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Open Access Article

Travel and Individual Factors in Determining the Risk of Becoming a Crime Victim while Commuting in the Jabodetabek Metropolitan Area

Chotib[1]*, Mihoko Matsuyuki[2], Beti Nurbaiti[3], Mohamad Axel Putra Hadiningrat[4]

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Abstract: Crime can occur anytime and anywhere, including on the way from the place of residence to the location of work, and vice versa. Approximately 75% of commuters in the Jabodetabek Metropolitan Area are private vehicle users, and 25% of commuters use public transportation modes. Regardless of the transportation mode used in their journeys, the probability of being a crime victim is unavoidable. Travel time is an important factor in determining the probability of becoming a crime victim. This study aims to analyze 1) the probability of becoming a crime victim while commuting in the Jabodetabek Metropolitan Area; 2) the impact of travel factors on the probability of becoming a crime victim while commuting in the Jabodetabek Metropolitan Area; and 3) the impact of individual factors on the probability of becoming a crime victim while commuting in the Jabodetabek Metropolitan Area. The novelty of this study is that the research is unobstructive as it analyzed existing data about the risk of a commuter becoming a crime victim. The existing statistical data used in this study are from Commuter Surveys in the Jabodetabek Metropolitan Areas 2019 microdata. This survey was conducted by the Central Bureau of Statistics in 2019 and is an important source of information for determining policies regarding commuting behavior and patterns in the Jabodetabek Metropolitan Area. Data exploration was based on commuters' criminal experiences and their relation to travel time. This study also applies an alternative model in which other variables such as individual factors (gender, age, marital status, education, employment status) and travel factors (mode of transportation, distance travel, time of departure, time of arrival at home. Descriptive statistics analyze the data by using cross tabulation between the dependent variable (probability of being a crime victim) and each independent variable. The inferential analysis in this study uses logistic regression analysis by applying some alternative developed models.

Keywords: unobstructive research, travel time, logistic regression.

决定贾博德塔贝克大都市区通勤期间成为犯罪受害者风险的出行因素和个人因素

摘要：犯罪可以随时随地发生，包括从居住地到工作地点的途中，反之亦然。贾博德塔别克大都市区约75%的通勤者是私家车用户，25%的通勤者使用公共交通方式。无论他们在旅途中使用何种交通工具，成为犯罪受害者的可能性都是不可避免的。旅行时间是决定成为犯罪受害者的可能性的重要因素。本研究旨在分析1)在贾博德塔别克大都市区通勤时成为犯

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1 Urban Studies, School of Strategics and Global Studies Universitas Indonesia, Indonesia,
2 Yokohama National University, Japan,
3 Universitas Bhayangkara Jakarta Raya, Indonesia,
4 School of Strategics and Global Studies Universitas Indonesia, Indonesia,

We are pleased to inform you that your manuscript **« Travel Factors and Individual Factors in Determining of the Risk of Becoming a Crime Victim during Commuting in the Jabodetabek Metropolitan Area »** has been accepted for publication in the scientific Journal of Hunan University Natural Sciences, Volume 51, Issue 2, February 2024. The issue will be published at the end of March 2024.

We thank you for your contribution and support!
We look forward to working with you in preparing the articlefor publication.

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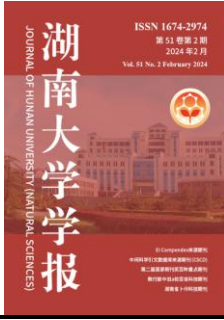Once the Payment is done, share us the receipt of the payment through Email

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Travel and Individual Factors in Determining the Risk of Becoming a Crime Victim while Commuting in the Jabodetabek Metropolitan Area

Chotib[1]*, Mihoko Matsuyuki[2], Beti Nurbaiti[3], Mohamad Axel Putra Hadiningrat[4]

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决定贾博德塔贝克大都市区通勤期间成为犯罪受害者风险的出行因素和个人因素

摘要： 犯罪可以随时随地发生，包括从居住地到工作地点的途中，反之亦然。贾博德塔别克大都市区约75%的通勤者是私家车用户，25%的通勤者使用公共交通方式。无论他们在旅途中使用何种交通工具，成为犯罪受害者的可能性都是不可避免的。旅行时间是决定成为犯罪受害者的可能性的重要因素。本研究旨在分析1)在贾博德塔别克大都市区通勤时成为犯

