53,869	62,656	8,786	16.31%

Source: Calculated and predicted by the author.

Table 4.7 describes the percentage change in the number of first-year students in each study field in 2018, compared to 2026. We allocate the students to each area of study by using the share ratio of each field in the year 2018 and multiply those numbers with the total number of first-year students in that year. In student allocation, the number of first-year students in baseline scenario in Table 4.3 is used. GDP and wage are assumed to be equal to the average numbers in 2012-2016. We then apply the same method to forecast 2026 numbers in order to compare the result between 2018 and 2026. The result states that, by the year 2026, all fields of study will lose at least 20.75% of the students. The field of Humanities and Arts gets biggest drop in terms of percent change in the number of first-year students. In 2026, this study field will lose 49.62% of the students, amounting to 22,196 students, compared to 2018. The field of Agriculture and Veterinary will also receive 2,686 less students, which is

equivalent to 45.29%. Education field will get 9,523 less students, accounting for 40.71%.

Services; Science, Mathematics and Computing; and Health and Welfare are likely to get lower impact than other fields. The field of Services will receive 7,359 less students, equivalent to 20.75%. Health and Welfare will experience a drop in the number of students by 31.84% or 7,506 students. Science, Mathematics and Computing will receive 10,036 less students, amounting to 24.69%. However, when the decrease in the total number of students was taken into the consideration, it was found that Social Sciences, Business and Law were the most affected. By the years 2026, the number of students in this study field will fall by 38.68% or 81,721 students. Engineering, Manufacturing and Construction will also be faced with a big loss of students by 37.35%, accounting for 17,638 students.

For the above studies, the description is based on the prediction result of the number of first-year students in the baseline scenario. However, if we are allocating students to each study field by using the prediction of student enrollment from scenario1, in which GRP growth is assumed to be 1.5% per year and education price index increases by 1.1 percentage point per year, the student loss in each field of study tends to be lower than the prediction results of the student enrollment from baseline scenario. It is because the student loss in the prediction results from baseline scenario is bigger than that from other scenarios.

In the same manner, the student loss in each field of study is likely to be lower than the prediction results of the student enrollment from baseline scenario when scenario 2 is applied, in which the assumed GRP growth is equal to 3% per year and the education price index rises by 1.1 percentage point. Similarly, when scenario 3 is used, in which the assumed GRP growth is equal to 3% per year and education price index expands by 2.1 percentage point, the student loss in each field of study tends to be lower than the prediction results of the student enrollment from baseline scenario.

If we are allocating students to each study field by using the prediction of student enrollment from scenario1 and scenario 3, the number of students received in each study field would be drop in the same way as using the baseline scenario. However, the impact size of scenario1 and scenario 3 will be lower as the predictions of the student enrollment in the scenario 1 and 3 fell below that of the baseline.

This study result corresponds with the historical data in Table 1.5 and Figure 1.4, in which the number of first-year students in every field of study in the year 2017 decreased from that of the year 2013. The field of Social Sciences, Business and Law was the area where it showed the most massive slump.

To compare the impact on each field when the student enrollment changed in both incremental and decremental directions, we allocated the students to each area of study by using the share ratio of each field in the year 2018 and multiply those numbers with the total number of first-year students in that year. In student allocation, the number of first-year students in scenario 2 that was predicted to have an increased student enrollment. In this scenario, GRP growth was assumed to be 3% per year and education price index was assumed to increase by 1.1 percentage point per year as shown in Table 4.3. We then apply the same method to forecast 2026 numbers in order to compare the result between 2018 and 2026. The result states that, by the year 2026, all fields of study will receive at least 1.58% more students, except Humanities and Arts which will get 3,298 less students, equivalent to 6.46% drop. Services will experience the highest rise in the number of students at 47.13%, or 19,066 students.

The number of students in the field of Science, Mathematics and Computing will be 39.83% higher, amounting to 18,473 students, while that of Health and Welfare will be 26.55% higher, accounting for 7,139 students. However, when the increase in the total number of students was taken into consideration, it was found that Social Sciences, Business and Law would get the highest increase. By the year 2026, this study field will have 33,373 more students, equivalent to 13.85% increase. Engineering, Manufacturing and Construction increased student 8,786 or 16.31%. The field of Agriculture and Veterinary and the field of Education are likely to experience smaller increases than other fields. By 2026, the number of students in the field of Agriculture and Veterinary will increase by 1.58%, accounting for 107 students, while that of the field of Education will rise by 10.07%, amounting to 2,689 students.

