Chapter 5

Empirical Results

5.1 Introduction

In this chapter, the empirical results obtained are analyzed and discussed. Before going through the results, the summary statistics of the sample acquired from the train and bus passenger survey are presented in section 5.2. The effect of socioeconomic and demographic variables on the demand for intercity rail passenger services are later evaluated in section 5.3, followed by an evaluation of the accuracy of the binary logit models.

5.2 Summary Statistics

Table 5.1 shows the number of train respondents interviewed according to train stations where the journey took place (origin) in Peninsular Malaysia. There were 253 train passengers interviewed. The highest number of train passengers interviewed came from Kuala Lumpur where 62 passengers were accounted for or 24.5% out of the total number of train passengers interviewed. Meanwhile the lowest number of train passenger being interviewed came from Bukit Merah, Gemas, Kuala Krai,Nibong Tebal, Perak, Pulau Pinang, Tapah, and Tanjung Malim where each train station had 1 train passenger (0.4%) who took the train from each station.

Table 5.1

Number of Train Respondents Interviewed According to Train Stations Where the Journey Began

Train Station	Number of respondents	Percentage (%)
Alor Setar	5	2
Batu Gajah	4	1.6
Bukit Merah	1	0.4
Bukit Mertajam	2	0.8
Butterworth	20	7.9
Gemas	1	0.4
Hatyai	2	0.8
Ipoh	5	2
Johor Bahru	25	9.9
Kajang	4	1.6
Kampar	2	0.8
Kuala Lumpur	62	24.5
Kluang	12	4.7
Kuala Krai	1	0.4
Kulai	19	7.5
Labis	2	0.8
Nibong Tebal	1	0.4
Padang Besar	13	5.1
Pasir Mas	4	1.6
Perak	1	0.4
Pulau Pinang	1	0.4
Segamat	8	3.2
Seremban	19	7.5
Singapore	17	6.7
Taiping	5	2
Tampin	4	1.6
Tanah Merah	4	1.6
Tapah	1	0.4
Tapah Road	5	2
Tanjung Malim	1	0.4
Wakaf Bahru	2	0.8
Total	253	100

Table 5.2 shows the number of bus respondents interviewed at major bus stations in Peninsular Malaysia. The interview was conducted at nine bus stations. They were conducted at Alor Setar, Butterworth, Ipoh, Johor Bahru, Kluang, Melaka, Puduraya, Pulau Pinang and Segamat bus stations. A total of 272 bus passengers were interviewed. Puduraya had the highest percentage of respondents interviewed. Out of the total number of bus passengers interviewed, 46.3% respondents came from Puduraya. And the lowest number of respondent interviewed came from Butterworth, which was 3.3% of the total number of bus passengers interviewed.

Table 5.2
Number of Bus Respondents Interviewed at Major Bus Stations in Peninsular Malaysia

Venue	Number of respondents	Percentage (%)
Alor Setar	15	5.5
Butterworth	9	3.3
Ipoh	17	6.3
Johor Bahru	45	16.5
Kluang	19	7
Melaka	12	4.4
Puduraya	126	46.3
Pulau Pinang	13	4.8
Segamat	16	5.9
Total	272	100

Table 5.3 shows the crosstabulation between the type of passengers and gender of respondents. The total number of the sample was equivalent to 525 respondents (including bus and train passengers). From that total, 53.1% of the respondents were male and 46.9% respondents were female.

In Table 5.4, it shows the crosstabulation between the type of passengers and race of respondents. From the sample of 525 respondents, 60% of the respondents were Malay, 23.4% respondents were Chinese, 9.3% respondents were Indian and 7.2% respondents were of other races.

Table 5.5 is the crosstabulation between type of passengers and age of respondents. From the sample, 48.8% of the respondents belonged to the age group of 20 to 30 years, which was the highest among the other age categories. There were 12.6% of the respondents were under 20 years old, 11.4% respondents belonged to the age group of 31 to 40 years old, 9.9% respondents from 41 to 50 years age group, 9.5% respondents from 51 to 60 years old age group and 7.8% respondents were over 60 years old.

