Bayesian Model Average for Student Learning Location

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Abstract

The paper was conducted to understand the factors affecting the student's learning location. The official study carried out an online survey through Google forms using a questionnaire with the participation of 125 samples. The Bayesian Model Selection shows that 03 factors are affecting student studying location (SSL), which are Students' perception (PP), Price perception (PRI), Perception of universities in a big city (UNI). From the results, we have proposed many implications for improving student learning. This study uses the optimal choice of Bayesian Model Selection for the student learning location. Students' perceptions (PP), price perceptions (PRI), and university perceptions in big cities (UNI) all have a 97.1 percent impact on student studying places (SSL). Model 1 is the best option by BIC, and four variables have a probability of 100%.

Keywords: Bayesian Model Selection, Students' perception, price perception, perception of university, city, student, learning location.

1 Introduction

In recent years, the socio-economic conditions of Vietnam's provinces have increasingly developed and gradually reduced the disparity in socio-economic and infrastructure between provinces. Socio-economic development also leads to increasing demand for human resources everywhere in the country. Many schools, many disciplines, have been born throughout the provinces and cities of Vietnam to meet that need and create a diverse and rich ecosystem for students to choose for themselves a place to study. It also poses an enormous challenge that faces so many options. How can you choose a suitable place to study?

Ho Chi Minh City is a dynamic economic region, rich in historical and traditional culture in Vietnam. The first impression left for visitors when coming to the 300-year-old city is the excitement, youth, and dynamism. Luxury high-rise buildings in the city center, busy markets, streets with shops, restaurants, restaurants, entertainment areas open until late. HCMC increasingly asserts its role as a center for high-quality education and training. Regarding the education and training of human resources, it has developed in an increasing direction. The number of training is usually higher in the following year than in the previous year; Types of training are also diversified, facilities are interested in investment. The number of universities and colleges in the area has increased rapidly, along with the momentum of economic development. In the process of development and integration, HCMC has always affirmed its role as an economic, financial, and service center of the entire country; is the nucleus of the Southern key economic region, one of the three largest key economic regions in the country and also the driving force for socio-economic development in the Southern region and the entire country according to the strategic industrialization and modernization. With these achievements, along with the strength of scientific and technical human resources, the city has become the center of training, science and technology, and technology transfer of Vietnam [1].

The reality of the past years has shown that most candidates do not fully understand the place they intend to study, but only choose according to the trend, sentiment, or orientation of their family without grasping information about that place. Is it suitable for you or not? Leading to choosing the wrong place to study so that when studying, many students feel unsuitable, depressed, and sometimes drop out midway.

The problem of choosing a place to study is not only the problem of the candidates but also affects the existence and development of the school.

Over the years, universities and colleges in Ho Chi Minh City have made significant efforts to improve educational training quality, facilities, and enrollment counseling to attract more students to attract candidates. The article uses the Bayesian Model Selection student learning places. Students' perceptions (PP), price perceptions (PRI), and university perceptions in big cities (UNI) all have a 97.1 percent impact on student studying places (SSL). Model 1 is shown to be the best option by BIC, and four variables have a probability of 100%.

This paper is presented as follows: Section 1 presents an overview of this research, Section 2 presents a review of literature on variable used in this research, and Section 3 present the methodology. Results and analysis with some discussion and implications are presented in Section 4. Lastly, Section 5 concludes this paper.

2 Literature Review

2.1 Students' Perception (PP)

Yusya and Ariyanto [2] emphasized that individuals with a high level of education and expertise often choose to study and practice in urban areas. This comes from the following reasons: First, they can find work that matches their expertise; second, a better working and studying environment there will help them improve their education or expertise, creating better job opportunities in the future.

According to Wang et al. [3], when students are aware of their ability to study well in a particular training discipline according to their forte, they will register for the city entrance exam. Some schools train this profession. Wright [4] said that the choice of the right major for an individual plays an important role in the decision to choose a city to study and practice.

Belló [5] said that students are often attracted by job opportunities and social positions after graduation. They are very interested in job opportunities and are influenced by what graduates are doing, contributing to society. From the above analysis, we propose the following hypothesis:

Hypothesis (H1): Students' perception affects the choice of city to study.

2.2 Price Perception (PRI)

Roberts [6] said that price has a significant influence in deciding to choose where to study and practice.