The study result reveals that, while the school-age population significantly affects the student enrollment, it does not have any effect on the share of students in each field of study. The share of students is influenced by economic and labor market trend, presented through real GDP and relative real wage in this study. During the time when the student enrollment decreases dramatically, the number of students received

in each area tends to go down inevitably. However, in the year 2026, the number of students in each field can increase when the economic growth in each region is equal to 3 percent per year and the rise in educational costs is equal to the consumer price index. As the university students in Thailand rely on their parents' income, the economic growth affecting the income of parents would also have an impact on the parents' decision to support their children to join university. The cost of education is another important factor influencing the parents' decision to allow their children to join university level. Therefore, avoiding the deterioration of the economy and increasing educational costs can help reduce the impact of the reduction of student enrollment in each field.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The education system plays an essential role in producing human capital for the economy. But, in recent years, the school-age population has been decreasing and contributing a critical part to the lower student flows of higher education, especially in the Bachelor's degree program. This study aims to investigate the impact of school-age population decrease on Thai universities. This study evaluates the impact in terms of student enrollment, the market share of each study field, and the number of students entering each study field in Thai universities. Thailand panel data and panel regression method from 2011-2017 have been utilized to predict the number of first-year students in Bachelor's degree program. We focus on the students aged 18, and use macro-economic factor as the main forecasters. The study also applies the panel regression method to forecast the market share and number of the first-year students that each university field receives. The purpose of this process is to emphasize on the impact of school-age population decrease on market share and number of students each university field receives.

The estimation of the university enrollment model indicates that, at the significance level of 0.05, the real GDP by region, population aged 18, Education, and Price Index have a positive significant effect on the student enrollment. It means the hypothesis that "The decline in this population age 18 years old directly affects the number of students entering Thai universities" is correct. The university enrollment model is applied to predict the student enrollment. The forecast results indicate that the amount of first-year students in a bachelor's degree program is likely to continue to decline over the next 5-10 years. The first-year students of bachelor's degree program will drop from 407,125 people in 2018 to 322,300 in 2021. This group of students will plunge to as low as 254,194 people in 2026. However, the severity of the impact depends on the assumptions about economics growth and cost of study in each scenario. From the results, it can be concluded that the change in the number of first-year students

entering Thai universities is significantly affected, not only by the changing population aged 18, but also by the real income growth and the cost of education.

The estimation result in the student share which each field received model shows that the real GDP and relative real wage have a positive significant effect on the student share of each study field. It means the hypothesis that "The decline in this population age 18 years old directly affects the number of students entering Thai universities in each field of study" is not true. The result states that, by the year 2026, the fields of Education; Humanities and Arts; Social Sciences, Business and Law; and Agriculture and Veterinary; will lose at least 0.18% of student share whereas the fields of Health and Welfare; Services; Science, Mathematics and Computing; and Engineering, Manufacturing and Construction; will gain more student share in the future. However, when the decrease in the total number of students was taken into the consideration, it was found that the number of students in all field of study will be lower as a result of the decrease in student enrollment. The field of Services , Health and Welfare are likely to get lower impact than other fields, this may be because Thailand has recently become an aging society, the economic growth and the demand for labor in the fields of Services and Health and Welfare study have been growing.

It can be derived from the study results that the school-age population significantly affects the number of students enrolled by the university. On the other hand, it does not affect the share of students in each field of study. Instead, the share of students in each field is influenced by economic trend; Real GDP and Real wage in this study. Furthermore, although the share of students in each field of study is not directly determined by the school-age population, when the number of students enrolled by the university diminishes, it can lead to a reduction in the number of students in each field of study anyway if its share does not increase massively enough. With the study results taken into consideration, the following policy can be recommended.

5.2 Recommendations

5.2.1 The University Must Adjust Its Strategy to Survive the Situation

A. Find a New Market or Other Demand

From the prediction result, all university types will encounter the decline in number of first-year students due to lessening number of students aged 18. To increase the number of students, Thai universities should offer the courses that attract other population groups to the university, for example, the short courses for older people or for those who have graduated but would like to gain more knowledge in some specific topics. Moreover, Thai universities should improve their ranking in world university rankings. Better ranking will make Thai universities more competitive in the world education market. With higher competitive ranking, Thai universities will attract more foreigners to come to enroll in their programs. Then Thai universities can generate more income from broader market.

B. Generate Other Income from the University Services

Thai universities have to find other sources of income besides the income per student from the government subsidy or the block grant. The university should turn into a knowledge center for everyone in the society by providing different services, such as producing quality research in various fields and offering education services to the citizen. Not only would it help the university generate additional incomes but also improve its competitiveness ranking through providing the quality researches.

