HOW DIFFERENT DIMENSIONS OF SOCIAL EXCLUSION ARE INFLUENCING THE OPTING OF RIDE-HAILING FOR WOMEN:

A COMPARATIVE ANALYSIS BETWEEN BOGOTA AND MEXICO CITY

A dissertation submitted in partial fulfilment
of the requirements for the
MSc Urban Development Planning

10,664 words

Aida Liz Diaz Isasi

Supervisor: Daniel Ricardo Oviedo Hernández

Development Planning Unit

University College London

15th September 2021

Acknowledgments

This one is for me and for all Latin American women who are constantly stereotyped, belittled, excluded and victims of gender-based violence and sexual harassment.

"*It's hard not to be a fighter when you're constantly under siege*" – *Cassandra Duffy*

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Acronyms and Abbreviations

CDMX	Mexico City (by its acronym in Spanish)
IDB	Inter-American Development Bank
PO	Proportional Odds
SDG	Sustainable Development Goals
TGL	Transport Gender Lab
TNC	Transportation Network Companies
TRSE	Transport-related social exclusion
UN	United Nations

Chapter 1 – Introduction

"Good things happen when people can move, whether across town or towards their dreams. Opportunities appear, open up, become reality." (Uber, 2021)

The first sentence of this ride-sharing company's mission statement acknowledges the crucial role of transportation in shaping people's lives and promises mobility gains from their services. However, the question is: who benefits from them? Given their indisputable importance, growth and popularity as a relatively new mode of transportation throughout the world, much attention has been shown to app-based ride-hailing services in contemporary international research in developed countries. Nonetheless, there is still scarce study on the determinants of their usage in developing countries, particularly in the Latin American context, where social inequalities are highlighted by rapid urbanisation, segregation and car-oriented development of cities.

Moreover, considering the dissimilar types of perceptions and related regulations (sometimes non-existent due to being perceived as illegal for the authorities but legitimate for most parts of society) of these services, it is essential to reflect on particular contexts when analysing and comparing behaviours, practices, and experiences of the users. Hence, the distributional consequences of this form of mobility vary in unique ways, but what is unquestionable is their effect and relationship with social inequalities (Oviedo et al., 2021). Exclusion from the benefits of ride-hailing services is therefore often similarly related to the socio-economic factors responsible for transport inequalities such as income, race, age, disabilities and gender (Young & Farber, 2019).

In order to raise awareness on particularly gender disparities during their exercise of the right to be mobile and participate in the city, this work aims to examine the associations between the frequency of the usage of on-demand transport services and particular factors related to gender-based inequalities such as sexual harassment, gender-based violence and fear, crime rates, social class and individual practices to contribute with broader debates on gendered social exclusion and inaccessibility.

While intersecting concepts underpinning transport-related social exclusion (TRSE) and access to the city, this study uses official quantitative data, including attitudinal preferences, from the cities of Bogota and Mexico City (CDMX by its acronym in Spanish) provided by the Inter-American Development Bank (IDB) as part of their broader research on ride-hailing and Social Exclusion.

Among the body of work in the subject, some findings show an association between ride-hailing use and socio-economic factors (e.g. income, race or ethnicity, education, internet access) or the built environment (e.g. land-use, populations and employment density, walkability, transport access) (Yu & Peng, 2019; Dias et al., 2017; Wang & Mu, 2018; Etminani-Ghasrodashti & Hamidi, 2019; Marquet, 2020). Notwithstanding, there is still a need to observe these relationships through gender and social exclusion lenses as women are often part of socially disadvantaged groups.

In this sense, fear and vulnerability are part of women's daily life travel behaviour in Latin America, mainly rooted in a general vision of 'traditional' gender roles and social representation of women that has been repeatedly linked to capitalism. A survey carried out in 2017 by the UN WOMEN in the framework of the 'Global Insignia Safe Cities and Public Spaces for Women and Girls Programme' in CDMX showed a considerably high percentage of perception of unsafeness by women (*Figure 1*) and fear to be sexually harassed in public transportation and even more so in public spaces (*Figure 2*) (ONU Mujeres, 2017).

