The Commuting Behavior and Perception Correlates of Commuting Trips: A Comparative Study on the Egyptian and Migrant Populations in Cairo and Alexandria

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ABSTRACT

Recent political conflicts in the Middle East have led to a significant increase in refugees' numbers in Egypt, causing a substantial population increase in neighborhoods like Al-Rehab City and the 6th of October. The resulting semi-hybrid communities have had a notable impact on travel behavior in these areas. Due to the economic impact that is affected by this travel behavior, this study aims to investigate the commuting behaviors and preferences of individuals in Cairo and Alexandria, focusing on demographic groups such as Egyptians and migrants. The research addresses two main questions: (1) What significant variations exist in commuting characteristics between Egyptians and migrants based on their social and cultural backgrounds, and what variables influence the travel behavior of these two groups? (2) What factors relate to public transport use, that map all aspects of work/home trip choices that affect the daily commuting distances? Initially, to find the significant differences between both test groups, a questionnaire was designed and distributed through a sample of 1,810 face-to-face interviews (1,193 in Cairo and 617 in Alexandria). The questionnaire comprised 39 questions, these questions are covered in six sections that cover the following aspects: sociodemographic and household profiles, mobility habits, commuting habits and preferences, perceptions of public transportation, ridesharing, and housing. In the data analysis stage, a non-parametric statistical test "The Mann–Whitney U test" is used to determine if there is a difference between both groups according to certain variables. To examine the relationship between subjective public transport utilization and commuting trip generation, a multivariate Ordinary Least Squares (OLS) model was applied. The model application provides valuable insights for the formulation of impactful urban and mobility systems. Drawing a road map to help policymakers in enhancing public transport infrastructure to better match the preferences of commuters, ultimately fostering safer and more gratifying travel experiences.

Index-words: Urban Transportation Planning, Travel Behavior, Commuting, Land Use Planning, Migrants, Egypt.

I. INTRODUCTION

Traffic congestion is considered a major concern in urban areas, as it negatively affects the quality of life of the citizens. As the main approach worldwide is directed to utilize public transportation and group mobility to maintain a better sustainable environment, the private car remains the predominant mode of transportation.

After the political changes occurred in the MENA region due to wars and forced refugees that fled to the neighboring countries, such as Syrians and Sudanese, an urgent need evolved concerning

the transportation decisions for a new population configuration. In Egypt, the presence of refugees is welcome to merge with the rest of the Egyptians freely; they are not restricted to a certain geographical location, neither gated communities nor ghettos. However, their presence with their distinct political status, social background, and economic conditions affected their travel decisions and their travel behavior.

With the new population structure, attention should be given to new users' requirements that evolves due to the new variation.

This research compares the Egyptian and migrants/refugee populations in their commuting behavior according to their perception of their physical environment. After interviewing the head of the transportation authority in Alexandria and after referring to the reports published by Transportation for Cairo in 2021 [1] for 6th of October studies done in the neighborhoods with most immigrants occupied, it was found that the public transportation dependency increased due to the accumulation of the immigrants' settlements in the mentioned areas since 2011 [2]. However, the pattern of use and the chosen mode of transportation/mobility needed more investigation to spot the change due to the user/demographic alteration according to the additions that took place in the sample population, which will help readjust the decisions concerning the transport/mobility in the study area.

In historic urban fabrics that are still standing today, the urban districts have been growing without control to meet the needs of the contemporary lifestyle leading to the formation of streets that were only meant for pedestrians and primitive transportation. Therefore, the connection between such areas and public transportation is weak and not easily accessible, and these areas suffer from major traffic problems due to the rapid motorization increase. In such cases, re-planning the streetscape and road rearranging is a must to further develop the accessibility to public transit [3].

In developed countries, some factors influence the generation of commuting trips. Firstly, the proximity and accessibility of workplaces play a role. When workplaces are together in connected urban areas, people tend to choose sustainable modes of transportation like walking, cycling, or public transportation instead of relying on long car commutes. Secondly, the way cities plan their

infrastructure and design their spaces has an impact on commuting patterns. Cities that have public transport systems and pedestrian-friendly layouts encourage people to make eco choices and reduce their reliance on cars by opting for greener travel options. A case study conducted on a sector of commuters from Palestine [4] proved that the lack of awareness toward the negative impacts of single-occupancy vehicles and fuel compassion for the environment on the other hand there is a strong support from the commuters toward the developing strategies for sustainable transportation system.

According to a case study-based research about urban sprawl and travel patterns in Iran, the increase in age and the number of driving licenses in households and the use of motorized means in commuting and non-commuting travel all are correlated with the increased probability of urban sprawl in Hamedan. This shows that people on sprawled areas would pick private cars over public transit, unlike people in compacted areas. The results in Nowshahr are like those of Hamedan, linking urban sprawl with an increase in the number of cars in households and the dependency on them over public transit [5].

Economic factors also play a role. When people have high incomes, they can afford the luxury of living near their workplaces. This reduces the need for commutes. It gives them easy access to employment places [6]. Additionally, with increasing awareness, there is a growing preference for eco-commuting options such as electric vehicles and well-established public transportation networks. Commuter's choices for a transport mode are not only affected by objective factors like cost and time but also affected by subjective feelings of safety, comfort, flexibility, and convenience of different modes. When it is not hard to change the policies related to transport time and cost, it is easier to adjust some subjective feelings. [7]

Changes in culture, perceptions, and technology all contribute to how commuting has evolved. As cultural norms continue to emphasize the importance of maintaining a work-life balance and being environmentally conscious, one's attitudes towards commuting are shifting. This in turn affects the mode of transportation he/she chooses [8]. Furthermore, having a view of the safety, convenience, and affordability of transportation is also influential in encouraging people to use it instead of their private vehicles. According to a study done at the Imperial College London, using data

from 28 world cities, about the gender differences in the perception of safety using public transportation, women are 10% more likely to feel unsafe in metros, and only 45% of women feel secure in metro stations and 55% in buses. These are averages of respondents from 28 cities, and they may differ in different contexts influenced by religion, cultural ideologies, habits, etc. of a specific city [9].

According to research by Maye Ehab, women in Egypt are suffering from a gender gap as they do not have the geographical mobility of men. However, there are other factors affecting women's commuting in Egypt, for example, women with more responsibilities have longer commutes than those who have fewer responsibilities, also married women have shorter commutes than single women [10].

Moreover, advancements in technology have introduced options, like ride-sharing services and electric scooters that provide alternatives and may reduce the frequency of driving alone [11], which already have been applied in rideshare applications like "Uber and Didi" in Egypt where they added the option of electric scooters in their ride-sharing trip options.