Table 5.6 shows the crosstabulation between type of passengers and marital status. There were 57.5% respondents who were single, 42.1% respondents were married and 0.4% respondents were divorced.

Table 5.7 is the crosstabulation between type of passengers and occupation. From the number of 525 respondents, 5.1% respondents were self employed, 13.9% respondents were working in the government sector, 30% respondents were working in the private sector, 27.8% respondents were students, 7.2% respondents were pensioners, 12.6% respondents were housewives or not working and 4.4% respondents belonged to other occupation group.

Table 5.3: Crosstabulation Between Type of Passengers and Gender

TYPE OF PASSENGERS * GENDER Crosstabulation

			GENDER		
			MALE	FEMALE	Total
TYPE OF PASSENGERS	BUS PASSENGERS	Count	134	138	272
		% within GENDER	48.0%	56.1%	51.8%
	TRAIN PASSENGERS	Count	145	108	253
		% within GENDER	52.0%	43.9%	48.2%
Total		Count	279	246	525
		% within GENDER	100.0%	100.0%	100.0%

Table 5.4: Crosstabulation Between Type of Passengers and Race

TYPE OF PASSENGERS * RACE Crosstabulation

			RACE				
			MALAY	CHINESE	INDIAN	OTHERS	Total
TYPE OF PASSENGERS	BUS PASSENGERS	Count	178	65	21	8	272
		% within RACE	56.5%	52.8%	42.9%	21.1%	51.8%
	TRAIN PASSENGERS	Count	137	58	28	30	253
		% within RACE	43.5%	47.2%	57.1%	78.9%	48.2%
Total		Count	315	123	49	38	525
		% within RACE	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.5: Crosstabulation Between Type of Passengers and Age

TYPE OF PASSENGERS * AGE Crosstabulation

			AGE						Total
			<20	20-30	31-40	41-50	51-60	>60	
TYPE OF PASSENGERS	BUS PASSENGERS	Count	40	152	27	24	22	7	272
		% within AGE	60.6%	59.4%	45.0%	46.2%	44.0%	17.1%	51.8%
	TRAIN PASSENGERS	Count	26	104	33	28	28	34	253
		% within AGE	39.4%	40.6%	55.0%	53.8%	56.0%	82.9%	48.2%
Total		Count	66	256	60	52	50	41	525
		% within AGE	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.6: Crosstabulation Between Type of Passengers and Marital Status

TYPE OF PASSENGERS * MARITAL STATUS Crosstabulation

			MARITAL STATUS			Total
			SINGLE	MARRIED	DIVORCED	
TYPE OF PASSENGERS	BUS PASSENGERS	Count	182	90		272
		% within MARITAL STATUS	60.3%	40.7%		51.8%
	TRAIN PASSENGERS	Count	120	131	2	253
		% within MARITAL STATUS	39.7%	59.3%	100.0%	48.2%
Total		Count	302	221	2	525
		% within MARITAL STATUS	100.0%	100.0%	100.0%	100.0%

Table 5.7: Crosstabulation Between Type of Passengers and Occupation

TYPE OF PASSENGERS * OCCUPATION Crosstabulation

			OCCUPATION							
			SELF EMPLOYED	GOVERNMENT SECTOR	PRIVATE SECTOR	STUDENT	PENSIONERS	HOUSEWIFE OR NOT WORKING	OTHERS	Total
TYPE OF PASSENGERS	BUS PASSENGERS	Count	13	42	68	98	12	25	14	272
		% within OCCUPATION	48.1%	57.5%	44.7%	67.1%	31.6%	37.9%	60.9%	51.8%
	TRAIN PASSENGERS	Count	14	31	84	48	26	41	9	253
		% within OCCUPATION	51.9%	42.5%	55.3%	32.9%	68.4%	62.1%	39.1%	48.2%
Total		Count	27	73	152	146	38	66	23	525
		% within OCCUPATION	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.8: Crosstabulation Between Type of Passenger and Monthly Personal Income