Figure 1. Safety Perception of women in CDMX. Elaborated with data from ONU Mujeres (2017)

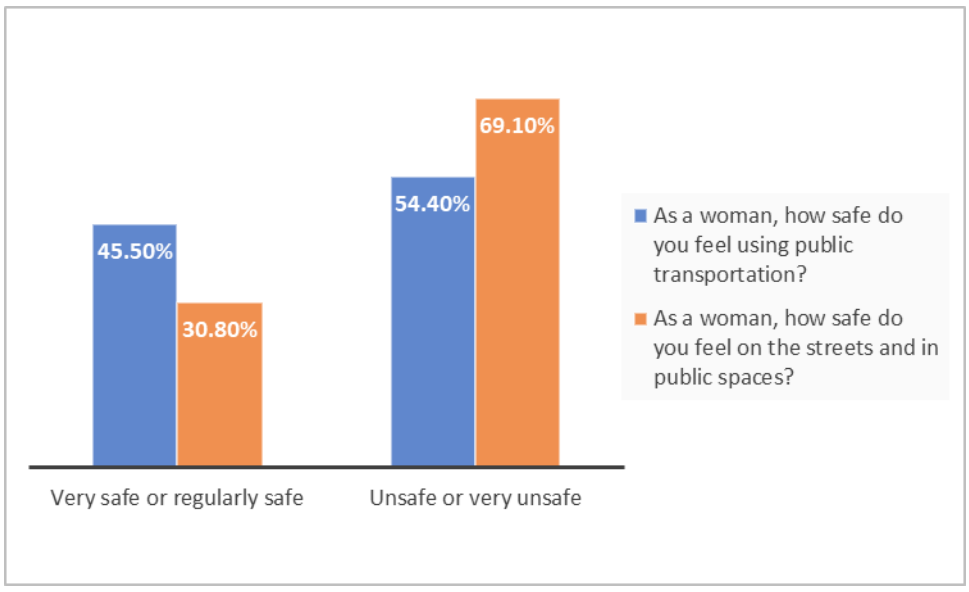
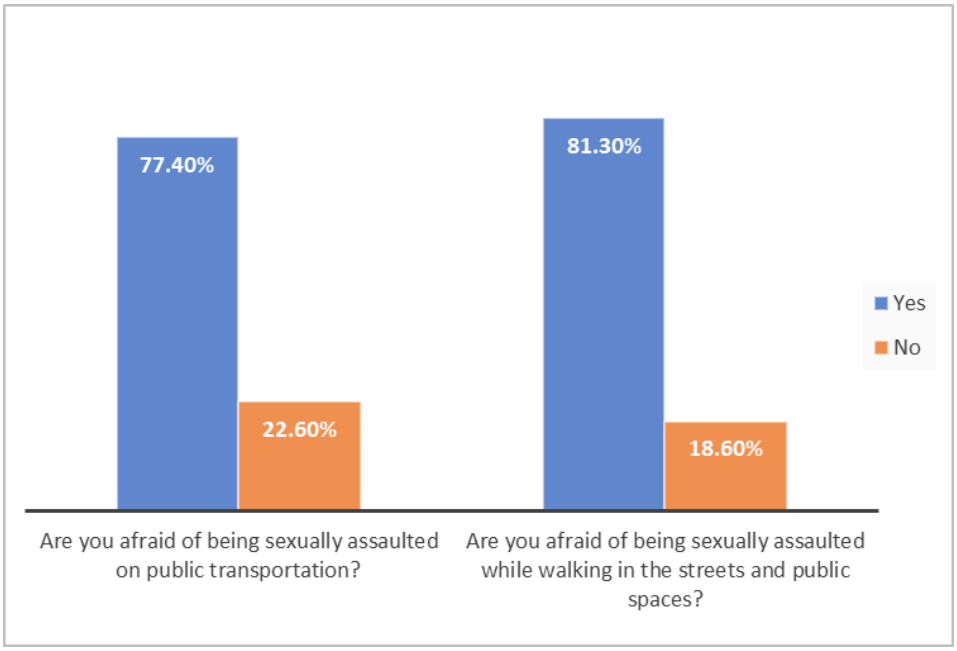


Figure 2. CDMX women fear of being sexually assaulted. Elaborated with data from ONU Mujeres (2017)



In the same study, 96.3% of women from 15 years old onwards stated that they had been the object of some act of sexual violence in public transport or public spaces throughout their lives and 88.5% in the last year. These violent acts can take various forms, but all of them are considered serious to a greater or lower extent by the victims (*Table 1*).