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罪受害者的概率；2)出行因素对在贾博德塔别克大都市区通勤时成为犯罪受害者的可能性的影响；3)个人因素对贾博德塔别克大都市区通勤时成为犯罪受害者的可能性的影响。这项研究的新颖之处在于，该研究是无障碍的，因为它分析了有关通勤者成为犯罪受害者的风险的现有数据。本研究使用的现有统计数据来自贾博德塔别克大都市区通勤调查2019年微观数据。这项调查由中央统计局于2019年进行，是确定贾博德塔别克大都市区通勤行为和模式政策的重要信息来源。数据探索基于通勤者的犯罪经历及其与出行时间的关系。本研究还应用了另一种模型，其中其他变量如个人因素（性别、年龄、婚姻状况、教育、就业状况）和旅行因素（交通方式、旅行距离、出发时间、到达家时间）。统计学通过因变量（成为犯罪受害者的概率）和每个自变量之间的交叉表来分析数据。本研究中的推论分析通过应用一些替代开发模型来使用逻辑回归分析。

关键词：无阻碍研究、旅行时间、逻辑回归.

1. Introduction

The development of urban areas over the last decade has been expanding to the suburban areas and creating sprawls. According to UNDESA, 23% of the world population lived in cities in 2018 and is projected to increase in 2030 [1]. Preventing the use of private vehicles and committing to sustainability, many cities have developed public transportation to provide accessibility for commuting to work. According to [2], the existence of public transportation provides ecological benefits by reducing emissions and air pollution and economic benefits through decreasing the cost of commuting. Public transportation also has health benefits, including increased physical activity by walking to transit stations [3]. Public transportation also plays a fundamental role in economic development by maximizing the productivity of people from different places [4]-[5].

DKI Jakarta is one of the high-density provinces in Indonesia that happens to have an impact on its suburban areas known as the Jabodetabek Metropolitan Area. The Jabodetabek Metropolitan Area is a high-density region consisting of three provinces and several cities and regencies such as DKI Jakarta, West Java Province (Bogor City, Bogor Regency, Depok City, Bekasi City, and Bekasi Regency), and Banten Province (Tangerang City, Tangerang Regency, and South Tangerang City). The Jabodetabek Metropolitan region is becoming a center of national economic activities, characterized by high population density and intense spatial interaction with other regions [6].

As the center of economic activities, the Jabodetabek Metropolitan Area has around 75% of commuters with private vehicle users, and 25% of commuters use public transportation. Regardless of the transportation mode used in their journeys, the probability of being a crime victim is unavoidable.

Commuting to work could lead to the right targets and greater contact with potential offenders; thus, differences in commute rates between cities may explain part of the variability in crime rates [7]. The effect of crime that happens in public spaces can give individuals a feeling of insecurity that leads them to avoid certain places during day or night time [8].

Although the safety of public transportation is important, there is no availability of crime data related to public transportation in Jabodetabek. This study analyzes the effect of travel time factor on the probability of becoming a crime victim while traveling in commuting within the Jabodetabek Metropolitan Areas by exploring commuter survey in Jabodetabek 2019 microdata. This study also analyses the role of other factors in determining the probability of becoming a crime victim, such as individual factors (gender, age, marital status, education, employment status), and travel factors (mode of transportation, distance travel, time of departure, time of arrival at home.

2. Literature Review

Crime is an action that occurs because of the overlapping activity between the offenders and the victims. According to [9], this theory is called routine activity theory, where both potential offenders and victims are in the same place and form the basic skeleton of an individual's daily activity. Crime is likely to be concentrated where the offender's areas of routine activity intersect with the appropriate crime targets [10].

The presence of urban public transportation has many positive impacts on people. Public transportation plays an important role in reducing social exclusion by providing access to facilities such as workplaces, health, recreation, and employment [10]. However, the

transportation infrastructure of cities allows criminals to easily reach places where crime is high [11]. According to a study in Cleveland, the crime rate increased by 2.8% in public transit neighborhoods compared to everywhere without a public transit system [12]. The theory between crime and public transportation has been tested in the geographic model [9], which states that crime hotspots in public areas are caused by the overlapping activities of vulnerable targets and motivated offenders with a lack of place guardianship. However, this model does not include specific age and gender, only spatial crime records, and the absence of security and neighborhood activities.

Potential crimes related to public transportation include infrastructure violations, violent crimes (knife attacks, terrorism, theft), vandalism, and even infections and viruses [13]. According to [10], the types of crime that are mainly identified in public transportation networks are theft, robbery, assault, and line-of-route crimes, which are offenses along routes that cause delays or affect safety. The occurrence of public transportation crime can occur anywhere. As found in [14], the hot spot crime activity in New York is located near subway stations and schools around 3 pm and around 12 am, mostly on weekends. A study in New Jersey found that crime happens in both daytime and nighttime, and the distance of commuting has a significant correlation with the experience of crime in commuters [15]. In the meantime, according to a study in El Salvador, the most vulnerable location is inside the busses, and most crime reports describe property crime, particularly theft and robbery [16]. Another study found that mass public transportation such as bus and subway are most likely to have a higher crime rate than taxi or uber [17]-[18].