C. Thai Universities Should Turn This Crisis into an Opportunity.

Referring to the prediction, we have found that, by the year 2026, the first-year students are likely to fall by 37.56%. If the university still operates at the same level, it might unavoidably be faced with the excess capacity. Thai universities should turn this crisis into an opportunity by deducting the number of students per classroom to increase the efficiency of the teaching process. Thailand Ministry of Education should control the number of students per class and the students per teacher ratio to be at a lower level. When the teacher has fewer students per class, the students can

participate better, and the teacher can concentrate more on each student. With a smaller classroom, it will be more beneficial to the students.

5.2.2 Thai Government Must Adjust Its Policy to Support National Development

I. Develop advanced technology to solve the problem of labor shortage in all production sectors.

The forecast results display that, by the year 2026, the number of the first-year students in all fields of study will plunge beyond 20.75% from 2018 onwards. From this result, it can be implied that, in the next 10 years, skilled labor in all production sectors will shrink by at least 20.75%, possibly resulting in the lack of skilled labor in Thailand. Normally, the shortage of skilled labor negatively affects the decisions of both Thai and foreign investors who consider investing in Thailand. This will inevitably have an impact on Thailand overall economy. Therefore, accelerating the development of production technology, along with equipping people with the skills to work with more advanced technology, must be done strategically.

II. Promote Enrollment in the Fields that are Important to The National Development Strategy.

Thai government should promote enrollment in the fields that are important to the national development strategy. For example, from the prediction result, the number of students in the field of Science, Mathematics, and Computing and the field of Engineering, Manufacturing, and Construction are plunging over 24.69%. This reduction may cause Thai government's 4.0 policy to fail because we do not have enough skilled labor to work in this sector. The government should support science and technology businesses as well as generate more jobs in these production sectors to prompt the students to enroll in these fields of study. If the economy in this sector grows, it will lead to more demand in labor because the demand of labor is derived from the demand of product. In addition, according to the theory of macro-economics in the short term, when demand for labor increases, real wage rises. Then it can encourage more students to enroll in these fields. If Thailand does not support domestic technology and still imports machinery and technology from abroad, local workers in this industry

will be replaced by either machines or foreign workers. Thus, Thailand 4.0 policy will never be a success.

The field of Health and Welfare is another field that is important to Thai society, both at present and in the future. The prediction result demonstrates that the number of first-year students in this field will dwindle by 31.84% in 2026. However, as Thailand is becoming an aging society, the demand for labor in the Health and Welfare sector is getting higher. Therefore, Thai government should provide more financial aids to the students who have the ability to enroll in this field. If we have a labor shortage in this industry, we might need to import foreign labor. This may cause problems in providing enough public health services in the future.

The above examples of the field of study are the areas where Thai government should pay attention and solve the foreseeable problems by enabling Thai education system to produce the human capital to support the national development strategy. In addition, Suksiriserekul (2019) found that in the next 20-40 years, the demand for high-skilled workers would likely increase. For Thailand development to achieve its goal of changing from Thailand 3.0 to Thailand 4.0, increasing the supply of high-skilled labor should increase by 0.05%, 0.04%, and 0.03% per year for the next 20, 30, and 40 years, respectively. Thus, the national development strategy cannot be a success without skilled labor which is an essential force of national development.

5.3 Limitations of This Study

1. This study had limited data because there was available data from only a short time span or less number of years. This problem forced the researcher to use regional data to increase the number of observations. We had to make the assumptions on the student movement between each region of Thailand.

2. The university-type level analysis was challenging because of the limited access to the university type data, for example, the annual tuition fees for each type of university that change differently. Therefore, in the future, if such a data can be collected, the models can be developed for the university-type level and analysis can be done for the program level.

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APPENDICES

APPENDIX A

THE DETAIL OF RESULT

Table A.1
The Population Age 18 by Region Prediction Result

YEARS	BANGKOKANDVICINITIES	CENTRAL	EASTERN	WESTERN	NORTHERN	NORTHEASTERN	SOUTHERN	TOTAL
2018p	131,881	35,330	63,285	45,407	138,644	204,152	134,548	753,247
2019p	120,222	33,755	60,032	43,070	130,489	192,265	128,554	708,387
2020p	120,108	33,818	59,710	42,374	128,804	187,846	128,641	701,300
2021p	118,972	33,722	59,230	42,913	128,641	185,632	124,838	693,947
2022p	120,563	34,270	62,146	44,616	130,878	189,202	127,765	709,442
2023p	117,272	33,515	61,125	43,673	127,757	184,674	128,751	696,768
2024p	113,855	32,788	59,399	43,001	125,751	180,643	126,757	682,194
2025p	114,189	33,245	59,710	43,110	125,828	179,976	129,497	685,555
2026p	109,253	31,994	59,259	41,259	121,482	174,889	127,398	665,534

Source: Calculated and predicted by the author.