In a country such as India (developing country), various factors contribute to the number of trips people make for commuting. These factors include conditions, the availability of infrastructure, and urban planning. When cities experience growth and development (urban sprawl) it often leads to commutes due to increased distances between residential areas and workplaces. Insufficient public transportation options and heavy traffic congestion can also lead individuals to rely on vehicles for their commuting [12].

The Middle East is generally rated fifth out of eight regions of the whole world for transportation. However, it is rated last for environmental indicators and second-last for social indicators. The poor environmental rates are due to the high rating of pollutants and the highest land area used for transit (20%). Also, the Middle East has the second least affordable systems. The lack of consistent data also helps limit studies of sustainable mobility, and that must be improved for future developments in the area [13].

In Egypt, where the infrastructure and living conditions are still developing, several factors play a

role in shaping how people commute. The expansion of areas and the population density often result in distances between residential areas and workplaces. Limited public transportation options and traffic congestion contribute to relying on vehicles or informal modes of transport, which in turn affects commuting patterns. Additionally, unfortunate economic limitations and the lack of housing near workplaces make individuals want to seek accommodation in far areas resulting in longer travel times. Moreover, in today's challenging climate, the high occurrence of a weak economy results in bad working schedules and the need for individuals to have multiple jobs. Therefore, commuting patterns become complex and diverse. [14].

The transportation infrastructure of both cities goes back to decades and even centuries, making a very complicated network of transportation, for example, the first railroads in Africa and the Middle East, and the second in the whole world after England [15]. The infrastructure of transportation, of course, goes way beyond that, especially with the latest projects focusing mainly on mobility and, supposedly, improving road conditions. All to match and satisfy the needs of the population that are formed under the influence of culture-induced behavior, leading to longer commuting time because of the culture's role in choosing a house location in Egypt.

The commuting trips in the collected data were based on the essential daily trips, which are mostly homework. Residential self-selection is the freedom of the user to choose their housing unit [16]. Extensive literature addresses the issue of residential self-selection yet the knowledge concerning residential self-selection based on population typology and the effect on their travel behavior is far from complete [17] update earlier work, include additional outcome measures, and address the methodological issue of self-selection. Methods: We computed elasticities for individual studies and pooled them to produce weighted averages. Results and conclusions: Travel variables are generally inelastic with respect to change in measures of the built environment. Of the environmental variables considered here, none has a weighted average travel elasticity of absolute magnitude greater than 0.39, and most are much less. Still, the combined effect of several such variables on travel could be quite large. Consistent with prior work, we find that vehicle miles traveled (VMT. In Egypt, the housing system is largely market-oriented. In market-oriented housing, many factors such as a lack of affordability limited

housing options, and low accessibility, may prevent households from choosing a convenient distance between home and work and affect their travel preferences [18], [19]. It is important here to refer to the term 'spatial mismatch' that was proposed by [20], which addressed low-income households and their distant segregation from suitable job opportunities. In this aspect, he addressed black Americans as a disadvantaged minority.

As public transportation is inevitably not as accessible as the door-to-door options, it still needs improvements to be more accessible. Additionally, it is significant to encourage people to use sustainable public transportation through better service quality and safety perception as they crucially affect the perceived accessibility and ease of use leading to the connection between using the public (sustainable) transport system and achieving the comfort and ease of living desired by the users [21].

Since Kain (1968) [20], proposed the concept of "spatial mismatch", many studies have been conducted to measure the degree of spatial mismatch and its impact on employment outcomes. However, a gap is found regarding the effect of the mismatch concept on the refugees/migrants' settlements and the effect on their travel behavior [22].

This research suggests that spatial mismatch is related to residential self-selection on the one hand and commuting behavior due to users' perception on the other hand. In this regard, in the past few decades, Greater Cairo and Alexandria have experienced rapid urbanization and socio-spatial transformation. Many new settlements have been moved out to the suburbs and new gated communities emerged [23]. However, Alexandria did not go through the vast urban sprawl that Cairo faced. There are differences between both cities in terms of residential densities and distributions. Both cities had most of the immigrants/refugees choosing the suburbs and perimeter because they could not afford the high housing prices in inner cities which provide a spatial mismatch status [24]. A knowledge gap that this study covers is that data-driven travel behavior about land use as well as individuals' needs and perceptions have not been addressed in the countries in the Middle East and North Africa (MENA) region. Thus, this study is built on this gap by addressing the issue and using disaggregate, primary data collected in two large cities in Egypt, namely Cairo and Alexandria.

This paper adapts a methodology commonly used in travel behavior research. The research discusses the determination of the individual and alternative-specific variables that affect commuter's choice of a specific transportation mode. In the following sections, this paper will report on first, the reasons that control a commuter's decision to make a trip and the choice of a transport mode. Second, the strategies used to elicit the variables considered in the survey. Third, explain the methodology used to analyze the data. Fourth, finding the significant differences between the commuting characteristics of Egyptians and migrants. Finally, representing the limitations of the research and recommendations for future research.

This paper aims to give a thorough insight into transportation in Egypt in a comparative study between Egyptians and migrants, particularly in Cairo and Alexandria, to provide usable data and outcomes that help in getting closer to achieving the ultimate goal - Sustainable Urban Mobility. Also, helping the business sector associated with transportation with an insight of the market that could open the field for new opportunities or investments that would change the way transportation is used and perceived from the local point of view.

All are discussed in this paper in the following sections, respectively. The first section, Methodology, discusses the research questions and hypotheses, explains the choice of these two cities (Cairo and Alexandria) specifically, introduces their transportation infrastructure and travel behavior, discusses data collection, sample size and representativeness of the data, and discusses the analysis methods by which the data are to be put into results and be usable. The second section, Findings, includes commuting characteristics of Egyptians and migrants and shows how subjective public transport use correlates with commuting trip generation. The third section, Discussion, explains the difficulties of collecting data in both cities, and the variables that were not included in the data collection but could have been used in this research or for future research. The fourth section, Conclusion, includes a summary of the whole paper, the findings, and recommendations for planning and future research. The fifth and final section, References, is where all the sources used in the paper are stated in detail according to their mention in the paper.

II.   METHODOLOGY

A.   Research Questions and Hypotheses

This study is based on two research questions (RQ): (1) Are there significant differences between the commuting characteristics of Egyptians and migrants? (2) What are the subjective public transport use correlates with commuting trip generation among Egyptians and migrants? In this study, it is hypothesized that there are significant differences between the commuting behavior and the related perceptions of Egyptians and migrant populations of Cairo and Alexandria. This might be true about the way these two sociodemographic groups use public transportation and perceive it.