Table 1. Victims of acts of sexual violence in public transport or public spaces. Elaborated with data from ONU Mujeres (2017)

Violent act	Percentage of occurrence in the long term	Percentage of occurrence in the last year	Considered serious %
They looked at your body morbidly	81.7	71.4	86.1
They gave you obscene or offensive compliments of a sexual nature	81.2	70.0	70.3
They laid their body over you with intentions of a sexual nature	65.8	51.1	95.9
Said words that were offensive or derogatory about you or women	57.3	49.2	86.8
Made you fearful of sexual assault or abuse	53.0	39.2	97.6
They touched or groped your body without your consent	50.9	35.2	96.8
They spanked you	37.1	23.0	96.5
They showed you the genitals	25.8	13.5	96.6
They whispered things in your ear	24.0	19.9	86.1
They touched their genitals or masturbated in front of you	23.5	14.1	95.8
They followed you with the intention of attacking you sexually	22.4	13.9	99.1
Made unwanted sexual proposals	20.7	14.4	90.4
Took photos of your body without your consent	9.2	6.7	93.6
They ejaculated in front of you	2.8	1.3	96.0
They forced you to have sex	2.7	1.1	93.0

Mexican authorities have confirmed and addressed these structural inequalities by implementing women-exclusive public transport, which has been argued to linger forms of protectionism (Dunckel Graglia, 2016; Knecht, 2020). Likewise, women-only services and options from Transportation Network Companies (TNC) have been implemented worldwide (e.g. Uber "Ellas", Pinkcab, DriveHER, Safr and Shebah) to offer safer experiences for both riders and drivers. Nevertheless, separatist approaches have been probed unsustainable with similar initiatives, especially facing legal battles (e.g. See Jane Go and SheTaxis) (Brown, 2018). These policies neither analyse the more rooted motives of how gender-based dichotomies are shaped and sustained nor question equitable access to transport services and whether other patterns are related to these problems at different scales.

Following this, a number of objectives were set to guide more comprehensive research:

- Understand the particularities that define people's travel patterns in two different contexts of cities in the same region through gender lenses.
- Analyse what drives the use of ride-hailing by women in the metropolises of Latin American countries using different tools.
- Encounter possible paths for future research and planning that help create more inclusive and accessible cities for Latin American women.

In order to provide new standpoints on the use of app-based modes of travel, statistical models will be constructed and evaluated to reflect on the patterns of social phenomena and the inequalities embedded in them. More specifically, a logistic model using ordinal logistic regression will be built for both cities to understand the more significant and potential variables affecting the use of ride-hailing by women. Simultaneously, spatial analysis and descriptive statistics will be considered in order to find other patterns. All of the above will be done using tools such as SPSS and GIS software.

Using Colombia and Mexico as study cases for this research provides a unique gender perspective on ride-hailing and travel behaviours between different metropolitan cities of Latin America as part of the developing world. The interest then relies on examining comparatively the results in the context of a region marked by social disparities and with still a long way towards implementing socially just policies.

Chapter 2 – Literature Review

2.1. Gender inequalities and mobility

Women's ability to participate inclusively in the city's activities is directly related to transportation availability and strongly influenced by differences in travel behaviours and mobility patterns; hence, transport is far from being gender-neutral and does not benefit everyone equally (Páramo & Burbano, 2011; Lindkvist Scholten & Joelsson, 2019). Notoriously, access to cars has been dominated by men, who are also more prospective to use costly public transport such as trains, and the transport system's routes are mainly conceived towards the coverage of their needs and activities (Stuart, 2021; Lubitow et al., 2020). Conversely, women tend to walk or use the bus to make shorter and more complex trips than men, frequently involving more things to carry or a companion to take care of (e.g., taking children to school, moving from more than one job and caring responsibilities). The discordance of transport systems with women's requirements often results in them spending more time and money on mobility and consequently restricting their professional and academic development (BID, 2016).

Moreover, as introduced in the previous chapter, capitalism's ubiquitous presence in shaping gender inequalities in mobility cannot be neglected, given the political nature of transport planning (Lindkvist Scholten & Joelsson, 2019). It has been argued that the economic system has continually separated jobs from dwellings and gendered labour division, creating profound segregation of spatial functions (Levy, 2013; Pavlovskaya et al., 2018) and, therefore, isolation of women from the productive realm in cities (England, 1991).

Nonetheless, far from encouraging exclusionary dichotomies, a more inclusive and comprehensive approach to transport is needed when addressing gender disparities since, according to Hanson (2010, p.6), gender and transport "are completely bound up with each other, to the point of almost being inseparable". At the same time, Law (1999) propounds changing the dualistic approaches to gender and transport by broadening the scope of the considered problems that allows for the current equity gaps to be bridged.