Table A.2
The Number of First Years Student by Region

YEARS	BANGKOKANDVICINITIES	CENTRAL	EASTERN	WESTERN	NORTHERN	NORTHEASTERN	SOUTHERN	TOTAL (Y)
2018p	228,666	6,178	20,050	6,673	28,597	74,521	42,440	407,125
2019p	193,588	5,999	19,016	6,212	25,687	63,739	39,167	353,407
2020p	185,527	5,929	18,612	5,886	24,733	59,065	38,580	338,332
2021p	175,905	5,850	18,187	5,651	24,209	56,047	36,450	322,300
2022p	171,768	5,814	18,431	5,494	24,316	56,591	37,015	319,429
2023p	159,210	5,697	17,907	5,192	23,062	52,391	36,814	300,273
2024p	147,403	5,586	17,268	4,921	22,137	48,766	35,463	281,544
2025p	142,103	5,546	17,020	4,703	21,732	47,063	35,940	274,106
2026p	129,496	5,408	16,640	4,402	20,347	43,319	34,582	254,193

Source: Calculated and predicted by the author. Note: The number of first year's student =Ex(In first years student)

Table A.3
The Student Share Which Each field Receive Prediction Result

yearc	Education	Humanities and Arts	Social Sciences, Business and Law	Science, Mathematics and Computing	Engineering, Manufacturing and Construction	Agriculture and Veterinary	Health and Welfare	Services
2018p	0.0575	0.1099	0.5189	0.0999	0.1160	0.0146	0.0579	0.0871
2019p	0.0571	0.1072	0.5178	0.1024	0.1160	0.0143	0.0586	0.0900
2020p	0.0567	0.1046	0.5166	0.1050	0.1161	0.0141	0.0592	0.0930
2021p	0.0564	0.1019	0.5154	0.1076	0.1161	0.0139	0.0599	0.0959
2022p	0.0560	0.0993	0.5143	0.1101	0.1162	0.0137	0.0606	0.0988
2023p	0.0556	0.0966	0.5131	0.1127	0.1162	0.0134	0.0612	0.1017
2024p	0.0553	0.0940	0.5119	0.1153	0.1163	0.0132	0.0619	0.1047
2025p	0.0549	0.0913	0.5108	0.1179	0.1163	0.0130	0.0625	0.1076
2026p	0.0546	0.0887	0.5096	0.1204	0.1164	0.0128	0.0632	0.1105

Source: Calculated and predicted by the author.

Table A.4.

The Number of Student Which Each Field Receive Prediction Result

Year	Education	Humanities and Arts	Social Sciences, Business and Law	Science, Mathematics and Computing	Engineering, Manufacturing and Construction	Agriculture and Veterinary	Health and Welfare	Services
2018p	23,390	44,732	211,263	40,652	47,216	5,931	23,572	31,814
2019p	20,176	37,893	182,977	36,198	41,003	5,068	20,696	31,449
2020p	19,193	35,379	174,779	35,525	39,271	4,776	20,038	30,903
2021p	18,167	32,848	166,123	34,671	37,426	4,477	19,302	31,564
2022p	17,889	31,708	164,272	35,184	37,108	4,365	19,342	30,551
2023p	16,707	29,010	154,071	33,847	34,897	4,036	18,381	29,471
2024p	15,563	26,454	144,134	32,461	32,734	3,721	17,421	29,495
2025p	15,053	25,028	140,008	32,309	31,882	3,561	17,143	28,098
2026p	13,867	22,536	129,541	30,616	29,578	3,245	16,066	31,814

Source: Calculated and predicted by the author. Note :Table A.4 = A.3 * Colum Total in Table A.