B.   Case Study

Cairo and Alexandria – the targeted cities of the research – are chosen to depend on and to be guided by several specific contextual factors, one of which is the diversity of their residents (ethnicity, religion, gender, etc.), so that a generic picture can be concluded with great accuracy. Another factor is the population in both cities (9.54 million in the capital Cairo in 2017, and 5.6 million in Alexandria) [25], making them a strong base to form a general and well-diversified sample to obtain maximum accuracy for the study. Also, these two cities are the ones with the most complicated network of transportation either with the formal means of transportation (buses, trams, railroads, etc.) and especially Cairo where two of the most complicated, expensive, important, and biggest transportation projects take place, which is the metro and the monorail, making the city well worth the study to draw upon and become a great source of the required data for the study. Another reason encompasses cultural attributes, geographical considerations, societal attitudes, land use patterns, and migration influx, where both cities resemble the main destination for the influx of migrants. These distinct qualities of both cities serve as a valuable case study for examining the factors that influence commuting patterns among Egyptians and migrants. By investigating the distinct qualities of these two groups, one can gain a deeper understanding of how various factors contribute to differences in the commuting behavior for both groups selected for this study.

1.   Data and Variables

The dataset collected in this research was obtained from a mobility survey conducted within two prominent cities in Egypt: Cairo, and Alexandria. The time interval for data collection for the Cairo case study spanned over three months, from November 2022 to January 2023. The data for the city of Alexandria was collected during an interval of six months, which is from November 2022 to May 2023. The neighborhoods selected in Cairo and Alexandria for this study encompass three main criteria: (1) one near the city center, which is compact or located near the historical core, (2) a semi-grid iron street network, (3) and near the city boundaries with lower densities that incorporates grid-iron planning which is prepared for car use.

The criteria adopted in this study include selecting those neighborhoods which have a high concentration of migrants/refugees. For instance, in Cairo, the following neighborhoods were selected: 6th of October (Giza Governorate), El Rehab City (New Cairo), and Hadayek El Qoba (Cairo). According to Kabbani (2018), [26] those neighborhoods have a high concentration of refugees. While neighborhoods selected for Alexandria are also neighborhoods of high concentration of migrants/refugees. Selected study neighborhoods within Alexandria, namely Fouad Street in the historic downtown area, and Abu Keir, characterized as a moderately populated urban neighborhood with a middle-class demographic.

The survey results are obtained from 1,810 face-to-face interviews, 1532 Egyptian and 287 migrants. 1,193 questionnaire interviews were conducted in Cairo and 617 in Alexandria. The survey distribution process covered a wide range of various group characteristics. The surveys answered by Egyptian and emigrant respondents varied between males and females from different age groups. Although the data showed the employment state of the respondents whether they were employed, non-employed, or self-employed, the dataset had a homogeneous group of different education qualifications, high school students, undergraduate students, master's students, and Ph.D. students.

The margin of error of sample size collected for Cairo and Alexandria are 2.84% and 3.95%, respectively, according to the overall population in 2022 and the adult population of both governorates. The overall population of Cairo and Alexandria Governorates are 10,100,166, and 5,469,480, respectively [27]. The adult population is 4,720,227 in Cairo, and 2,452,602 in Alexandria according to the 2017 census [27].

The data collected were based on a questionnaire which comprised 39 questions. These questions are covered in six sections that cover the following aspects: Sociodemographic and household profiles, mobility habits, commuting habits and preferences, perceptions of public transportation and ridesharing, and housing. Some of the questions employed in this study are: How many commute trips did you have during the past seven days? How much time do you typically spend commuting on a weekday? How long is an ideal commuting time for you per day? And how long is the maximum time are you willing to commute per day? The responses to the previously mentioned questions were in minutes. In addition to questions related to commuters' satisfaction and perception, for instance: If you commute, how satisfied are you with your commuting? And questions on perception towards public transport which measure perceived level of security. Questions on satisfaction and perception were answered using a numerical scale from 0 to 100, in which "0" is the worst, and "100" is the best.

The overall variables generated from this questionnaire are 39 variables, of which nine questions were on commuting determinants, and nine questions on perception of security. The data exploration phase initiated with the trip generation variable along with the other 12 variables. Six variables were eliminated during an iteration process in which the other six variables were considered for this study, which will be further elaborated in the analysis section.

The variables were quantified according to the methods elaborated in Table I. In the sociodemographic sections, which are composed of questions on age, gender, employment, and nationality, the nationality variable is quantified in this study as "0" for Egyptians, and "1" for migrants.

A continuous rating scale is adopted in this study, where the respondent chooses a number from 0-100 for the nine questions on the perception of security. This scale represents the level of satisfaction of the respondent, where "0" represents the lowest satisfaction level, and "100" represents the highest satisfaction level. The range utilized in this study allows respondents to make more precise decision-making. Also, it enhances the level of reliability of the adopted method [28]. Moreover, it contributes to the possibility of obtaining normally distributed data, which allows for the application of a wide range of statistical processes (i.e., Regression, t-test, ANOVA, …etc.) [29]. Specifically, it is suitable for performing statistical analysis that requires parametric data, or when sufficient variance in data is required [30]. The range adopted in this study is nlike the 5-point Likert scale which may result in little variance in data and hence may limit the potential range of statistical procedures [30]. Unlike the 5-point Likert scale which usually generates ordinal data and limits the range of statistical analyses and procedures that could be utilized [28], [30]. The descriptive statistics of the continuous variables in the study are illustrated in Table II. whereas the values of N., Mean, Std. Deviation, Minimum, and Maximum are presented.

TABLE I
STUDY VARIABLES, UNITES, TYPES, AND QUANTIFICATION METHOD*S*

Variable	Type of variable	Quantification Method
Trip generation for commuting purposes (dependent variable to be investigated)	Continuous	The reported number of trips by the respondent during the seven days before the survey collection date.
Age	Continuous	The reported age of the respondent.
Household car ownership	Continuous	The reported number of cars owned by the household members.
Household size	Continuous	The number of household members reported by the respondent.
Time for the commuting trip on weekdays	Continuous	The reported typical number of minutes of commute time spent by the respondent during weekdays.
Ideal time for the commuting trip per day	Continuous	The reported number of minutes of the ideal commuting time according to the respondent.
Satisfaction of commuting	Continuous	The reported number is based on a numerical scale of satisfaction from 0 to 100. In which 0 is the lowest level of satisfaction, and 100 is the highest level.

Willingness to spend time commuting (max.)	Continuous	The reported number of minutes that the respondent is willing to spend on daily commutes.
Commuting expenses per month (EGP)	Continuous	The reported expenses number of Egyptian pounds on commuting per month.
Evaluation of the quality of buses and minibuses	Continuous	The reported evaluation using a scale from 0 to 100. Where 0 is the worst quality, and 100 is the best quality.
Perceived security when using public transportation	Continuous	The reported perception using a scale from 0 to 100.
Perceived security when uniformed guards or security forces are near the PT station/stop	Continuous	The reported perception using a scale from 0 to 100.
Perceived security when the stations/stops are well-lit	Continuous	The reported perception using a scale from 0 to 100.