Furthermore, in Latin America, the degrees of freedom experienced by women and men when mobilising or travelling through the city present particular differences, where in addition to the fear of robbery or crime, women are more exposed to street sexual harassment and other forms of violence that negatively impact their displacement, the enjoyment of public space and preventing the full achievement of their autonomies (Rozas & Salazar, 2015).

In this sense, it is necessary to mention the initiatives that have been undertaken in both cities to face these concerns. For example, the CDMX App 'My Safe City' group functions to report dangerous situations. These include immediate alerts in case of emergencies such as sexual harassment in space and public transportation. Also, years ago, it was established that the first carriages in the metro were exclusively for women during rush hour. There are barriers on the platform that show the area's boundaries with signs that say: "exclusively for women and children". In the Metrobús, the bus system of the Mexican capital, it is also established that women enter through the front doors of the units and wait at stops in exclusive areas. As mentioned in the previous chapter, the city's public transport network also has a pink bus service, in which men cannot travel (TGL, n.d.). While these segregations do not tackle habits modification in the long term, they serve as political tools "that operate as emerging platforms for feminist activism and challenge the status quo by generating new debates around exclusionary urban dynamics" (Knecht, 2020, p.42).

Likewise, in Bogota, following the guidelines of the 'Sectoral Plan for Gender Mainstreaming in the Mobility Sector ', training programs and campaigns were conducted for public transport companies. Additionally, undercover policewomen patrol the Transmilenio (bus rapid transit) in order to alert the authorities of any act of sexual harassment and, if possible, capture the offenders in the same unit. Moreover, the Secretariat for Women used the 'Safetipin' georeferencing tool to identify the places in the city with the greatest insecurity for women (TGL, n.d.).

All of the above confirms that violence creates an intimidating environment for women that ultimately limits their liberty and contributes to their further exclusion from the urban realm (Soto Villagrán, 2012; Dunckel-Graglia (2014). The fear related to the various forms of transportation is interrelated with its public nature and its great male essence (Knecht, 2020). Hazard then leads females to undertake precautionary attitudes and accept restricting trade-offs that limit the way in which they can move to access fundamental assets of the city (Páramo & Burbano, 2011). Thus, the city becomes a segregated space where victims of harassment are limited only to certain territories, vehicles and types of mobility.

Particularly in the use of ride-hailing services, studies have shown the predominant use by men than women (De Souza et al., 2018; Rayle et al., 2016). The latter is strongly related to insecurity issues and increased cases of gender-based violence and harassment charges faced by TNC (Wakabayashi, 2018). The lack of safeness ends up affecting not only the rejection of female users but also dissuade women from becoming

drivers, while female Uber drivers in the US represent 14% of the total (Hall & Krueger, 2017), in Mexico, this percentage is only 4% (Uber Mexico, 2021). Notwithstanding, women still may perceive ride-hailing services as the safest or only option, especially at night.

The gap presented between recognising transport as a contributor of inclusive and just cities and transportation policies that address these inequalities has led to the pushing forward of guidelines such as the Sustainable Development Goals (SDG) - specifically in the SDG target 11.2 - where safe and accessible transport systems need to be provided for all "with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons" (UN-Habitat, 2018).

Limitations in mobility opportunities are considered a supplementary way of social exclusion that can aggravate disadvantages in already vulnerable groups (Buchardt et al., 1999). Therefore, social exclusion must be reconsidered as guidance for transport planning to improve accessibility to the city (Church et al., 2000; Lucas, 2012; Kenyon et al., 2002). This important approach will be further developed in the next section and taken into account to explore whether ride-hailing services as a mode of transport plays a role in offsetting gender exclusion or helping to perpetuate these limitations.

2.2. Transport-related Social Exclusion and Accessibility

According to Duran (2019, p.10): "Accessibility is determined by the spatial distribution of potential destinations, the magnitude, quality and character of the activities found there and the ease to reach them which is determined by the transportation system, individual characteristics and resources". Here, the author refers to the concept as the facility with which individuals can travel and the capability to achieve desired services, goods or activities—which is usually measured as costs in time, money and quality of service, highlighting the role of mobility as a means rather than an end to access the various features that make up the daily life of urban citizens. This rationale of understanding the Macro-accessibility of different socio-economic groups in relation to their possibility of accessing a range of social and economic opportunities has also been supported by numerous authors (Alvarez & Estrada, 2018; Oviedo et al., 2017; Brussel et al., 2019).