Jackson et al. [7] concluded that the level of study costs, as well as living expenses in the living area, have a negative influence on student's decision to choose where to study and practice, while financial aid, scholarships reduce costs.

The price is reflected in the following factors: reasonable price, diversified price, stable price, flexible payment, suitable price with quality. Price is the amount of money, or all, of value that consumers must exchange or pay to use a product or service, and buyers calculate the price with the benefits the product provides them [8]. According to Batt and Chamhuri [9], the impact of the price factor is always noticed and is always the leading factor compared to other factors. The research result of Dukert [10] shows that when we live in an area with high costs, it motivates the intention to stay to live or move to other areas with lower costs. From the above analysis, we propose the following hypothesis:

Hypothesis (H2): Price perception affects the choice of city to study.

2.3 Perception of Universities in the Big City (UNI)

Students strive to achieve their best on the university entrance exam to attend a university in a major city. Parents are afraid to send their children to big cities because the expense of living is much greater. The city name is more important to students in their decision-making process than the university name. Universities in large cities have many qualified students; universities in smaller cities work much harder to attract qualified students and academics [11]. From the above analysis, we propose the following hypothesis:

Hypothesis (H3): Students' perception of city choice affects the choice of a city to study.

Figure 1 presents the model for the hypotheses and the variables.
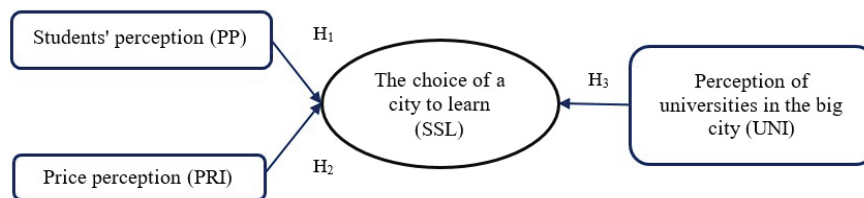
Figure 1   Research model.

3 Method

3.1 Sample Approach

Convenience sampling is one of the non-probabilistic sampling methods. This method is convenient based on the accessibility of the subjects, in places where the enumerator can meet the object. For example, employees can stop at any place to ask for an interview. Sampling is often used in the discovery factor, confirming the real meaning of the study, or pre-check the question to complete, when estimating the problem of interest without spending too much time and money. The research sample is based on the topic of decision-making on choosing Ho Chi Minh City as a place to study, practice, and take students of Ho Chi Minh City as a model for the research process. Descriptive statistics to show the will: Find out the factors that affect the choice of Ho Chi Minh City as a place to study and practice for students. According to Tabachnick and Fidell [12] for the best regression analysis, it is necessary to ensure the sample size: $N = 8m + 50$. The official quantitative study was carried out by surveying 125 students who are studying in Ho Chi Minh City, Vietnam. Table 1 describes statistics of sample characteristics.

The survey participation rate of second-year students is the majority, with 68.8% because most group members are second-year students, so it is easier to approach and survey. In terms of gender, the majority is female with 69.6% because most of the group's members are female. Most of the students who took part in the survey with 64.8% said that their family supports from 2 to 4 VND million per month. 28% of surveyed students have an income of less than 2 million a month because they have to study and the part-time income is quite low in Table 1. Factors and items are in Table 2 to survey

Table 1   Statistics of sample

Characteristics		Amount	Percent (%)
Sex and School year	Male	38	30.4
	Female	87	69.6
	First	16	12.8
	Second	86	68.8
	Third	14	11.2
	Fourth	9	7.2
Income/Month	Below 2 VND millions	35	28.0
	2 to 4 VND millions	81	64.8
	5 to 7 VND millions	8	6.4
	Above 8 VND millions	1	0.8

Table 2   Factor and item

Factor	Item
PP	The score of the student's entrance exam ability
	The school's entrance exam score is suitable for students
	Job opportunities that students want
	The need for a social position after graduation
	The field of training in the school is suitable for students
PRI	The cost of moving to HCMC is suitable for students
	The cost of eating in HCMC is suitable for students
	The cost of living in HCMC is suitable for students
	Support for scholarship fees
UNI	Excellent facilities make students feel satisfied
	Student-centered teaching and communication
	The academic reputation of the faculty is highly appreciated
	The reputation of HCMC university is highly appreciated
	Internet, the library make you satisfied with completeness and convenience
	Extracurricular programs, quality of life
	Access graduate education
SSL	Students' perception is the reason for choosing HCMC to study
	Price perception is the reason for choosing HCMC to study
	Perception of universities is the reason for choosing HCMC to study

$$\alpha = \frac{k}{k-1}\left[1 - \frac{\sum \sigma^2\left(x_i\right)}{\sigma_x^2}\right]$$

questions based on the previous research to provide the most accurate factors for decision-making to choose Ho Chi Minh City as a place to study and practice.