TABLE II
THE DESCRIPTIVE STATISTICS OF THE CONTINUOUS VARIABLES IN THE STUDY

Variable	N	Mean	Std. Deviation	Minimum	Maximum
Trip generation for commuting purposes during the past seven days	1548.00	6.33	4.25	0.00	28.00
Commuting trip time on weekdays	1481.00	46.91	53.01	0.00	400.00
Ideal commuting trip time per day	1449.00	32.32	38.80	0.00	400.00
Satisfaction of commuting	1544.00	60.26	29.71	0.00	100.00
Willingness to spend time commuting (max.)	1521.00	53.12	48.71	0.00	400.00
Commuting expenses per month	1528.00	1126.56	1209.42	0.00	20000.00
Nationality-Binary	1810.00	0.15	0.36	0.00	1.00
Age	1409.00	27.51	9.73	13.00	78.00
Household car ownership	1409.00	1.52	1.28	0.00	8.00
Household size	1409.00	4.29	1.59	0.00	14.00
Evaluation of the quality of buses and minibuses	1409.00	43.69	28.39	0.00	100.00
Perceived security when using public transportation	1409.00	53.12	34.08	0.00	100.00
Perceived security when uniformed guards or security forces are near the PT station/stop	1409.00	67.35	33.23	0.00	100.00
Perceived security when the stations/stops are well-lit	1409.00	69.58	32.52	0.00	100.00

TABLE III
THE RESULTS OF KOLMOGOROVE-SMIRNOV AND SHARIPO-WILK TESTS OF NORMALITY

Variable	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	P	Statistic	df	P
Trip generation for commuting purposes during the past seven days	0.207	1331	<0.001	0.878	1331	<0.001
Commuting trip time on weekdays	0.217	1331	<0.001	0.685	1331	<0.001
Ideal commuting trip time per day	0.248	1331	<0.001	0.623	1331	<0.001
Satisfaction of commuting	0.157	1331	<0.001	0.925	1331	<0.001
Willingness to spend time commuting (max.)	0.219	1331	<0.001	0.793	1331	<0.001
Commuting expenses per month	0.170	1331	<0.001	0.713	1331	<0.001

a.　Analysis Methods:　To solve the first research question, about finding the significant differences between the commuting characteristics of Egyptians and migrants, a nonparametric method (Mann–Whitney U) was employed since the results of the normality tests (Shapiro–Wilk (SW) and Kolmogorov–Smirnov (KS)) proved the non-normality of all the commuting variables (p<0.001), as presented in Table III. These results declined the null hypothesis of the normality of the commuting variables through Egyptians and migrants. The Mann–Whitney U test evaluates a null hypothesis that the probability distribution of a randomly drawn observation from the Egyptian group is the same as the probability distribution of a randomly drawn observation from the migrants' group against an alternative that those distributions are not equal. The commuting variables which are presented in Table II were input as the Mann–Whitney U test variables list, and they were grouped according to nationality-binary as Egyptians were coded "0" and migrants were coded "1".

Regarding the second research question, which inquiries about the correlation between subjective public transport use and commuting trip generation for Egyptians and migrants, a multivariate Ordinary Least Squares (OLS) model was employed for commuting trip generation as the dependent variable three times (for overall, Egyptian, and emigrant's samples). The Twelve variables presented in Table I were defined as independent variables of the model, and after running six iterations, the most efficient model was generated with the highest R^2 value. Three variables of age, household car ownership, and household size were controlled. Four subjective variables of evaluation of the quality of buses and minibuses, perceived security when using public transportation, when uniformed guards or security forces are near the public transportation (PT) station/stop, and when the stations/stops are well-lit were tested. The variables of p<0.001, p<0.05, and 0.10>p>0.05 were taken as highly significant, significant, and marginally significant predictors, respectively. The five insignificant variables that were disregarded from the model were possession of an individual driving license, public transport use, gender, perceived security when there is surveillance by cameras, and commuting to work or study place most of the day, respectively.

2.　Results

a.　Commuting Characteristics of Egyptians and Migrants:　The Mann-Whitney U test demonstrates intriguing results regarding the significant differences in commuting characteristics for Egyptians and migrants. As a non-parametric test, it represents the difference between the mean rank of the commuting variables across Egyptians and migrants. Table IV displays the mean rank of the commuting variables for Egyptians and migrants. In contrast, the mean rank of willingness to spend time commuting is significant (p<0.05) for Egyptians and migrants. At the same time, it is highly significant (p<0.001) for all other commuting variables among Egyptians and migrants. As illustrated in Table IV, migrants generated more commuting trips during the past seven days than Egyptians, and they are more satisfied with commuting than Egyptians. While Egyptians spend more time commuting on weekdays, their ideal commuting trip time per day is higher than migrants. They are willing to spend more time commuting than migrants, and they spend more money on commuting per month than migrants.

TABLE IV
THE RESULTS OF THE MANN_WHITNEY U TEST FOR EGYPTIANS AND MIGRANTS

Nationality-Binary		N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	P (2-tailed)
Trip generation for commuting purposes during the past seven days	Egyptian	1299	748.59	972421.5	128071.5	972421.5	-5.252	<0.001
	Migrants	249	909.66	226504.5				
	Total	1548						
Commuting trip time on weekdays	Egyptian	1236	763.40	943557.5	123728.5	153863.5	-4.542	<0.001
	Migrants	245	628.01	153863.5				
	Total	1481						
Ideal commuting trip time per day	Egyptian	1209	746.97	903090.5	118514.5	147434.5	-4.515	<0.001
	Migrants	240	614.31	147434.5				
	Total	1449						
Satisfaction of commuting	Egyptian	1297	741.47	961692.0	119939	961692	-6.301	<0.001
	Migrants	247	935.42	231048.0				
	Total	1544						
Willingness to spend time commuting (max.)	Egyptian	1274	775.65	988184.0	138669	169297	-2.970	0.003
	Migrants	247	685.41	169297.0				
	Total	1521						
Commuting expenses per month	Egyptian	1283	787.90	1010882.0	127139	157274	-4.750	<0.001
	Migrants	245	641.93	157274.0				
	Total	1528						

b. Subjective Public Transport Use Correlates with Commute Trip Generation: Findings of the most efficient multivariate OLS model involve four significant subjective variables and three controlled variables for the three models of the overall sample, Egyptians, and migrants. The independence of subjective variables was tested using the Collinearity Statistics test, which validated the model because all the variables were independent ($5>VIF>1$). Furthermore, the models were validated by ANOVA – F Test which reported significant p-values ($p<0.001$) as presented in Table V. Regarding the R2-value, the OLS model for migrants works better than the other two models because the R2-value is finer. The R2 shows how much the model predicts the variability for the dependent variable. 18.7 % of the variability of the commute trip generation per week is defined by this model, and it is highly related to public transportation. This means that the subjective measures of public transportation can explain the commuting trip generation per week of migrants better than the Egyptians because they are more dependent on public transportation.