Moreover, the strategic connexion of accessibility with TRSE needs to be taken into account when developing social policies (Social Exclusion Unit, 2003) and, at the same time, these linkages cannot be neglected when designing equal cities towards social justice involving transport (Levy & Davila, 2017). All these relationships pinpoint the

requisite of analysing available data on mobility for transport planning outside of mere technical/quantitative approaches and also consider qualitative experiences or attitudinal preferences (Lindkvist Scholten & Joelsson, 2019).

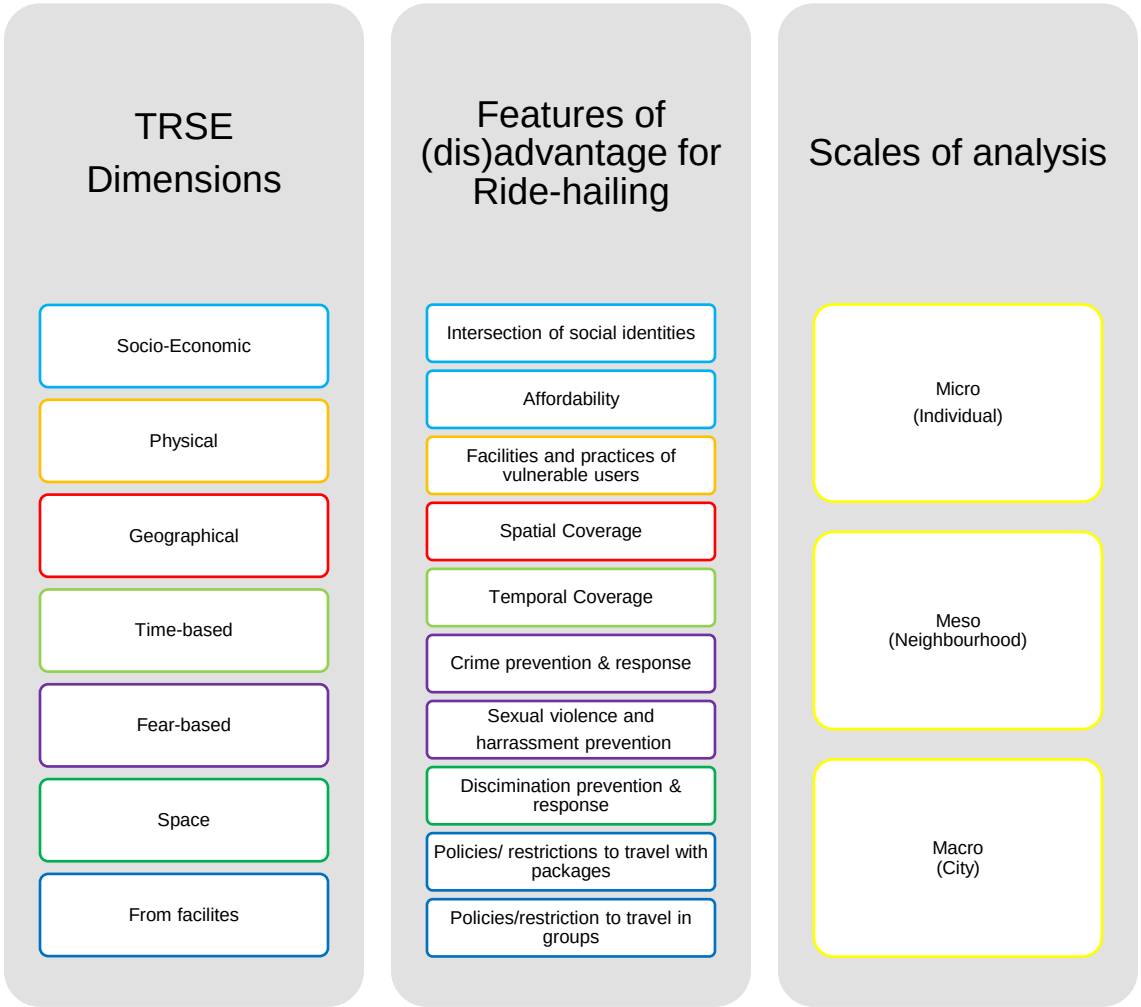
Within this requirement, other scales apart from Macro-accessibility emerged for a more comprehensive approach (Jones & Lucas, 2012). Firstly, the Meso-scale focuses on mobility at a neighbourhood level, concerning local street's connectivity and means of entry by a myriad of transport modes, especially for vulnerable groups. Secondly, the Micro-scale focuses on particularly the transport's physical design and individual features (Jones & Lucas, 2012). Hence, high levels of accessibility would essentially involve a good perception at all scales.