For the duration of the study, all study staff and respondents were blinded. No one from the outside world had any contact with the study participants in Table 2.

3.2 Bayes' Theorem

Let *H* be the hypothesis and *D* denote the actual data got from the collection. Bayes' theorem [13] states that the probability of *H* given *D* occurs, denoted as $P(H|D)$, is:

$$P(H/D) = \frac{P(H) * P(D/H)}{P(D)} \tag{1}$$

The probability of the hypothesis before collecting data is called P (H). $P(D|H)$ is the probability that the data happens under the correct hypothesis H; P(*D*) is the distribution of the data in Equation (1) [14].

3.3 Bayes Inference

According to Gelman and Shalizi [15], based on the Bayes theorem, we can see that the inference Bayes has 3 types of information: information we want to know [posterior information], the information we already know [prior information], and practical information [likelihood]. Here, "information" can be understood as probability or distribution in Equation (2). Therefore, Bayesian inference can be generalized:

$$\textbf{Posterior information} = \textbf{Prior information} \times \textbf{Likelihood} \qquad (2)$$

3.4 Selection of the Model by the Bayesian Model Averaging

Usually, to simply define a model for a research problem, one gives only a single model (the model includes all the collected variables) to estimate and then deduce, as if that model were the model most suitable for the data. Therefore, the method can ignore other models built with some variables from the set of collected variables, and some of those models may be more suitable. Therefore, it is necessary to survey and compare the models of a research problem to find the actual most suitable model for the data (can also be interpreted as the "best" model) [16]. The Bayesian statistical model selection method is the Bayesian mean model method (BMA), which uses posterior probabilities and the BIC index to measure the model [16]. The advantage of using the BMA method is the ability to take the model uncertainty into account by considering all models of the study.

4 Results

4.1 Bayesian Model Selection

BIC (Bayesian Information Criteria) was used to choose the best model by R software. BIC has been used in the theoretical context for model selection. As a regression model, BIC can be applied, estimating one or more dependent variables from one or more independent variables [17, 18]. An essential and useful measurement for deciding a complete and straightforward model is the BIC [19]. Based on the BIC information standard, a model with a

Table 3   BIC model selection

SSL	Probability (%)	SD	Model 1
Intercept	100.0	0.007682	2.1516
UNI	100.0	0.007684	0.2783
PRI	100.0	0.007668	0.3212
PP	100.0	0.007596	0.2394

Table 4   Model test

Model	nVar	R^2	BIC	Post Prob
Model 1	3	0.971	−426.2751	1
BIC = −2 * loglikelihood + d * log(N)				

lower BIC is selected. The best model will stop when the minimum BIC value [16, 17, 20]. R report shows every step of searching for the optimal model. BIC selects the best 1 model as in Table 3.

There are three independent and one dependent variable. Students' perception (PP), Price perception (PRI), Perception of universities in big cities (UNI) influence Student studying place (SSL) with Probability is 100% in Table 3.

4.2 Model Evaluation

According to the results from Table 4, where N is the sample size set and d is the total number of parameters. The lower BIC score signals a better model. BIC shows model 1 is the optimal selection because BIC (−426.2751) is the minimum. Students' perception (PP), Price perception (PRI), Perception of universities in big cities (UNI) impact Student studying place (SSL) is 97.1% in Table 4. BIC finds model 1 is the optimal choice and four variables have a probability of 100%. The above analysis shows the regression equation below is statistically significant.

$$\mathbf{SSL = 2.1516 + 0.2783UNI + 0.3212PRI}$$
$$\mathbf{+ \, 0.19965SN + 0.2394PP}$$