Regarding the results of the overall sample model, the evaluation of the quality of buses and minibuses, and perceived security when using public transportation are significant subjective variables ($p<0.05$). While the perceived security when uniformed guards or security forces are near the PT station/stop, and when the stations/stops are well-lit are highly significant variables ($p<0.001$). Table V indicates that the increase of one scale of evaluation of the quality of buses and minibuses is correlated with a 9.2% reduction in commuting trips per week. Unlike the perceived security when using public transportation, that scale unit is correlated with a 13.8% increase in commuting trips per week. Perceived security when uniformed guards or security forces are near the PT station/stop is highly significantly correlated positively with commuting trip generation. The increase of one unit of it is correlated with a 26.3% increase in commuting trips per week. This means that the more people feel secure because of the presence of uniformed guards or security forces near the PT station/stop, the more they commute per week, which is logical. Finally, the perceived security when the stations and stops are well-lit is highly significant negatively with the number of commuting trips per

week; its scale unit increase was correlated with a 21.1% decrease in commuting trips per week. This seems counterintuitive because the respondents' perceptions of security may be influenced by other variables. They may give a lower score to the lighting element because they believe it is less relevant than the presence of uniformed guards or security forces near the public transport station.

Finally, by comparing the results of the Egyptian and emigrant models, all the subjective public transport use variables are significant (p<0.05) except for the Egyptian perceived security when uniformed guards or security forces are near the PT station/stop variable, which is highly significant (p<0.001) and the migrants' evaluation of the quality of buses and minibuses variable which is marginally significant (0.10>p>0.05). This means that the main variable affecting the commuting trip generation of Egyptians is perceived security when uniformed guards or security forces are near the PT station/stop. While

in the migrants' conditions, all the independent variables have the same effect on the commuting trip generation except for the evaluation of the quality of buses and minibuses variable, which has lesser impact. The model indicates that the increase of one scale of Egyptians' and migrants' perceived security when using public transportation and when uniformed guards or security forces are near the PT station/stop is correlated with 9.4%, 32.7%, 23.2%, and 49.3% increase in commuting trips per week, respectively. This means that migrants generate more commuting trips when they feel secure than Egyptians. Conversely, the increase of one scale of Egyptians' and migrants' evaluation of the quality of buses and minibuses and perceived security when the stations/stops are well-lit led to a reduction of 10.6%, 14.7%, 15.5%, and 46.5% in commuting trips per week, respectively. This indicates that migrants generate fewer commuting trips when the station is well-lit than Egyptians. All the above-mentioned results have been outlined in Table V.

TABLE V
MULTIVARIATE OLS MODEL FOR COMMUTING TRIPS GENERATION OF THE OVERALL SAMPLE, EGYPTIANS AND MIGRANTS

Independent Variable	Overall Sample			Egyptian			Migrants		
	B	β	P	B	β	P	B	β	P
(Constant)	4.337		<0.001	4.008		0	2.81		0.048
Age	0.031	0.073	0.007	0.034	0.086	0.004	0.103	0.148	0.014
Household car ownership	-0.319	-0.100	0.000	-0.21	-0.067	0.034	-0.408	-0.112	0.11
Household size	0.177	0.069	0.010	0.174	0.065	0.027	0.183	0.087	0.184
Evaluation of the quality of buses and minibuses	-0.013	-0.092	0.006	-0.015	-0.106	0.005	-0.021	-0.147	0.051
Perceived security when using public transportation	0.017	0.138	0.001	0.011	0.094	0.029	0.039	0.327	0.002
Perceived security when uniformed guards or security forces are near the PT station/stop	0.032	0.263	<0.001	0.028	0.232	<0.001	0.066	0.493	0.002
Perceived security when the stations/stops are well-lit	-0.026	-0.211	<0.001	-0.019	-0.155	0.01	-0.061	-0.465	0.001
R²	0.063			0.049			0.187		
ANOVA - F Test P	<0.001			<0.001			<0.001		

III.   DISCUSSION

A.   Feedback to Previous Studies

This study examined the correlation between subjective independent variables and trip generation, as dependent variables, among Egyptians and migrants. Thus, it attempts to highlight the determinants influencing commuting trip

generation. The results demonstrate some notable findings that contribute to the understanding of the commuting determinants among both groups of the study (i.e., Egyptians and migrants). As well as, shedding light on some findings which need further investigation.

One of the findings revealed that migrants generated more commuting trips (during the seven

days before filling out the study survey) than Egyptians, which is illustrated in Figure 1. The R2 value of the OLS model for migrants denotes that the commuting trip generation is highly related to public transport. This finding is supported by several studies carried out in Canada, the USA, and Germany, which state that immigrants and non-natives use public transport more than residents [31], [32], [33].
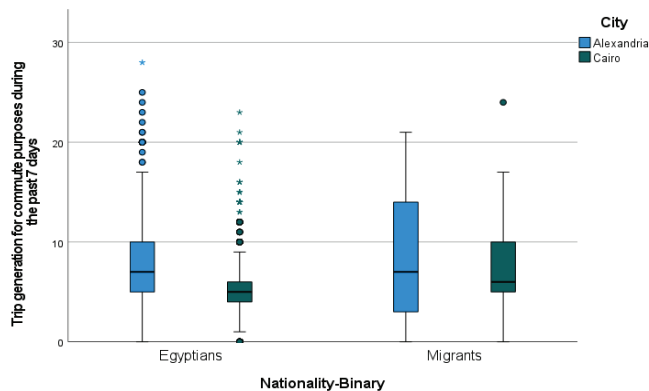

Fig. 1. Illustration of the trip generation for commute purposes for Egyptians and migrants in both cities

When comparing the results on the willingness to spend time commuting between both groups, it is found that Egyptians are more willing to spend more time than migrants. The results of a study conducted in Southern Ontario, Canada, reveal that the car-dependent-individuals have longer commuting trips [33]. Thus, the willingness to spend more time commuting expressed by Egyptians reinforces the assumption that they are considered car-dependent commuters.