TYPE OF PASSENGERS * INCOME Crosstabulation

			INCOME							
			RM 0	<RM500	RM501-1000	RM1001-1500	RM1501-2000	RM2001-2500	>RM2500	Total
TYPE OF PASSENGERS	BUS PASSENGERS	Count	115	26	44	39	23	9	16	272
		% within INCOME	56.7%	46.4%	62.0%	60.9%	45.1%	45.0%	26.7%	51.8%
	TRAIN PASSENGERS	Count	88	30	27	25	28	11	44	253
		% within INCOME	43.3%	53.6%	38.0%	39.1%	54.9%	55.0%	73.3%	48.2%
Total		Count	203	56	71	64	51	20	60	525
		% within INCOME	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.9: Crosstabulation Between Type of Passengers and Vehicle Ownership

TYPE OF PASSENGERS * VEHICLE OWNERSHIP Crosstabulation

			VEHICLE OWNERSHIP		
			YES	NO	Total
TYPE OF PASSENGERS	BUS PASSENGERS	Count	126	146	272
		% within VEHICLE OWNERSHIP	48.5%	55.3%	51.9%
	TRAIN PASSENGERS	Count	134	118	252
		% within VEHICLE OWNERSHIP	51.5%	44.7%	48.1%
Total		Count	260	264	524
		% within VEHICLE OWNERSHIP	100.0%	100.0%	100.0%

Table 5.10: Crosstabulation Between Type of Passengers and Purpose of Travel

TYPE OF PASSENGERS * PURPOSE OF TRAVEL Crosstabulation

			PURPOSE OF TRAVEL				
			OFFICIAL BUSINESS	HOLIDAY	PERSONAL	OTHERS	Total
TYPE OF PASSENGERS	BUS PASSENGERS	Count	40	42	173	17	272
		% within PURPOSE OF TRAVEL	42.6%	47.2%	54.2%	73.9%	51.8%
	TRAIN PASSENGERS	Count	54	47	146	6	253
		% within PURPOSE OF TRAVEL	57.4%	52.8%	45.8%	26.1%	48.2%
Total		Count	94	89	319	23	525
		% within PURPOSE OF TRAVEL	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5.8 is the crosstabulation between type of passengers and monthly personal income. About 38.7% of the respondents did not have any income, 10.7% respondents belonged to the income group of less than RM500, 13.5% respondents were from RM501 to RM1000 income group, 12.2% respondents from RM1001 to RM1500 income group, 9.7% respondents were from RM1501 to RM2000 income group, 3.8% respondents were from RM2001 to RM2500 and 11.4% respondents have a monthly income exceeding RM2500.

Table 5.9 shows the crosstabulation between type of passengers and vehicle ownership. About 49.6% respondents owned a vehicle (either a bike or a car) and 50.4% respondents who did not own any vehicles.

Table 5.10 is the crosstabulation between type of passengers and purpose of travel by respondents. Out of 525 respondents, 17.9% respondents travelled for official business purposes, 17% respondents were on holiday, 60.8% respondents travelled due to personal reasons and 4.4% respondents travelled for other reasons.

5.3 The Effect of Socioeconomic and Demographic Variables on the Demand for Rail Passenger Services

The analysis in this section is made based on the empirical results obtained from econometric estimation of the binary logit models. The results are presented in Table 5.11. The effects of the socioeconomic and demographic variables on the demand for

Table 5.11
Estimation results for the five binary logit models
Dependent variable : Intercity Train-Bus mode choice
(zero if bus, one if train)
Estimation method : Maximum likelihood
Sample size : 525 respondents