According to [19], gender, age, disability, income, ridership frequency, and years of ridership are correlated with crime in Chicago public transportation. The study found that gender had no significant correlation with the experience of crime in public transportation. This means that both men and women are vulnerable to crime encounters in public transportation. Insignificance was also found in age and ridership frequency. Those mean that anyone, whether young or old, can be the victim of public crime. Moreover, no matter familiar or not the commuters with the environment by frequently using public transportation, they can still experience crime. However, income has a significant effect on crime, where people with low income experienced more crime than people with higher income. As stated in [19], this happened because people with low incomes tend to live and commute to and from high-crime neighborhoods, and the crime happened in unsupervised streets.

Focusing on gender studies, it was also explained that women are more vulnerable than men in terms of public crime [20]. The study found that 69.7% of women have encountered public crime. Most of the

crime occurred in urban spaces such as isolated streets, subways, subway stations, and other public transits with percentages of 88, 85.6, and 57.6, respectively. Testing the variables including age, level of education, jobs, incomes, and marital status, the study found that the variables have no significance with crime experiences. The most the most frequent crime is verbal abuse in urban spaces, with 63.4%. Victims of public transportation crime choose to avoid traveling alone [20].

3. Methods

As an unobstructive research, where the research does not interfere with and interact with respondents, this study uses the Commuter Survey in Jabodetabek 2019 microdata (raw data), which was conducted by the Central Bureau of Statistics, Republic of Indonesia. This survey covers 12,960 sample households obtained from 1,296 census blocks (CB). The sample area includes 13 regencies/cities in the Jabodetabek Metropolitan Area, namely Central Jakarta City, West Jakarta City, South Jakarta City, East Jakarta City, North Jakarta City, Bogor Regency, Bogor City, Depok City, Tangerang Regency, Tangerang City, South Tangerang City, Bekasi Regency, and Bekasi City [21].

The microdata include 155 variables that cover information on location information (block I), household member information (block IV), household information (block V), general information on commuters (block VI), specific information on working commuters (block VII), specific information for school commuters (block VIII), and specific information for course commuters (block IX) [21]. The variables used in this study are more related to the questions in Blocks VI and IV, as presented in Table 1.

Table 1 Operational definition of variables used in this study (Data analysis by the authors)

No.	Name of Variable	Operational Definition	Category Conversion	Question Number
1.	crime_exp (Crime Experience)	have had the experience of a crime on the way while being a commuter	7 = yes, recoded to '1' 8 = no, recoded to '0'	628d
2.	dep_dur (duration of commute time at departure)	Duration of commute time at departure	Numerical type of data in minute	612b1
3.	ar_dur (duration of commute time at arrival)	Duration of commute time at arrival	Numerical type of data in minute	612b2
4.	dep_time	Time departure from place of residence to place of activities	1. rush hour, if 05.00 – 09.00 AM 0. non rush hour, if others	612a
5.	ar_tistme	Time arrival at place of residence	1. rush hour, if 17.00 – 20.00 PM 0, non rush hour, if others	612c
6.	distance	Travel distance between place of residence and place of activities	Numerical type of data in km	611
7.	tr_mode	the main mode of transportation commonly used at departure time	1. motorbike ojek/online ojek 2. online rental car/taxi 3. Pick up vehicle 4. city transportation/public bus/transjakarta 5. train/comline 6. others	615b
8.	Age_gr	Last birthday at the time of enumeration	4. Baby Boomers (56-74 yrs)+tradisionalis (>=75) 3. Gen. X (40 -55 yrs) 2. Gen. Y (Millenial; 26-39 yrs) 1. Gen. Z (<=25 thn	601b
9.	sex	Sex of respondents	1= male 0= female	404
10.	mar_stat	Status perkawinan responden	1=married 0=others	406
11.	educ	Highest education completed	1 <= Junior H S 2. Senior H. S 3. Diploma +	409
12	com_act	Main purposes of commuting	1. working, if 609=1 0. school/course, if 609 = 2|3	609

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In accordance with the research objective, which is to analyze the effect of travel time and the effect of other variables on the possible risk of becoming a crime victim for commuters, these variables are arranged in such a way based on the availability of data and the nature of the variables included in the research model. The operational definitions of each of these variables are presented in Table 1.