APPENDIX B
THE DATA SUMARY

Table B.1
The Data Summary for First Years Student Model

Region	Statistics	First-Year Students	Real GRP	Population Aged 18	Education Price Index	Unemployment
BANGKOKANDVICINITIES	Mean	284,553	4,362,500	154,087	98.61	0.89
	Std. Dev.	19,032	415,143	5,984	1.6	0.24
	Min	307,913	5,000,000	159,627	100.72	1.41
	Max	251,406	3,700,000	139,399	95.84	0.62
CENTRAL	Mean	5,665	548,809	50,132	100.92	1.26
	Std. Dev.	2,388	30,052	1,948	3.9	0.31
	Min	10,196	589,941	51,935	111.2	2
	Max	2,232	505,107	45,530	99.03	0.95
EASTERN	Mean	23,289	1,475,000	90,370	99.87	0.85
	Std. Dev.	2,992	96,825	3,728	2.56	0.25
	Min	26,725	1,600,000	95,505	106.38	1.45
	Max	16,594	1,300,000	85,212	98.11	0.54
WESTERN	Mean	9,507	305,604	79,369	99.01	0.61
	Std. Dev.	1,970	13,538	1,659	3.27	0.21
	Min	12,353	320,310	81,929	105.12	0.95
	Max	5,555	281,760	76,256	95.02	0.38
NORTHERN	Mean	70,389	615,000	199,130	99.95	0.76
	Std. Dev.	8,532	35,588	7,149	3.39	0.21
	Min	78,799	652,807	208,288	108.52	1.18
	Max	50,794	550,301	188,384	97.24	0.51

Source: Calculated and compiled by the author.

Table B.1
The Data Summary for First Years Student Model (Continued)

Region	Statistics	First-Year Students	Real GRP	Population	Education Price Index	Unemployment
NORTHEASTERN	Mean	72,331	813,523	180,105	99.27	0.86
	Std. Dev.	9,032	67,123	6,011	3.84	0.38
	Min	83,493	892,676	187,768	108.35	1.69
	Max	57,712	690,635	168,614	95.76	0.59
SOUTHERN	Mean	48,211	734,815	135,414	99.29	1.09
	Std. Dev.	5,522	49,654	24,578	2.94	0.29
	Min	58,334	814,662	199,463	105.73	1.64
	Max	39,889	655,025	119,482	95.32	0.67

Source: Calculated and compiled by the author.

Table B.2
The Data Summary for First Year Student Model : Overall

Variable	Observation	Mean	Std. Dev.	Min	Max
FirstyearStudents	63	73,147.08	92,714.71	2,232.00	323,821.00
PopulationAge18	63	126,699.900	52,373.90	45,530.00	208,288.00
RealGRP	63	1,247,134.00	1,307,397.00	280,418.90	4,965,013.000
EducationPriceIndex	63	102.33	8.87	95.02	133.31
Unemployment	63	0.95	0.36	0.38	2.00

Source: Calculated and compiled by the author.

Table B.3
The Data Summary for Student Share Which Each Field Received Model

Filed of Study	Filed	Student Share	GDP by Sector	Real wage	Relative Real Wage	Education Price Index	Population age18
Education	Mean	0.072	318,229	22,042.96	1.21	99.36	938,888
	Std. Dev.	0.01	10,511	1,797.69	0.03	0.92	50,690
	Min	0.059	296,475	19,281.80	1.17	98.07	836,459
	Max	0.085	328,661	23,832.70	1.24	100.43	989,446
Humanities and Arts	Mean	0.145	492,056	16,812.02	0.92	99.36	938,888
	Std. Dev.	0.046	67,562	1,877.17	0.04	0.92	50,690
	Min	0.079	386,262	13,018.39	0.84	98.07	836,459
	Max	0.208	585,116	19,057.09	0.96	100.43	989,446
Social Sciences, Business and Law	Mean	0.531	1,428,571	21,790.73	1.2	99.36	938,888
	Std. Dev.	0.135	138,505	1,392.55	0.03	0.92	50,690
	Min	0.387	1,200,000	19,265.79	1.15	98.07	836,459
	Max	0.741	1,600,000	23,323.90	1.24	100.43	989,446
Science, Mathematics and Computing	Mean	0.125	197,328	21,214.97	1.16	99.36	938,888
	Std. Dev.	0.017	11,095	1,816.54	0.02	0.92	50,690
	Min	0.098	171,610	17,698.70	1.14	98.07	836,459
	Max	0.151	207,159	23,199.10	1.19	100.43	989,446
Engineering, Manufacturing and Construction	Mean	0.139	716,797	26,382.36	1.45	99.36	938,888
	Std. Dev.	0.038	49,012	1,365.62	0.07	0.92	50,690
	Min	0.086	627,799	23,833.51	1.36	98.07	836,459
	Max	0.187	780,000	28,069.31	1.57	100.43	989,446

Source: Calculated and compiled by the author.