Furthermore, Church et al. (2000) propound seven intertwined and transport-related social exclusion dimensions that shape communities' participation in society: 1) Physical exclusion: where physical barriers inhibit transport accessibility. 2) Geographical exclusion: spatial separation – often located in the peripheries – prevent transport services access. 3) Exclusion from facilities: involving distance of key facilities like shops or schools. 4) Economic exclusion: regarding the high monetary value of travel. 5) Time-based exclusion: or time poverty, referring to other demands on time like care duties. 6) Fear-based exclusion: fear for safety impede the use of transport services. 7) Space exclusion: space management prevents access to public spaces and transport from certain groups.

2.3. Conceptual Framework

Based on the above, this research will be based on questioning women's accessibility to the frequency of use of ride-hailing services through transport and social disadvantage features and making connections with the definition of social exclusion. Hence, similarly to Jones & Lucas (2012), three different scales will be analysed to question ride-hailing positionality for women at the macro (i.e. regional/city), meso (i.e. neighbourhood/community) and micro (i.e. individuals) scale. Simultaneously, the seven dimensions of TRSE of Church et al. (2000) will be used to examine the intersecting social identities similarly to Oviedo et al. (2021). For the purposes of this study, the social dimension related to the intersection of social identities (e.g., gender, age, education) will be included with the Economic dimension, broadening the category (*Figure 3*).

Figure 3. Conceptual Framework. Based on Oviedo et al. (2021) and Jones & Lucas (2012)



Chapter 3 – Methodology

3.1 Research questions and methods

Following the exposed objectives in Chapter 1, for the exploration of the determinants of on-demand transport services' use by women in Latin America that are profoundly marked by a manifold of components related to social exclusion, this study will ultimately pose and attempt to answer the following questions:

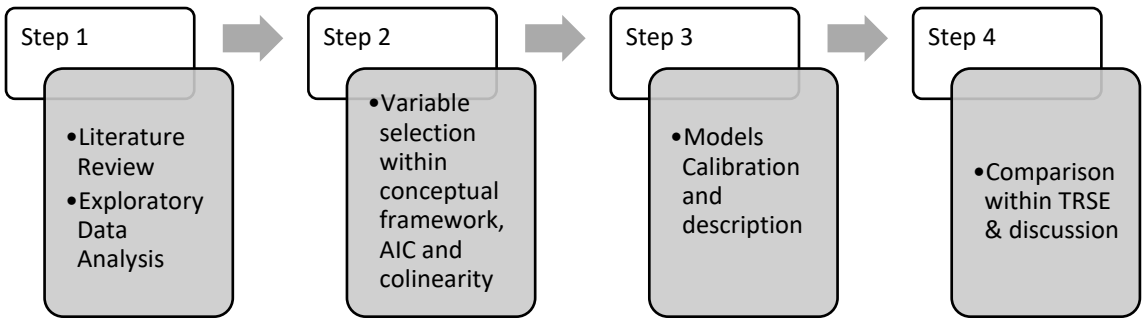
1. What drives the demand for ride-hailing services among Latin American women? And which similarities and differences can be highlighted in the contexts of Bogota and CDMX?

2. To what extent are the determinants of ride-hailing use by women influenced and explained by the TRSE dimensions?

To address the research questions, this work uses data from a survey conducted between September and October of 2020 as part of the consultancy developed by Steer for the IDB "to design and disseminate surveys in three cities (Mexico City, Bogotá, and Medellín), seeking to obtain information on the impacts of TNCs on travel patterns and the use of public transport in order to provide technical advice that will serve the implementation of public policy" (Steer, 2020, p.i). In the mentioned dataset, 2,061 entry points for the city of Bogota and 2,006 for Mexico City fall in the spatial area of interest of this study. Furthermore, GIS shapefiles were extracted from open sources and government platforms to represent the data available spatially.

The process was divided into four parts (*Figure 4*). Firstly, a set of relevant variables based on the literature review, the conceptual framework, and the survey's questions will be generated and classified in accordance with the TSRE dimensions. Consequently, the initial selection will be tested for collinearity and forward variable selection into a logistic regression model built with SPSS software. Thirdly, the selected variables will be used to develop the most accurate model possible to predict the frequency of use of ride-hailing services. Finally, the models for both cities will be compared to comprehend the extent to which the TSRE dimensions describe the variation in ride-haling use, in what way the scale of analysis affects the results, and to appreciate how the processes may differ with taking into account the local nuances in each dimension. An exploratory data analysis via data visualisation and statistics to observe relevant patterns will accompany the description and analysis processes. Hence, an overview of the mathematical logic of the models will be presented next.