Socioeconomic & demographic data	Independent variable	Model 1	Model 2	Model 3	Model 4	Model 5
Gender	Gender	-0.2076 (0.1857)			-0.2184 (0.2075)	-0.1630 (0.2189)
Race	Malay	-1.5836* (0.4094)			-1.4419* (0.4373)	-1.3584* (0.4498)
	Chinese	-1.3575* (0.4295)			-1.4103* (0.4537)	-1.3287* (0.4626)
	Indian	-1.0269** (0.4919)			-1.0159*** (0.5237)	-0.8260 (0.5405)
Age(years old)	< 20	-1.2702** (0.5511)			-0.8029 (0.6291)	-0.9453 (0.6398)
	20-30	-1.4049* (0.4792)			-1.2041** (0.5512)	-1.3350** (0.5612)
	31-40	-1.1348** (0.4780)			-1.1962** (0.5396)	-1.3146** (0.5513)
	41-50	-1.4358* (0.4912)			-1.5846* (0.5667)	-1.6106* (0.5779)
	51-60	-1.1297** (0.4915)			-1.0466** (0.5117)	-1.0878** (0.5174)
Marital Status	Single	2.3880* (0.6145)			2.2582* (0.8137)	1.4774 (0.9211)
	Married	2.9581* (0.5645)			2.7389* (0.7732)	1.9061** (0.8803)
Occupation	Self employed		0.7558*** (0.4521)		0.7902 (0.6156)	0.5846 (0.6212)
	Government sector		0.4109 (0.3426)		0.5340 (0.5608)	0.2409 (0.5718)
	Private sector		0.8494* (0.2614)		0.9385*** (0.5276)	0.7764 (0.5291)
	Student		-0.5890 (0.5788)		-0.3667 (0.7324)	-0.4442 (0.7306)
	Pensioners		1.3316* (0.4525)		0.6949 (0.6559)	0.5670 (0.6641)

	Housewife or not working		0.6881 (0.5607)		0.5162 (0.7313)	0.4402 (0.7302)
Income	RM 0		-0.1011 (0.5629)		-0.1337 (0.6490)	-0.1116 (0.6651)
	< RM500		-0.5988 (0.3922)		-0.6414 (0.4766)	-0.5589 (0.4949)
	RM501-1000		-1.1252* (0.3237)		-1.0745** (0.4293)	-1.0048** (0.4422)
	RM1001-1500		-1.1242* (0.3556)		-1.0481** (0.4152)	-0.9193** (0.4277)
	RM1501-2000		-0.4759 (0.3779)		-0.4081 (0.4313)	-0.3409 (0.4387)
	RM2001-2500		-0.4510 (0.5152)		-0.2491 (0.5573)	-0.2560 (0.5636)
Vehicle ownership	VHC			-0.3332*** (0.1729)		-0.0013 (0.2247)
Purpose of travel	Official Business			0.4331** (0.2206)		1.3125** (0.5461)
	Holiday			0.2962 (0.2393)		1.0055*** (0.5446)
	Personal			-0.0037 (0.1415)		0.7787 (0.5154)
R^2_p		0.6286	0.6305	0.5534	0.64	0.6527
Percent correctly predicted						
Bus passenger (%)		76.1	71.32	77.94	72.79	73.53
Train passenger (%)		48.62	54.15	30.95	54.55	56.35
Model Chi Square		53.174*	48.97*	8.293***	77.772*	84.491*

Notes :
(Standard error in parentheses)
* significant at 1% level
** significant at 5% level
*** significant at 10% level

intercity rail passenger services will be discussed in terms of log odds[34] of intercity rail passenger services being the mode of choice for travel in comparison with intercity bus services. The higher the log odds, the higher the probability that intercity rail passenger services will be the choice of mode and vice versa.

In the first binary logit model, the explanatory variables used consist of gender, race, age of respondent and their marital status. There was no evidence showing that the variable representing gender is statistically significant. But the negative coefficient of that variable suggests that a female decreases the log odds of intercity rail passenger service being the mode of choice when compared to a male. From the perspective of races, we notice that the variables created to represent races that consist of Malay, Chinese and Indian also decreases the logs odds compared to the other races category because the sign of coefficients for the three variables are negative. The variable representing Malay and Chinese is highly significant using a significance level of 1% while the variable representing Indian is statistically significant at a level of 5%. In terms of age, the coefficients for age category of 60 years old and below are also negative which means that individuals at the age of 60 years old and below decrease the log odds of intercity rail passenger services being the choice of mode in comparison with individuals with age over 60 years old. Those in the age category between 41 and 50 years old decrease the log odds more than other age categories and it is highly significant using a significance level of 1%. The sign of the coefficients representing the variables for singles and married couples are