The first variable as the subject of this study is the experience of being a victim of a crime, taken from questionnaire question number 628d. The next variable is the length of the trip, the time of travel, the distance of the trip, and the distance of the trip from the location of residence to the location of activities. These variables are the main variables that affect the probability of becoming a crime victim. Next are the variables related to individual commuting attributes, namely age group, gender, marital status, education level, and the main activity of commuters.

The analysis used in this study is descriptive and inferential. Descriptive analysis was performed with bivariate cross tabulation between each independent variable, especially the categorical type, with the dependent variable (percentage of crime victims). The inferential analysis used a binary logistic regression model, namely multivariate regression analysis, where the dependent variable consisted of two categories: experiencing a victim of a crime ($Y = 1$), and not experiencing a victim of a crime ($Y = 0$). The general function of the probability of the occurrence of $Y = 1$ is as follows:

$$f(z) = \frac{e^z}{1+e^z} \quad \text{(1)}$$

From Equation (1), the logistic regression model is obtained:

$$\pi(X) = \frac{exp^{(\beta_0+\beta_1 x_1+\cdots+\beta_p x_p)}}{1+exp^{(\beta_0+\beta_1 x_1+\cdots+\beta_p x_p)}} \quad \text{(2)}$$

where $\pi(X)$ - probability of occurrence $Y = 1$, and p - number of predictor variables.

The logistic transformation model from equation (2) takes the form:

$$g(X) = ln\left(\frac{\pi(X)}{1-\pi(X)}\right) = \beta_0 + \beta_1 x_1 + \cdots + \beta_p x_p \quad \text{(3)}$$

Hypothesis tests of the effect of the independent variable (predictor), both globally and partially, on the dependent variable through this binary logistic regression model were performed using SPSS version 25 software.
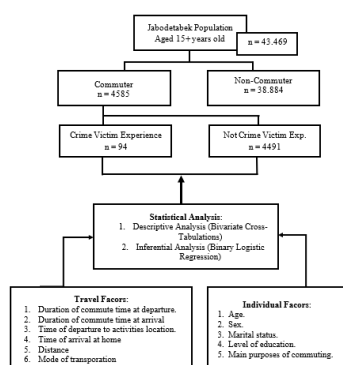

Fig. 1 Analytical framework (Developed by the authors)

4. Results and Discussion

4.1. Descriptive Analysis

According to the results of the analysis, the proportion of crimes experienced by commuters in the Jabodetabek Metropolitan Area generally reaches 2%. If it is analyzed by descriptive statistics through cross tabulation with the independent variables, it can be seen that there are variations in the proportion of crime events. This cross tabulation describes the difference in the proportion of crimes experienced by respondents by category group for each independent variable.

The first independent variable proposed in the research model is the duration of the trip, both the departure trip from the location of residence to the location of activity and the arrival trip return to home.

Table 2 Percentage of commuters who are crime victims by categories of independent variables (Developed by the authors)

Independent Variables	Categories of Variables	Percentage of commuters who experience crime victims		Total Number of Estimated Population	
		No	Yes	Count	%
Time of Depart. to The Location of Activities	Non Rush Hour	96.8%	3.2%	306681	100.0%
	Rush Hour	98.1%	1.9%	2953213	100.0%
Time of Arrival The Location of Residence	Non Rush Hour	98.1%	1.9%	1222722	100.0%
	Rush Hour	97.9%	2.1%	2037172	100.0%
The main mode of transportation commonly used at departure time	Mtr/online ojek	97.7%	2.3%	147462	100.0%
	Taxi, online car	100.0%	0.0%	5175	100.0%
	Pick up/share vehicle	98.1%	1.9%	84043	100.0%
	City/public transp/transjakarta	96.4%	3.6%	330167	100.0%
	Train/comline	95.7%	4.3%	298834	100.0%
	Others	98.5%	1.5%	2394213	100.0%
Age Groups	Gen Z (<= 25)	98.2%	1.8%	1127030	100.0%
	Gen Y (26-39)	98.3%	1.7%	983801	100.0%
	Gen X (40-55)	97.4%	2.6%	990295	100.0%
	Baby Boomers (>=56)	98.0%	2.0%	158768	100.0%
Sex	Female	97.6%	2.4%	1083772	100.0%
	Male	98.2%	1.8%	2176122	100.0%
Marital Status	Others	97.9%	2.1%	1471100	100.0%
	Married	98.1%	1.9%	1788794	100.0%
Level of Education	<= Junior H School	98.7%	1.3%	631591	100.0%
	Senior H School	98.2%	1.8%	1652527	100.0%
	>= D1	97.3%	2.7%	975776	100.0%
The main purposes of commuting	Working	98.0%	2.0%	2625505	100.0%
	Oth.(School/Courses)	97.9%	2.1%	634389	100.0%
Total		**98.0%**	**2.0%**	**3259894**	**100.0%**