Immigrants generally decide to relocate within their immediate surrounding area and tend to refrain from more extended distances. This observation suggests that natives show more willingness to commute longer distances [34]. This finding is further supported by the claim established by Kabbani (2018) that refugees, specifically Syrians, are concentrated in specific neighborhoods and cities. Additionally, they tend to reside near the location of their business [26]. This is further supported by the claim established by Casado-Díaz, Simón-Albert, and Simón (2022), [35] which states that the commuting differences between locals and non-locals are possibly a result of various factors that might include their tendency to reside in specific agglomerations. This further denotes that locals/natives have more willingness to spend more time commuting. This in turn potentially implies that spatial variations exist between local and non-local individuals regarding

their willingness to trade off commuting time for other attributes such as job quality and housing affordability among commuters.

Additionally, according to the findings of this study, Egyptians spend more money on commuting than the other group. High expenditure of money on commuting by Egyptians aligns with the research findings which reveal that Egyptians are unlikely to use public transport when compared to migrants. Accordingly, this suggests that Egyptians rely on more expensive means of transport, in that case: individual means of transport (i.e. cars). Thus, this finding implies the reliance of Egyptians on cars for commuting more than any other mode, which is supported according to a comparative study carried out in Tehran and Cairo [36].

Migrants expressed a lower willingness to spend more time commuting, in contrast to the high willingness of Egyptians. Additionally, migrants are more satisfied with commuting than Egyptians. The high level of satisfaction and low level of willingness to spend time commuting of the migrants group implies a shorter commuting distance for migrants. The Findings of a previous study conducted in Canada concede with the findings of this study, which demonstrates that non-natives or immigrants commute shorter distances [33], [37].

However, there is a contrast between the findings related to shorter commuting distances and the findings reported by another study on immigrants' commuting times in Spain. The findings of the study conducted in Spain show that immigrants have more commuting time compared to locals [38]. This could be further explained by the claim established by [33] that the commuting distance for immigrants or non-natives is correlated to the number of years of their stay in the country of immigration, in which, the commuting distance of native and non-natives or immigrants converge over two decades [33], [37].

The claim established by [33] is highly considered for this study, to plan further research and investigation in the near future. Particularly in the light of the current duration of refugees/Syrian's influx to Egypt, which started in 2011-2012, which is roughly 12 years. Thus, Egypt is currently roughly in the middle of two decades interval. Thus, in less than a decade, further studies could be conducted to investigate the potential convergence of commuting time between locals and non-locals. To address this concern, the researchers plan to conduct further

research and analysis that consider the temporal aspect of commuting distance evolution over the years for both native and non-native populations.

One of the notable results of this study is that perceived subjective variables related to public transport are positively correlated with trip generation per week. Specifically, in the case of migrants, trip generation is positively and highly correlated to perceived security in public transport and perceived security when guards are near stops. The perceived subjective variables related to public transport are presented in Figure 2. A study on immigrants in Australia revealed that immigrants usually have a positive perception towards public transit in the country of immigration [39]. This supports the findings primarily revealed by [33], [37] which highlight the role of the duration of the immigrants' stay in the country of immigration on commuting time and distance, as mentioned earlier . Contrastively, the results of perceived security when the stations and stops are well-lit are negatively and highly correlated with trip generation. This either supports or declines the results of other previous studies. Although there is a lack of studies on the correlation between commuting trip generation and station lighting factors, some studies have investigated the correlation between safety and waiting time at public transport stations, such as the study by [40]. This study opposes the negative correlation, as 18% of their study's sample approved the positive correlation between station good lighting and safety perception. On the other hand, the findings of [41], proved that individuals may not necessarily link well-lit zones with improved feelings of personal safety because well-lit areas may allow thieves to see them more easily.
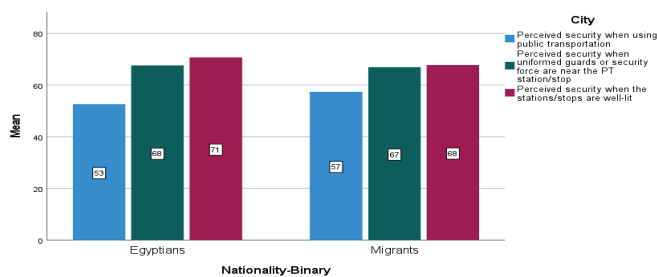

Fig. 2. The perceived subjective variables related to public transport

Given that most of the migrants group sample are Syrians, and the influx of most Syrians initiated during 2011, hence, they are currently commencing the second decade of their stay as immigrants and as underscored by the previously mentioned studies,

after the second decade, non-natives' commuting determinants and perceptions are expected to shift towards longer commuting distances and negative perceptions [33], [37], [39].

a. ***Lessons Learned for Urban and Mobility Planning:*** This study shapes one's understanding of the complex relationship between trip generation, commuting determinants, and perceptions among Egyptians and migrants. The findings of this study underline the importance of continuous, efficient, and strategic investment in enhancing the quality of public transit (i.e., Buses and minibuses) in the Egyptian context and MENA region. Such investments will promote the usage of public transit and will attract a broader spectrum of users. Moreover, transport planners and policymakers' efforts should be directed to acknowledge the sense of security for all commuters, especially for public transit. This should be considered strategically to better manage the prospective change in the upcoming decades. In which perceived security towards public transit is expected to decline, thus, leading to a car-dependent mobility pattern. If sound investments are encouraged, it will shift transit mode choices towards more sustainable transport and mobility options, away from car dependency. Urban mobility and transport plans require holistic approaches in which the diverse needs of different groups of commuters should be met and, more importantly, to meet the needs of the growing population, increasing demands, and changing perceptions of the future of both Egyptians and migrants.

b. ***Study Limitations:*** Cairo city data were collected from November 2022 till January 2023, these months represent the start of a new academic year in Egypt which may present data that will differ over the other months of the year like summer months. So, the data collection is supposed to be from different seasons of the year to correctly project the actual behavior of the commuters. Moreover, a longer time frame for the data collection method means a bigger sample size, which will improve the process of forecasting the behavior of the commuters. The nature of the emigrant commuter's trip numbers and destinations will increase and decrease due to international events and the economic state of their countries. As a matter of fact, not all the variables that were intended to be applied in the survey have existed in the collected data due to expecting some difficulties in the data collection method between both cities.

IV. CONCLUSION

The research studies Egyptian and emigrant/refugee populations in their commuting behavior according to their perception of their physical environment; Home/Work distance, the choice of mode of transportation, with a special highlight on the six variables of age, household car ownership, and household size, the role of socioeconomic characteristics, the quality of buses and mini-buses, perceived security when using public transportation were tested along with features of transport built environment in explaining commuting patterns and forecast sustainable modal splits.