Figure 4. Methodology



3.2 Ordered logit model

Acknowledging that the different categories in which the survey classified the intensity of use of ride-hailing services could better define the factors that influence the regularity of its adoption, the dependent variable was adopted with its original multiple-categories structure rather than opting for a transformation into a binary form (i.e., whether an individual is a user or not). Hence, the undergo of a binary logistic regression was discarded.

Ordinal logistic regression is the type of model that will be utilised since the dependent variable comprises values coming in the form of ordered categories for the frequency of use by women coded from 1 to 7 (frequent user to non-user). Therefore, it is necessary to develop a firm understanding of the concepts underlying this particular type of regression. The assumption when treating a variable as ordered categorical is that the response categories simply reflect a relative ordering on that variable and that differences in adjacent ranks do not convey equivalence in terms of the amount of a characteristic as would be the case had the variable been measured with greater precision (i.e., taking on a metric quality).

There are several types of ordinal logistic regression models (Bürkner & Vuorre, 2019). However, the focus in this study is on the Proportional Odds (PO) model or cumulative logit model since it is the most common form of ordinal logistic regression in the literature (Osborne, 2017). According to Liu et al. (2011, p. 513), the purpose of this kind of model is to predict the case chances of "being at or below a particular level of a response variable or being beyond a particular level, which is the complementary direction".

The PO model is a generalisation of the binary logistic regression. Yet, a key difference is that while binary logistic regression centres on modelling the relationship between a set of predictors and the probability of a case being in a particular group with respect to

the dependent variable, the selected model is designed to explain the cumulative probability of a case being at or below a given level on the ordered categorical variable. Thus, if the main assumption is not met, it is necessary to perform a multinomial logistic regression which allows all effects to vary across levels of the dependent variable. Favourably, this was not the case with neither of the samples for each city, and ergo, this work will forego an intense explanation of this type of logistic model.

To avoid the usual confusion that the classic parameterisation of the PO model produces as to the interpretation of the meaning of the regression coefficients (Osborne, 2017), the ordinal logistic regression formula is parameterised upon by programs such as SPSS in the following way:

$$ln\left(\frac{\Pr\,(y\leq j)}{\Pr\,(y>j)}\right) = ln(odds(y \leq j)) = \theta_j - (\beta_1\, X_1 + \cdots + \beta_k\, X_k).$$

Where θ_j refers to a threshold/cut-point on the latent continuous variable y* (marking the transition from one category to another) and β_k refers to the regression coefficient for a predictor k. This adoption will render an interpretation more consistent with how one typically interprets the direction of effects in the context of linear regression (Heck et al., 2012) and how the analysis of coefficients will be carried and explained in the following chapter.

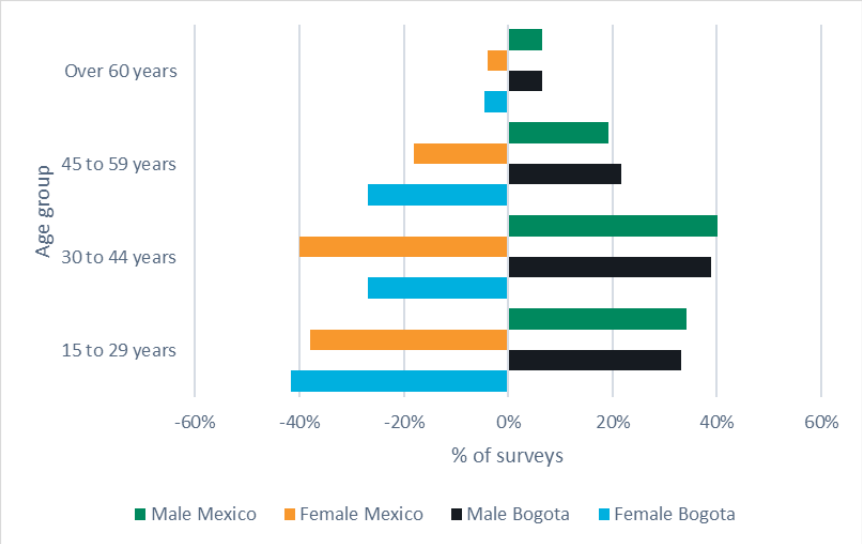
Chapter 4 – Analysis of Data and Results

4.1 Study areas and variables selection

As stated before, the primary data source that will be utilised for the analysis is the survey responses produced for the IDB in 2020. It is paramount to understand the nature and distribution of the gathered data used for this study and locate them geographically for better visualisation. The survey was divided into different sections comprising filter questions or general information, reference trip characterisation questions, the exercise of declared preferences, questions of perception and influence of TNC services, and complementary and related questions to the COVID 19 pandemic.