Graphs a and b (Figure 2) show the estimated curve of the relationship between the predicted probability of the occurrence of a crime victim, according to the length of the trip at the time of departure and the length of the trip when returning to the place of residence. Both charts show an increasing pattern as the trip duration increases. However, graph 1b shows a quadratic pattern, where the probability decreases when the duration of the trip back home is approximately 150 minutes.
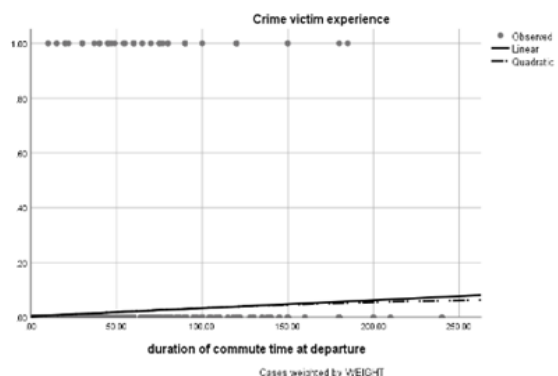
Graph a. Predicted probability of crime victims by duration of commute time at departure
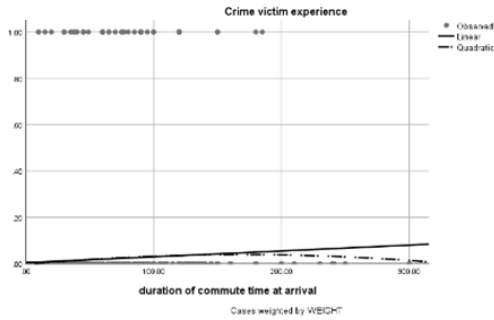
Graph b. Predicted probability of crime victims by duration of commute time at arrival

Fig. 2 Predicted probability of crime victims (Developed by the authors)

Still related to the effect of the travel time factor, the time of departure and the time of arrival also have an effect on the probability of a crime occurrence. It can be seen in Table 2 that there is a difference in the percentage of respondents who experience being a crime victim according to the time of departure. Respondents whose departure time was not during rush hour were seen to be higher, namely 3.2% compared to respondents who departed during rush hour. The definition of rush hour for this departure time has been stated in Table 1 above, which is 05.00–09.00 AM. Only 1.9% of respondents who departed during non-rush hours experienced a crime.

This study also analyzes the time of arrival at home of commuter respondents. The arrival time is also divided into two groups, namely rush hour and non-rush hour, whose operational definition is presented in Table 1 above, which is 17.00–20.00. In contrast to the time of departure, the proportion of commuters who experience crime tends to be higher during rush hour, which is 2.1%. While commuters who arrive at their homes are not in rush hour, the experience of crime victims is only 1.9%.

Figure 3 shows the variation in the percentage of crime victims according to the time of departure and arrival. The highest percentage of crimes occurred in respondents who departed in the early hours of the morning (before rush hour), namely at 4 am (reaching 83%), although a high percentage of crime cases also occurred during rush hour (5.35 hours, which reached 57%). Cases of high crime during rush hour occurred between 5.00 and 6.30 in the morning. The rest are crimes that occur in respondents who depart during non-rush hours, especially in the early morning and late afternoon before rush hour returns (arriving home).
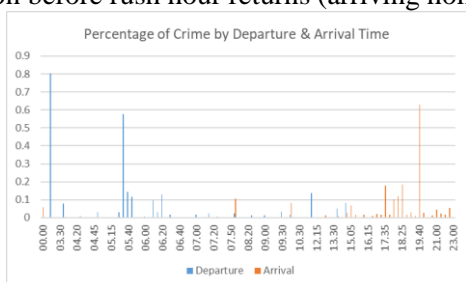

Fig. 3 Percentage of crime victims by departure and arrival time (Developed by the authors)

If Figure 3 is examined closely, the pattern of crime according to time looks like the letter 'U', which is initially high in the early morning and slightly decreases until the start of rush hour departure, and continues to decline until noon. However, in the afternoon, the pattern of crime increased again and continued to increase until rush hour arrived. Therefore, the percentage of crime victims tends to be higher at non-rush hour departure hours (tends to be in the early morning), while at arrival time tends to be higher during rush hour (occurring in the afternoon and evening).