Table B.3
The Data Summary for Student Share Which Each Field Received Model (Continued)

Filed of Study	Filed	Student Share	GDP by Sector	Real wage	Relative Real Wage	Education Price Index	Population age18
Agriculture and Veterinary	Mean	0.033	638,101	5,425.16	0.3	99.36	938,888
	Std. Dev.	0.008	19,435	381.83	0.01	0.92	50,690
	Min	0.024	608,097	4,812.56	0.28	98.07	836,459
	Max	0.046	660,000	5,772.28	0.31	100.43	989,446
Health and Welfare	Mean	0.068	397,200	20,507.48	1.12	99.36	938,888
	Std. Dev.	0.017	24,300	1,786.75	0.01	0.92	50,690
	Min	0.041	346,135	17,356.72	1.1	98.07	836,459
	Max	0.087	429,892	22,358.39	1.14	100.43	989,446
Services	Mean	0.084	5,557,143	11,886.25	0.65	99.36	938,888
	Std. Dev.	0.06	471,645	1,415.22	0.03	0.92	50,690
	Min	0.032	4,800,000	9,342.62	0.6	98.07	836,459
	Max	0.219	6,300,000	13,202.29	0.68	100.43	989,446
General and other Programs	Mean	0.03	1,228,571	18,257.74	1	99.36	938,888
	Std. Dev.	0.059	103,016	1,413.97	1	0.92	50,690
	Min	0	1,100,000	15,576.26	1	98.07	836,459
	Max	0.174	1,400,000	19,754.05	1	100.43	989,446

Source: Calculated and compiled by the author.

Table B.4
The Data Summary for Student Share Which Each Field of Received Model: Overall

Variable	Observation	Mean	Std. Dev.	Min	Max
Share of each field	63	0.1497	0.1606	0.0238	0.7408
PopulationAge18	63	938,888	51,096	836,456	989,446
RealGDPbysector	63	1,218,837	1,601,586	171,610	6,332,129
EducationPriceIndex	63	99.35857	0.9240555	98.07	100.43
Wagebycareer	63	19,047.56	7,409.308	4812.56	36,633.34

Source: Calculated and compiled by the author

APPENDIX C
THE DATA CLASIFICATION

C.1 **The University type Clasification**

From Chapter One, Section 1.1.1.1 that describes the types of higher education institutions in Thailand, the following table shows more details about the list of higher education institutions, categorized by the type of institution included in this study, based on the classification criteria of the Ministry of Education of Thailand in 2017.

Table C.1

The Classification Criteria for The Types of Higher education Institutions in Thailand

No.	Public University
1	**Nakhon Phanom**
2	**Narathiwat Rajanagarindra**
3	**Naresuan**
4	**Mahasarakrm**
5	**Maejo (Head Center)**
6	• Maejo - Chumphon
7	• Maejo - Phrae Chalim Phra Kiat
8	**Srinakharinwirot**
9	**Silpakorn (Head Center)**
10	• Sanamchan Palace Campus
11	• Phetchaburi Information Campus
12	**Prince of Songkla (Head Center)**
13	• Prince of Songkla-Trang Campus
14	• Prince of Songkla -Pattani Campus
15	• Prince of Songkla -Phuket Campus
16	• Prince of Songkla -Surat Thani Campus
17	Ubon Ratchathani
18	**Pathumwan Institute of Technology**
19	**National Institute of Development Administration (Head Center)**
20	• Phuket Campus
21	• Udon Thani Campus
22	**Ramkhamhaeng**
23	**Sukhothai Thammathirat**
24	**Chulalongkorn University**
25	**Kalasin**

Source: Ministry of Education,2017

Table C.1

The Classification Criteria for The Types of Higher education Institutions in Thailand (Continue)