Both the questionnaire and the methodology are adaptable and scalable to be used, modified, and applied in a wide range of transport modal shifting strategies. The paper concludes the effectiveness of the "Residential self-selection" and the decreased "spatial mismatch" found in the migrants in the Work/Home distance and choice and its effect on their commuting experience positively, while the Home/Work distance and choice were bounded with other socio-cultural aspects that affected their commuting experience negatively. Variables addressing the Egyptias'n and migrants' travel behavior, and modal shifts were tested and addressed by "The Mann–Whitney U test" and the multivariate Ordinary Least Squares (OLS) model.

The non-parametric statistical test "The Mann–Whitney U test" showed the difference between both groups "Egyptians and migrants", migrants have produced a higher number of commuting trips compared to Egyptians, and their satisfaction with commuting surpasses that of Egyptians. Although Egyptians invest more time in weekday commutes, their preferred daily commuting time is greater than that of migrants. Egyptians demonstrate a greater willingness to allocate time for commuting and expend more resources on commuting expenses each month compared to migrants, Due to the high costs associated with changing residency in Egypt, Egyptians often find it challenging to easily relocate. Consequently, their regular home-to-work commuting typically incurs higher expenses compared to migrants, who look for accommodation close to their workplace.

To explore the correlation between subjective public transport usage and the generation of commuting trips among both Egyptians and migrants, a multivariate Ordinary Least Squares (OLS) model

was employed. The model was executed three times, encompassing the overall sample, the Egyptian-specific subset, and the migrants-specific subset, with commute trip generation serving as the dependent variable. When comparing the models for Egyptians and migrants, all subjective variables related to public transport usage are statistically significant. However, the Egyptian perceived security when uniformed guards or security forces are near the public transport station/stop variable is highly significant, while the migrants' evaluation of the quality of buses and minibuses variable is marginally significant. The model suggests that a one-scale increase in both Egyptians' and migrants' perceived security when using public transportation, and when uniformed guards or security forces are near the station/stop, is associated with a high percentage increase in weekly commuting trips, respectively.

The findings indicate that migrants tend to generate more commuting trips when they perceive a higher level of security compared to Egyptians. Additionally, the results suggest that migrants generate fewer commuting trips when the public transport station is well-lit, in contrast to Egyptians.

Due to the acceptance of Egyptian society for all nationalities to merge into the culture and live as they still in their home, the expansion of the migrants' population extended all over the 27 governorates of Egypt, which will require an extensive effort to cover all these governorates to have more accurate results. Future research will be required to cover the North and the south of Egypt, also a longer time frame will be required, which means the survey has to be collected during a full year, to measure accurately the behavior of each group during the peak seasons and off seasons.

In future research, it is recommended to have a larger sample size and access to governmental big data to maintain accuracy, save time, and help the researchers use more powerful parametric tools to analyze the data, which will have higher precision in the commuter's behavior forecasting process. Furthermore, it is recommended that forthcoming studies consider the geographical context of neighborhoods when examining the correlates of commuting behavior for Egyptians and migrants. Such an approach will enhance one's understanding of how neighborhood characteristics impact the variables of commuting behavior, thereby informing recommendations for urban and mobility planning initiatives.

References

[1] A. Hegazy and S. Abu Hendy, "Sustainable Urban Mobility Plan in 6th of October," : https://transportforcairo.com/wp-content/uploads/2021/10/6O_SUMP_P1_Final_Report_v1.2_En.pdf.

[2] Syria Refugee, "Syria Refugee Crisis Explained," https://www.unrefugees.org/news/syria-refugee-crisis-explained/.

[3] O. Hassan, E. A. K. Mohamed, A. Hassan, M. Shaheen, and W. Bekheet, "Sustainable urban development of mobility and streetscape in historic city quarters, an ancient street in Alexandria - Egypt, as a case study," Alexandria Engineering Journal, vol. 78, pp. 378–389, Sep. 2023, doi: 10.1016/j.aej.2023.07.065.

[4] S. Abu-Eisheh, W. Kuckshinrichs, and A. Dwaikat, "Strategic Planning for Sustainable Transportation in Developing Countries: The Role of Vehicles," Transportation Research Procedia, vol. 48, pp. 3019–3036, 2020, doi: 10.1016/j.trpro.2020.08.184.

[5] M. Mehriar, H. Masoumi, and I. Mohino, "Urban Sprawl, Socioeconomic Features, and Travel Patterns in Middle East Countries: A Case Study in Iran," Sustainability, vol. 12, no. 22, p. 9620, Nov. 2020, doi: 10.3390/su12229620.

[6] K. A. Small and E. T. Verhoef, The economics of urban transportation. 2007. doi: 10.4324/9780203642306.

[7] Y. Yang, C. Wang, W. Liu, and P. Zhou, "Understanding the determinants of travel mode choice of residents and its carbon mitigation potential," Energy Policy, vol. 115, pp. 486–493, Apr. 2018, doi: 10.1016/j.enpol.2018.01.033.

[8] P. G. Røe, "Qualitative research on intra-urban travel: an alternative approach," J Transp Geogr, vol. 8, no. 2, pp. 99–106, Jun. 2000, doi: 10.1016/S0966-6923(99)00039-3.

[9] L. A. B. Ouali, D. J. Graham, A. Barron, and M. Trompet, "Gender Differences in the Perception of Safety in Public Transport," J R Stat Soc Ser A Stat Soc, vol. 183, no. 3, pp. 737–769, Jun. 2020, doi: 10.1111/rssa.12558.

[10] M. Ehab, "THE COMMUTING GENDER GAP AND FEMALES' LABOR SUPPLY AND EARNINGS IN THE EGYPTIAN LABOR MARKET," in Economic Research Forum, 2018.

[11] J. Urry, "The 'System' of Automobility," Theory Cult Soc, vol. 21, no. 4–5, pp. 25–39, Oct. 2004, doi: 10.1177/0263276404046059.

[12] R. V. Ponnaluri, "Sustainable Bus Rapid Transit initiatives in India: The role of decisive leadership and strong institutions," Transp Policy (Oxf), vol. 18, no. 1, pp. 269–275, Jan. 2011, doi: 10.1016/j.tranpol.2010.08.010.

[13] C. De Gruyter, G. Currie, and G. Rose, "Sustainability Measures of Urban Public Transport in Cities: A World Review and Focus on the Asia/Middle East Region," Sustainability, vol. 9, no. 1, p. 43, Dec. 2016, doi: 10.3390/su9010043.

[14] D. Sims, "Understanding Cairo: the logic of a city out of control," Choice Reviews Online, vol. 49, no. 04, 2011, doi: 10.5860/choice.49-2329.

[15] "Egyptian National Railways," https://www.enr.gov.eg/En/ENR.aspx?ID=2.