[34] Log of the odds ratio of probability for choosing intercity rail passenger services to the probability for not choosing intercity rail passenger services

both positive and highly significant using a significance level of 1%. Individuals who are married increase the logs odds more than those who are single. It is also important to note that the sign of the coefficients for all explanatory variables used in the first binary logit model are consistent with the findings in the fourth and fifth binary logit models.

In the second binary logit model, the explanatory variable used consists of occupation and personal income of respondents. The coefficients representing each occupation have a positive sign except for the category that represents students. Individuals who are pensioners are the most likely among other occupation categories to travel by train and its coefficient is highly significant using a significance level of 1%. Second in pursuit, are individuals working in the private sector. A very startling finding is that students are the most unlikely group of individuals to travel by train. This finding is consistent with the results acquired in the fourth and fifth binary logit models. Coefficients representing each category of personal income have a negative sign. They are related to the decrease of log odds of intercity rail passenger service being the choice of mode. Individuals with a personal income between RM501 to RM1500 are the most unlikely group of individuals to travel by train in comparison with other categories of personal income. Both variables are highly significant using a significance level of 1%. The sign of coefficients for the variables used to represent different categories of occupation and personal income are consistent with the results in the fourth and fifth binary logit models.

While the third binary logit model uses vehicle ownership and purpose of travel as explanatory variables. Individuals who do not own any mode of transport if they are given a choice will not travel by train because the sign of the coefficient representing this group of individuals is negative. It is found that individuals on official business are the most likely to travel by train because the coefficient representing this variable increases the log odds more than other purposes of travel. The variable representing the purpose of travel due to official business is statistically significant in the third and fifth binary logit model using a significance level of 5%. However, the sign of the coefficient representing purpose of travel due to personal reasons differs between the third and fifth binary logit models. In the third binary logit model, individuals who will travel due to personal reasons are unlikely to travel by train whereby in the fifth binary logit model the situation is the opposite. The difference could be due to the exclusion of the variable gender, race, age of respondents, marital status, occupation and income in the third binary logit model that affects the overall outcome.

The fourth binary logit model uses explanatory variables from the first and second binary logit models. In terms of the sign of coefficients representing different categories of socioeconomic and demographic variables, the results generated are consistent with the findings in the fifth binary logit model that encompasses all socioeconomic and demographic variables.

5.4 The Model Chi Square

The Model Chi Square which is comparable to the overall F test for regression shows that all binary logit models that are built in this study are highly significant using a significance level of 1% except for the third binary logit model which is statistically significant at a level of 10% where we reject the null hypothesis that coefficients for all of the terms in each binary logit model are 0.

5.5 Prediction of the Binary Logit Models

In terms of model accuracy, the pseudo R squared for the fifth binary logit model (complete model) is the highest compared to the remaining binary logit models. This means that the fifth binary logit model is the most accurate in its estimation compared to the remaining four logit models. From a sample of 525 respondents that includes train and bus passengers, 65.27% of the respondents were correctly predicted by the complete model, which includes all explanatory variables.[35]

For the reproduction of the empirical results for the five binary logit models, please refer to Appendix E.

[35] If the binary logit model predicts accurately, the pseudo R squared would be equal to the value 1.

The demand for intercity rail passenger service is found to be significantly affected by the variables representing age of 20 years old and above. And the coefficients are negative in all regressions. Individuals with the age between 41 and 50 years old are found to be the most unlikely group of individual to travel by train and is highly significant at 1% in all of the regressions.

In terms of marital status, the variable married is found to be positive and statistically significant in all of the regressions. It seems that individual who are married will most likely to travel by rail compare to individuals who are not.[36]

Variables representing different categories of occupation are found to be positive in all regressions except for the variable representing students. As a comparison with other categories of occupation, students are the most unlikely group of individuals that will travel by train.