4.3 Implications

First, Price perception shows that this is the factor that has the strongest impact on the intention to choose Ho Chi Minh City as a place to study and practice for students. When students choose a place to study and practice, is it necessary to pay attention to the cost of transportation, living costs in the area,

accommodation costs suitable for family circumstances or not? How should the university's tuition fees change over the years? Here, the tuition fee can be considered a rather sensitive factor because during the entire school year there are many expenses incurred. If not contemplated, it is easy to feel pressured and burdened. If you don't know how to arrange a reasonable time between work and study, you may even fall into the money, quit studying in the middle... then this is not good. As recently, many public universities have increased tuition fees next semester to improve the university's facilities or serve the teaching of lecturers, etc. Poor students cannot pay university fees. Therefore, the university wants to attract more students; it needs to have many policies such as scholarship support, policy loans with 0% interest rate, advances... This helps students reduce the burden when they have an idea to study and practice in Ho Chi Minh City, especially the 12th graders who are preparing to choose a university. That is also what Ho Chi Minh City needs to pay attention to and encourage universities to have policies on tuition waivers and reductions for students. In addition, it is necessary to improve the quality of life, but the cost is not too expensive to attract students living in the city to feel comfortable and feel that this is a city worth living in.

Second, when choosing to study in Ho Chi Minh City, students are interested in the Perception of universities in the big city, do they make themselves satisfied? Top facilities will meet the needs of students who want to solve problems in the subjects. When wanting to attract students to the school, a university should mention a brief introduction to the university's facilities. Is the school's reputation appreciated? If students choose low-level universities, it may be difficult to get a job when they graduate. If they can, they must have a high level of education or family conditions to open a self-employed business. The university's extracurricular programs or the academic qualifications of excellent teachers and lecturers can lead their students to become better and better and improve the school's achievements. Does the school take students as the center to teach, because if the school only cares about profits, surely no student wants to study at that university? There are also job opportunities inside the university while students are studying. Therefore, the school needs to pay attention to students and meet the needs of students, the intention of students to choose the school as a place to study will increase. Most schools have many branches in different cities, so schools in Ho Chi Minh City need to encourage students to study in the city because the facilities here are more advanced and modern than in other cities.

Finally, Students' perception makes sure that their choice is correct and suitable for them. Each student needs to study carefully the recruitment

information, the specific enrollment criteria of the school, and need to spend time on their own. To what extent do you assess your true ability, including your academic level? Is the field of study suitable for job opportunities upon graduation? Does your position need to meet yourself? Opinions from relatives, friends, etc. can be a source of additional reference, but the most decisive decision still lies with you. When choosing a place, students should consider the above issues, whether their learning ability can get into their desired school or not, taking measures to improve their learning results. Universities should provide information on enrollment, appropriate entry criteria for students to refer to and decide to choose. The university's reputation can help students' job aspirations after graduation. If Ho Chi Minh City wants students to choose this place to study, it should have some outstanding policies or services to attract students, because this is also a place where students have stayed for over 4 years when students attend universities.

5 Conclusions

The paper aims to find solutions to promote the choice of Ho Chi Minh City as a place to study for students. Find out information about students' interest in choosing a place to study and practice for themselves. From there, evaluate the influence of the following factors: Students' perception (PP), Price perception (PRI), Perception of universities in the big cities (UNI).

The scales, after evaluating by BIC method, find that the observed variables in economic factors are suitable for individual factors, school, and price. So our group will group the variables in the economic factor into the remaining 3 factors. Finally, to run the regression model to test the research hypotheses, 3 factors are Students' perception (PP), Price perception (PRI), Perception of universities in the big cities (UNI) to choose HCMC as a place to study and practice the most. This means relying upon on-campus employment opportunities; facilities suitable for students; the school takes the student as the teaching center; the academic reputation of the faculty; university reputation; extracurricular programs, quality of life; opportunities to access post-graduate education; moving expenses; accommodation costs suitable for students; monthly living expenses; scholarship support; school fees, job opportunities; the need for a position in society; suitable field of study; relationships in the market create job opportunities; The more suitable job opportunities outside the school for students, the higher the impact on the decision to choose Ho Chi Minh City as a place to study and practice. Which, the price factor has the greatest impact on the intention to choose Ho

Chi Minh City as a place to study and practice, followed by university and personal factors. As these factors increase, the intention to choose Ho Chi Minh City as a place to study and practice will increase.

Choosing Ho Chi Minh City is an effective place for students to study and practice, students need to pay attention to the above 3 factors and from there, schools in Ho Chi Minh City listen to what students need and offer solutions to attract students to the city.

Future researches should use the PLS-SEM model and extend more factors.

Acknowledgments

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