The travel distance variable tends to increase the likelihood of being a victim of a crime. In Graph 2, it can be seen that the prediction of the probability of becoming a victim of a crime increases with the length of the journey (linear curve estimation assumption). If the pattern of crime according to the distance of the trip is estimated by the quadratic pattern assumption, the pattern looks like an inverted U. Initially, there was an increase in the chance of becoming a crime victim in line with the increasing distance traveled, but at a certain point, namely after passing 60 km, the probability of becoming a crime victim again decreased. In the Jabodetabek Metropolitan Area, the long travel distance illustrates the decline in the number of passengers using public transportation modes (especially train/commuter lines mode of transportation).
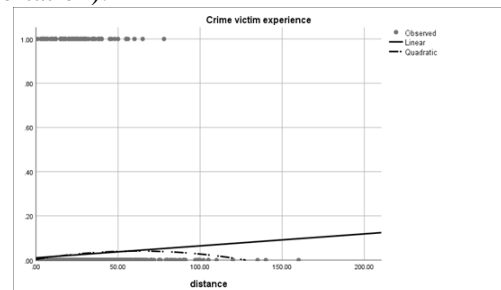

Fig. 4 Predicted probability of crime victims by travel distance (Developed by the authors)

As shown in Table 3, the average travel distance for commuters using public transportation modes is approximately 12-32 km. The statistic of mode (most passengers) for users of public transportation modes is between 10 and 25 km. More than that distance, passengers tend to decrease, so the probability of being a victim of a crime also tends to decrease, as the quadratic curve assumes.

Table 3 Statistics of travel distance by mode of transportation (Developed by the authors)

Mode of Transportation	Travel Distance (in km)							
	Mean	Median	Mode	Std	Min	Max	Count	%
mtr/online ojek	12.05	9	10	9.57	1	45	147462	4.50
taxi, online car	25.95	20	18	14.8	8	50	5175	0.20
pick up/share vehicle	25.45	22	20	17.67	2	90	84043	2.60
city/public transp/transjakarta	20.43	17	20	16.41	1	120	330167	10.10
train/comline	32.45	31	25	13.56	4	100	298834	9.20
Others	18.23	15	15	14.26	0	160	2394213	73.40
Total	19.68	16	20	15.04	0	160	3259894	100.00

The variation in modes of transportation used by commuters has a varied impact on the large proportion of commuters who experience crime. The use of public transportation modes seems to provide a high probability of being a crime victim. The table shows that the use of the train/commuter line transportation mode has the highest proportion, namely 4.3%; followed by the use of public transportation/city transportation/transjakarta, which is 3.6%.

The use of motorcycle taxis or online motorcycle taxis also provides a slightly higher percentage than the average figure of 2.3%. The use of other modes of transportation that tend to be private, such as private cars, two-wheeled vehicles, official vehicles, rickshaws, and bicycles, has a much lower proportion than the average experience of being a crime victim.

Variables attached to individuals also describe the difference in the percentage of commuters who become crime victims. Table 2 demonstrates that the younger generation (both millennial and gen-Z generations) tend to be below 2% to become crime victims. The older generation, especially Gen-X, has the highest proportion in terms of being crime victims, which is 2.6%. Meanwhile, the next older generation (baby boomers) has a proportion of 2.0%, similar to the proportion of crime victims in general.

The individual variable gender also illustrates a fairly significant difference, where female commuters tend to be more crime victims than men. It appears that the proportion of women is 2.4%, slightly higher than the proportion of crime victims in general. Meanwhile, the proportion of male commuters is slightly below the general proportion (2.0%), which is 1.8%.

The marital status of commuters has a slightly different proportion of crime victims. Commuters with 'other' status (such as not married, divorced, widowed) tend to have a higher proportion of crime victims, namely 2.1%, while commuters with married status have a lower proportion, even lower than the general proportion of being crime victims (1.9%).

As in the age group variable, the education level variable also shows a similar pattern, namely an increase in the percentage of crime victims of in line with the increase in education level. Commuters with an education level of diploma 1 and above have the highest percentage of crime victims, which is 2.7%, higher than the general proportion. While education is lower, junior high school and senior high school are 1.3% and 1.8%, respectively (below the general percentage).

There are three main activities of people doing commuting, namely work, school, and courses. Commuters with the main activity of working reached 80.5%, commuting with the main goal of going to school 19.2%, and commuting with the main goal of taking courses only 0.2%. Therefore, the categories of the main purpose of this commuting are simplified into

two categories: work and others (school and courses).