The coefficients representing different categories of income are negative in all of the regressions, however only individuals with income between RM501 to RM1500 are found to be significantly affecting the demand for intercity rail passenger service.

The variable representing non-vehicle ownership are found to be negative in the regressions but there is no evidence that suggests the variable is significantly

[36] During the train passenger survey, it was found that those who are married would usually travel along with their family members and relatives.

affecting the demand for intercity rail passenger services in Peninsular Malaysia at a level of 5%.

There is evidence that the demand for intercity rail passenger services is significantly responsive to the variable representing official business as a purpose of travel and positive in all regressions compare to variables representing other purposes of travel. Implying that individuals with official business will choose rail over bus. Furthermore, their respective companies usually fund the cost of travel.

One important aspect of the study is that the model that provides the most description for the demand for rail passenger services in Peninsular Malaysia is the fifth binary logit model that encompasses all socioeconomic and demographic variables based on the measurement given by the pseudo R squared.

6.2 Policy Implications

The results suggest that a lot of people in Peninsular Malaysia are not keen to use intercity rail passenger services for intercity travel. There are several ways for KTMB to improve its ridership. That includes improving its quality of service in terms of increasing public safety, train speed, reducing delays and providing better amenities and services.

It is wise for KTMB to review its fare structure because in terms of fares calculated for different modes of public transport in Chapter 3, the fare for intercity bus services is relatively cheaper than intercity rail passenger services. Moreover travelling by bus is relatively faster than the rail passenger services. Intercity rail passenger services lose its competitive edge in the end, which resulted those from lower income groups to choose bus over rail.

The terms of concessions given to special group of individuals should also be reviewed in order to attract more ridership. In the analysis it is found that students are the most unlikely group of individuals to travel by train even though they are given a discount as much as 50% (third/economy class). The same also applies to individuals with ages between 41 and 50 years old. [37]

There is a significant number of individuals who travelled by train because of official business. However, even with the booking and ticket delivery service provided by KTMB, it is not enough to attract this group of individuals. No doubt, their companies usually fund the cost of travel. One positive move by KTMB is to introduce the air-conditioned "Day & Night First Class" coach which is equip with all sorts of amenities including a built in shower room and toilet. More positive initiatives should be taken to attract individuals who travel for other purposes. For example, those travelling for pleasure. And it is critical to do so because one of Malaysia sources of income originates from the tourism sector.

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[37] Keretapi Tanah Melayu Berhad, Train Time Table & Fares (Kuala Lumpur: Aslita Sdn Bhd, 2001)

6.3 Limitation of Study

The empirical results acquired from the demand for intercity rail passenger services are based on primary data collected from train passenger survey and bus passenger survey. The interpretation of the estimates should be taken generally as it may be subjected to error and bias due to the process of data collection.

One of the setbacks of the binary logit model is that it cannot be used to predict individual probabilities of mode choice, only estimates of the odds ratios can be obtained from the cross-sectional study.[38]

Moreover, only socioeconomic and demographic variables were tested in the models. These socioeconomic and demographic variables were later converted into dummy variables. So comparison can only be made within categories in that variable but not between variables of other socioeconomic and demographic characteristics.

The binary logit models in this study use socioeconomic and demographic variables. There are other variables that are considered more important in the evaluation of the demand for intercity rail passenger service such as fares, service levels, journey time, frequency of travel and cost of operation of rail services and competing modes. In order to acquire a better prediction on mode choice, these variables should be included into the model.

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[38] David G.Kleinbaum,Logistic Regression : A Self Learning Text (New York :Springer-Verlag , 1994) 12

The results acquired from the binary logit models in Chapter 5, only compare the choice of mode between intercity rail passenger services and bus services. Additional binary logit models are required to compare intercity rail passenger service with other competing modes such as air services and private motorcars in order to gain the overall picture of the passenger transport industry in Peninsular Malaysia.