No.	Public University
	Kasetsart
26	• Bang Khen (Head Center)
27	• Kamphaeng Saen Campus
28	• Chalermphrakiat Sakon Nakhon Campus
29	• Sriracha Campus
30	• Suphanburi Campus
31	**Khonkaen**
32	**Chiang Mai**
33	**Thaksin**
	King Mongkut's University of Technology
34	• Thonburi
35	• North Bangkok
36	• North Bangkok Rayong Campus
37	• Suranaree University of Technology
38	• North Bangkok Prachin Buri Campus
	Thammasat
39	• Thaprajan (Head Center)
40	• Usa Prapha (Pattaya Center)
41	• Rangsit Campus
42	• Lampang Campus
43	**Burapa (Head Center)**
44	• Chanthaburi Information Campus
45	• Sakaew Information Campus
47	**Phayao**
48	**Mahachulalongkornrajavidyalaya (Head Center)**
49	• Khon Kaen Campus
50	• Chiang Mai Campus
51	• Nakhon Ratchasima Campus
52	**Mahachulalongkornrajavidyalaya (Head Center)**
53	• Nakhon Si Thammarat Campus
54	• Buddhist Studies Campus
55	• Phayao Campus
56	• Phrae Campus
57	• Surin Campus
58	• Nong Khai Campus
59	• Ubon Ratchathani Campus
60	• Nakhon Phanom Buddhist College
61	• Nakhon Sawan Buddhist College
62	• Chinnarat Buddhist College
63	• Lamphun Buddhist College
64	• Sangha College

Source: Ministry of Education,2017

Table C.1

The Classification Criteria for The Types of Higher education Institutions in Thailand (Continue)

No	Public University
65	**Mahamakut Buddhist University (Head Center)**
66	• Lanna Campus
67	• Sri Lan Chang Campus
68	• Sirindhorn Rajabhat
69	**Mahidol**
70	**Mae Fah Luang**
71	**Walailak**
72	**Suan Dusit**
73	**Chulabhorn College**
74	**Galyani Vadhana Music Academy**
75	**King Mongkut's Institute of Technology Ladkrabang**
No	**Institutions Under the Ministry and other Agencies (Include in Public University)**
1	**Royal Thai Army Nursing College**
2	**Naval Nursing College**
3	**Police Nursing College**
4	**Air Force Nursing College**
5	**Phramongkutklao College of Medicine**
6	**Naval Training Center**
7	**Civil Aviation Institute**
8	**Sri Sawarin Thira Nursing Institute, Thai Red Cross Society**
9	**Banditpatanasilpa Institute**
No	**Rajamangala University of Technology**
1	**Krungthep**
	Tawan-ok
2	• Tawan-ok Chakphong Phuphanat Campus
3	• Tawan-ok Chanthaburi Campus
4	• Tawan-ok Bang Phra Campus Chonburi province
5	• Tawan-ok Uthen Campus
6	**Thanyaburi**
7	**Phra Nakhon**
	Rattanakosin
8	• Rattanakosin Bophitphimuk Empire Campus
9	• Rattanakosin Camp Chang Campus
10	• Rattanakosin Wang Klai Kangwon Campus
11	• Rattanakosin Salaya Campus
	Lanna
12	• Lanna Chiang Mai
13	• Lanna Chiang Rai Campus
14	• Lanna, Tak Campus
15	• Lanna, Nan Campus
16	• Lanna Phitsanulok Campus

Source: Ministry of Education,2017

Table C.1

The Classification Criteria for The Types of Higher education Institutions in Thailand (Continue)

No	Rajamangala University of Technology
17	• Lanna Lampang Campus
	Srivijaya
18	• Srivijaya Nakhon Si Thammarat Campus
19	• Srivijaya Songkhla Campus
20	• Srivijaya Trang Campus
22	**Suvarnabhumi**
23	**Isan**
24	• Isan Khon Kaen Campus
25	• Isan Northeastern Campus (Nakhon Ratchasima)
26	• Isan Sakon Nakhon Campus
27	• Isan Surin Campus
No	**Rajabhat University**
1	**Kanchanaburi**
2	**Kamphaeng Phet**
3	**Chandrakasem**
4	**Chaiyaphum**
5	**Chiang Rai**
6	**Chiang Mai**
7	**Thepsatri**
8	**Thonburi**
9	**Nakhon Pathom**
10	**Nakhon Ratchasima**
11	**Nakhon Si Thammarat**
12	**Nakhon Sawan**
13	**Somdet Chao Phraya**
14	**Buriram**
15	**Phranakhon**
16	**Phra Nakhon Si Ayutthaya**
17	**Pibulsongkram**
18	**Phetchaburi**
19	**Phetchabun**
20	**Phuket**
21	**Maha Sarakham**
22	**Yala**
23	**Roi Et**
24	**Rajanagarindra**
25	**Rambhai Barni**
26	**Lampang**
27	**Loei**
28	**Valaya Alongkorn ,Royal patronage**
29	**Sisaket**

Source: Ministry of Education,2017

Table C.1

The Classification Criteria for The Types of Higher education Institutions in Thailand (Continue)