There is almost no difference between these two main categories of commuter activities in terms of the percentage of crime victims. Both groups are in the range of 2% as the general proportion of crime victims. However, commuters who attend school/course are slightly higher (2.1%) than commuters who work (2.0%), as well as slightly higher than the general proportion of crime victims.

4.2. Inferential Analysis

The results of the inferential analysis are generally in line with the results of the descriptive analysis as described above. The explanation of the results of the binary logistic regression analysis is easier to explain using the Odd Ratio (OR) parameter. If OR = 1, then there is no difference in the probability of something happening (Y = 1) in one category of the independent variable compared to the comparison category in the independent variable. Therefore, it can be said that there is no effect of these variables on the probability of occurrence of Y = 1.

If OR > 1, the probability of occurrence of Y = 1 tends to be in a certain category/group compared to the comparison category/group. For example, if OR = 2, the risk of Y = 1 probability tends to occur twice in one group compared to the comparison group. On the other hand, if OR < 1, it means that the probability of Y = 1 tends to occur in the comparison group. For example, if OR = 0.5, the risk of Y = 1 probability in one group is 0.5 times compared to the comparison group, or tends to be 2 times more likely to occur in the comparison group.

Table 4 Parameter estimates (odd ratio) of being a crime victim by independent variables (Developed by the authors)

No.	Independent Variables	Odd Ratio	S.E.	Sign.
1.	Duration of commute time at departure	1.004	0.000	0.000
2.	Duration of commute time at arrival	1.003	0.000	0.000
3.	Time of departure to activities (1)	0.547	0.012	0.000
4.	Time of arrival at home (1)	1.032	0.009	0.000
5.	Distance	1.010	0.000	0.000
6.	tr_mode			0.000
	tr_mode(1)	1.662	0.019	0.000
	tr_mode(2)	0.000	548.163	0.975
	tr_mode(3)	0.973	0.026	0.302
	tr_mode(4)	1.866	0.012	0.000
	tr_mode(5)	1.856	0.012	0.000
7.	age_gr			0.000
	age_gr(1)	1.490	0.015	0.000
	age_gr(2)	2.698	0.016	0.000
	age_gr(3)	2.025	0.023	0.000
8.	sex(1)	0.861	0.009	0.000
9.	mar_stat(1)	0.603	0.011	0.000
10.	Educational Level			0.000
	Educational Level(1)	1.311	0.013	0.000
	Educational Level(2)	1.699	0.014	0.000
11.	Main purposes of	1.875	0.015	0.000

	commuting (1)			
12.	Constant	0.008	0.021	0.000

Table 4 shows the results of the binomial logistic regression analysis, which shows that all variables have a significant effect at α = 1% on the probability of the occurrence of crime victims on commuters. The first and second variables, i.e., the duration of the trip at the time of departure and upon arrival back home, had a significant impact. With OR > 1, as the duration of the trip increases, the risk of becoming a crime victim continues to increase. This agrees with the results of bivariate analysis through linear and quadratic estimation curves, as shown in Graphs a and b above (Figure 2). Under the quadratic assumption, the probability of being a victim of a crime decreases after a journey time of more than 150 minutes.

The third and fourth variables are the time of departure to work and the time of arrival to return home, respectively. Each of these two variables is divided into two parts, namely 'rush hour' and 'non-rush hour' (as a reference category). Both variables have a significant effect at α = 1% on the number of crime victims. In the departure time variable, the value of OR = 0.547, which means that the risk of the occurrence of a crime victim tends to be during non-rush hour, which is about 1.8 times that during rush hour. On the other hand, when traveling back to their place of residence, the risk of becoming a victim of a crime is 1,032 times greater during rush hour than during non-rush hour time.

The fifth variable is the distance between the location of residence and the location of activities, which also has a significant impact at α = 1% of probability of becoming a victim of a crime. As seen from the table, with an increase of 1 km traveled, the risk of becoming a crime victim increases by 1,010 times. However, if the quadratic assumption is used, it turns out that increasing distance does not always increase the risk of becoming a crime victim. From the explanation of the bivariate relationship with quadratic assumptions depicted in Graph 2, it can be seen that at first there was an increase in the risk of becoming a crime victim in line with the increase in travel distance, but after traveling more than 60 km, this risk decreased.