[16] T. Lin, D. Wang, and X. Guan, "The built environment, travel attitude, and travel behavior: Residential self-selection or residential determination?," J Transp Geogr, vol. 65, pp. 111–122, Dec. 2017, doi: 10.1016/j.jtrangeo.2017.10.004.

[17] R. Ewing and R. Cervero, "Travel and the Built Environment," Journal of the American Planning Association, vol. 76, no. 3, pp. 265–294, Jun. 2010, doi: 10.1080/01944361003766766.

[18] P. Næss, "Residential location affects travel behavior—but how and why? The case of Copenhagen metropolitan area," Prog Plann, vol. 63, no. 2, pp. 167–257, Feb. 2005, doi: 10.1016/j.progress.2004.07.004.

[19] T. Schwanen and P. L. Mokhtarian, "What if you live in the wrong neighborhood? The impact of residential neighborhood type dissonance on distance traveled," Transp Res D Transp Environ, vol. 10, no. 2, pp. 127–151, Mar. 2005, doi: 10.1016/j.trd.2004.11.002.

[20] J. F. Kain, "Housing segregation, negro employment, and metropolitan decentralization," Quarterly Journal of Economics, vol. 82, no. 2, 1968, doi: 10.2307/1885893.

[21] M. Friman, K. Lättman, and L. E. Olsson, "Public Transport Quality, Safety, and Perceived Accessibility," Sustainability, vol. 12, no. 9, p. 3563, Apr. 2020, doi: 10.3390/su12093563.

[22] Y. Li, S. Geertman, P. Hooimeijer, Y. Lin, and H. Yang, "Do migrants and locals differ in commuting behavior? A case study of Xiamen, China," Transp Policy (Oxf), vol. 108, pp. 1–10, Jul. 2021, doi: 10.1016/j.tranpol.2021.04.020.

[23] D. Lin, A. Allan, and J. Cui, "The impacts of urban spatial structure and socio-economic factors on patterns of commuting: a review," International Journal of Urban Sciences, vol. 19, no. 2, pp. 238–255, May 2015, doi: 10.1080/12265934.2015.1016092.

[24] Y. Fan, "The Planners' War against Spatial Mismatch," J Plan Lit, vol. 27, no. 2, pp. 153–169, May 2012, doi: 10.1177/0885412211431984.

[25] UN DESA, "World Population Prospects - Population Division," World Population Prospects: 2023 Revision. Accessed: Aug. 12, 2023. Available: https://population.un.org/wpp/

[26] R. Kabbani, "Entrepreneurship and the integration of refugees and migrants: A case study of Syrian refugees in Egypt."

[27] "CAPMAS," Accessed: Aug. 12, 2023, https://www.capmas.gov.eg/.

[28] L. Hadjiiski, H.-P. Chan, B. Sahiner, M. A. Helvie, and M. A. Roubidoux, "Quasi-Continuous and Discrete Confidence Rating Scales for Observer Performance Studies," Acad Radiol, vol. 14, no. 1, pp. 38–48, Jan. 2007, doi: 10.1016/j.acra.2006.09.048.

[29] F. Funke and U.-D. Reips, "Why Semantic Differentials in Web-Based Research Should Be Made from Visual Analogue Scales and Not from 5-Point Scales," Field methods, vol. 24, no. 3, pp. 310–327, Aug. 2012, doi: 10.1177/1525822X12444061.

[30] S. Y. Y. Chyung, I. Swanson, K. Roberts, and A. Hankinson, "Evidence-Based Survey Design: The Use of Continuous Rating Scales in Surveys," Performance Improvement, vol. 57, no. 5, pp. 38–48, May 2018, doi: 10.1002/pfi.21763.

[31] E. Blumenberg and A. Evans, "Planning for Demographic Diversity: The Case of Immigrants and Public Transit," J Public Trans, vol. 13, no. 2, pp. 23–45, Jun. 2010, doi: 10.5038/2375-0901.13.2.2.

[32] J. Welsch, K. Conrad, and D. Wittowsky, "Exploring immigrants travel behaviour: empirical findings from Offenbach am Main, Germany," Transportation (Amst), vol. 45, no. 3, pp. 733–750, May 2018, doi: 10.1007/s11116-016-9748-9.

[33] K. Bruce Newbold, D. M. Scott, and C. Burke, "Immigrant status and commute distance: an exploratory study based on the greater Golden Horseshoe," Transportation (Amst), vol. 44, no. 1, pp. 181–198, Jan. 2017, doi: 10.1007/s11116-015-9633-y.

[34] I. Geis, "Foreign countries, foreign customs: an analysis of short-distance mobility of new immigrants in the Rhine-Main region in Germany," European Transport Research Review, vol. 11, no. 1, 2019, doi: 10.1186/s12544-019-0360-x.

[35] J. M. Casado-Díaz, R. Simón-Albert, and H. Simón, "Reassessing the commuting penalty for immigrants: new evidence from Spain," Transportation (Amst), vol. 49, no. 4, pp. 1099–1132, Aug. 2022, doi: 10.1007/s11116-021-10204-5.

[36] H. Mostofi, H. Masoumi, and H.-L. Dienel, "The Relationship between Regular Use of Ridesourcing and Frequency of Public Transport Use in the MENA Region (Tehran and Cairo)," Sustainability, vol. 12, no. 19, p. 8134, Oct. 2020, doi: 10.3390/su12198134.

[37] V. Preston, S. McLafferty, and M. Maciejewska, "Gender, Immigration and Commuting in Metropolitan Canada," Tijdschrift voor Economische en Sociale Geografie, vol. 113, no. 4, pp. 348–364, Sep. 2022, doi: 10.1111/tesg.12521.

[38] M. Blázquez, C. Llano, and J. Moral, "Commuting times: Is there any penalty for immigrants?," Urban Studies, vol. 47, no. 8, 2010, doi: 10.1177/0042098009356127.

[39] R. Shafi, A. Delbosc, and G. Rose, "The role of culture and evolving attitudes in travel behaviour assimilation among south asian immigrants in Melbourne, Australia," Transportation (Amst), vol. 50, no. 4, pp. 1261–1287, Aug. 2023, doi: 10.1007/s11116-022-10277-w.

[40] S. Chowdhury and B. van Wee, "Examining women's perception of safety during waiting times at public transport terminals," Transp Policy (Oxf), vol. 94, pp. 102–108, Aug. 2020, doi: 10.1016/j.tranpol.2020.05.009.

[41] M. S. H. and A. S. S. Atkins, "The influence of street lighting on crime and fear of crime. in Crime Prevention Unit paper," Home Office, Crime Prevention Unit, vol. 28. Home Office, Crime Prevention Unit, London, 1991.