No	Rajabhat University
30	**Sakon Nakhon**
31	**Songkhla**
32	**Suan Sunandha**
33	**Surat Thani**
34	**Surin**
35	**Chom Bueng Village**
36	**Udon Thani**
37	**Uttaradit**
38	**Ubon Ratchathani**
No	**Private university**
1	**Bangkok University**
2	**Bangkok Rangsit Campus**
3	**Bangkok Thonburi University**
4	**Bangkok University Suvarnabhumi**
5	**Eastern University of Management and Technology**
6	**Krirk**
7	**Kasem Bundit**
8	**Christian**
9	**Chao Phraya**
10	**Chalermkarnchana**
11	**Shinawatra**
12	**St. John's**
13	**Tapee**
14	**Mahanakorn University of Technology**
15	**Thonburi**
16	**Dhurakij Pundit**
17	**North Bangkok**
14	**Mahanakorn University of Technology**
15	**Thonburi**
16	**Dhurakij Pundit**
17	**North Bangkok**
18	**North-Chiang Mai**
19	**International Asia-Pacific**
20	**Stamford International**
21	**Nation**
22	**Pathum Thani**
23	**Payap**
24	**Phitsanulok**
25	**Fatani**
26	**Far Eastern**
27	**Central Regions**
28	**Northeastern**
29	**Rangsit**
30	**Rattana Bundit**

Source: Ministry of Education,2017

Table C.1

The Classification Criteria for The Types of Higher education Institutions in Thailand (Continue)

No	Private university
31	**Ratchathani**
32	**Rajapruek**
33	**Wongchavalitkul**
34	**Sriprathum**
35	**Sriprathum -Chonburi Campus**
36	**Siam**
37	**University of the Thai Chamber of Commerce**
38	**Huachiew Chalermprakiet**
39	**Hat Yai**
40	**Assumption**
41	**Eastern Asia**
42	**South East Asia**
No	**Community college**
1	**Tak**
2	**Narathiwat**
3	**Nan**
4	**Buriram**
5	**Pattani**
6	**Phang Nga**
7	**Phichit**
8	**Phrae**
9	**Mukdahan**
10	**Mae Hong Son**
11	**Yat Trat**
12	**Yasothon**
13	**Yala**
14	**Ranong**
15	**Songkhla**
16	**Satun**
17	**Samut Sakhon**
18	**Sa Kaeo**
19	**Nong Bua Lam Phu**
20	**Uthai Thani**
No	**Private college**
1	**Chalermkanjana, Rayong**
2	**Chiang Rai**
3	**St. Louis**
4	**Southeast Bangkok**
5	**Dusit Thani**
6	**Thongsuk**
7	**Chitralada Technology**
8	**Phanomwon Technology**
9	**Southern College of Technology**
10	**Technology Siam University**

Source: Ministry of Education,2017

Table C.1

The Classification Criteria for The Types of Higher education Institutions in Thailand (Continue)

No	Private college
11	**Nakhon Ratchasima**
12	**Northern**
13	**St. Theresa International**
14	**Asian Graduate College**
15	**Phichayabandit College**
16	**International Buddhist College**
17	**Santapol College**
18	**Sangtham College**
19	**Intertek College, Lampang**
No	**Private institutions**
1	**Kantana**
2	**Panyapiwat**
3	**Learning institutions for all people**
4	**Thai-Japanese Institute of Technology**
5	**Mahachai Automotive Technology Institute**
6	**Suvarnabhumi Institute of Technology**
7	**Ayothaya Institute of Technology**
8	**Rajapark**
9	**Witthaya Sirimet**
10	**Pacific Institute of Management Sciences**
11	**The Art Hermitage**

Source: Ministry of Education,2017

APPENDIX D

THE FORMULAR USED

D.1.The formula to calculate percentage change in the total number of first year's student and total number of population's during years t and t-n.

$$\text{Percentage change} = \frac{\text{Total number}_{t-1} - \text{Total number}_{t-n}}{\text{Total number}_{t}} * 100$$

D.2.The formula to calculate change in the total number of first year's student and total number of population's during years t and t-n.

$$\text{Change in total number} = \text{Total number}_{t-1} - \text{Total number}_{t-n}$$

D.3. The Number of first years student by region

Number of first years student = Ex(In (First years student) = A

D.4. The Number of first years student which each field i of all Thai universities received

Number of first years student in each field i = A*(Student Share of each field i show in table) =B

D.5. The Number of first years student which each field i received : classified by university type

The Number of first years student in field i of university type x = B * The share of first years student which each field i; university type x=C , where x= Public ,Private , Rajamangala,Rajabhat

BIOGRAPHY

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