The sixth variable is the mode of transportation used by commuters, which is categorized into 6 groups, namely motorcycle/online ojek (1), taxi/online car (2), pick up/share vehicle (3), city/public transportation/transjakarta (4), train/comline (5), and others (0), as a reference category. Of the five types of transportation modes compared to other modes of transportation, it appears that there are two modes of transportation that are not significant at α = 1% or α = 5%, namely taxi/online car and pick-up/share vehicles. This means that there is no significant difference in the risk of becoming a crime victim if commuters use these two types of transportation over other modes.

Meanwhile, the use of motorcycle/online ojek has a risk of 1.6 times; the use of city/public transportation/transjakarta has a risk of 1.87 times; and the use of the train/commuter line has a 1.86 times risk of becoming a crime victim compared to the use of other modes of transportation.

The seventh variable is the age group, which is categorized into 4 groups, with the Gen-Z age group (the youngest group = 0) as the reference category, followed by the Gen-Y (1), Gen-X (2), and Baby Boomers (3) groups. These three groups had a significant difference at α =1% in terms of the risk of becoming a crime victim. There is a tendency for increasing age to increase the risk of becoming a crime victim, although the Baby Boomers group (OR = 2.0) is slightly lower than the Gen-X group (OR = 2.7). Meanwhile, Gen-Y, which is the closest group to the reference group (Gen-Z), has an OR value of 1.5.

In the sex variable, the reference category is female (sex = 0). This variable also has a significant effect on the risk of becoming a crime victim. The table shows that there is a significance at α = 1% where male commuters have OR = 0.861. This means that men are 0.86 times less likely to become crime victims. In other words, female commuters are 1.16 times more likely to become crime victims than male commuters.

Marital status as the ninth variable consists of two categories, namely married (1) and 'other' category (unmarried, divorce, widow) as the reference category. The difference between the two groups of marital status is also significant in terms of the risk of becoming a crime victim. With an OR value of 0.6, the commuter group with married status is less likely to become a crime victim, whereas other marital status groups have a risk of 1.66 times (almost 2 times) of becoming a crime victim.

The tenth variable is the last education level achieved by commuters, which is categorized into 3 groups, namely junior high school graduates and lower (as ref. cat.), senior high school graduates (1), and diploma 1 graduates and upper (2). The variation in the risk of becoming a crime victim between educational groups was also significant at α = 1%. The table shows that the higher the level of education, the higher the risk of becoming a crime victim. Commuters with a high school senior level of education have a 1.3 times risk, and commuters with a diploma education of 1 and above have a 1.7 times risk of becoming a crime victim.

Finally, the main activity/purpose for commuting consists of 'work' (1); and 'other' (school/course), as a reference category. The two groups of main activity types differed significantly at α = 1% in terms of the risk of becoming a crime victim. Working commuters are 1.88 times more likely than commuters with school/course activities to become crime victims. These results are slightly different from those of the descriptive bivariate cross-tabulation analysis described

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previously.

In the descriptive analysis, it appears that there is almost no difference in the percentage of commuters who become crime victims. This can happen because in the bivariate descriptive analysis, only one independent variable (main purposes of commuting) is involved in explaining variations in the probability of crime. In inferential analysis, this independent variable together with 10 other variables influences variations in the probability/risk of becoming a crime victim.

5. Conclusions/Recommendations

The analysis description above concludes that the probability/risk of becoming a crime victim can be caused by travel factor variables (trip time, trip duration, trip distance, and mode of transportation used); and the variables of the factors attached to the individual commuters (age, sex, marital status, education level, and main activity in commuting).

Travel factors that provide a greater probability/risk of becoming a crime victim are departure travel time in the early hours of the morning, arrival travel time during rush hour, longer travel duration, and the use of public transportation modes, especially train/commuter lines, public transportation, and city/public bus/transjakarta.

Individual factors that provide greater probability/risks to become crime victims are commuters who are Gen-X (40-55 years old), female commuters, unmarried status (including divorced and divorced), highly educated (diploma 1 and upper), and commuters whose main activity is work.

Based on the results of this research, the academic contributions in preventing crime victims experienced by commuters can be described as follows:

It is appropriate for urban managers who are members of the Jabodetabek Metropolitan Area to provide protection for their citizens who make round trips, especially during early morning departure times and during rush hour when returning from work. The placement of security officers on patrol in public transportation (busses, transjakarta, commuter lines) and on roads is also important to prevent crime.

Commuters who are Gen-X age, female, unmarried, highly educated, and active at work should dress appropriately when commuting from home to place of work (or vice versa). Commuters should try not to leave in the early hours of the morning, if necessary. Someone should accompany them, and try not to carry valuables that can invite criminals to commit their crimes.

It is also hope that the results of this research may provide to the body of literature in preventing crime victims for commuters based on the characteristics of travel and individual factors.

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