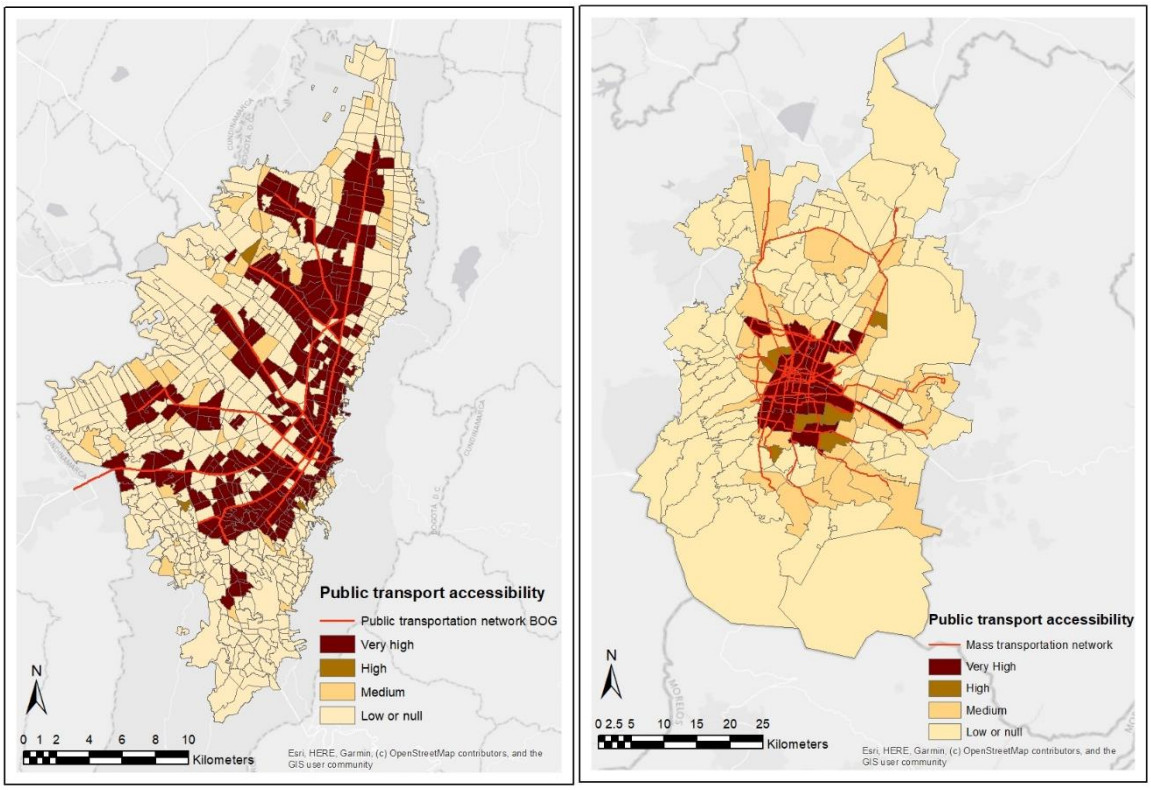
The observations for both cities presented a fairly similar distribution in terms of gender, where, of the 2,061 interviewed in Bogota, 1,051 are women (50.99%), and 1,010 are men (49.01%). Of the 2,006 interviewed in CDMX, 1035 are women (51.60%), and 971 are men (48.40%). Conversely, whilst the age group distribution is alike when making subdivisions by gender in CDMX, the sample in Bogota is less balanced (*Figure 5*). When analysing only the female sample, more individuals are counted in the age group of 15 to 29 years in Bogota and the age group of 30 to 44 years in CDMX.

Figure 5. Distribution by age group and gender of the sample



Moreover, to locate the data spatially, the areas of study are shown in maps alongside the public transportation network for each city in relation to the accessibility level for every spatial subdivision (*Map 1*). For the case of Bogota, the spatial boundaries utilised are Transportation Analysis Zones. For the case of CDMX, the analysis is done by districts.

Map 1. Accessibility levels in the areas of study of Bogota and CDMX



Public transport accessibility is distributed alongside the principal network in both cities. However, it can be seen that in CDMX, there is a cluster towards the centre due to a greater infrastructure of mass transportation in that area. This distribution also translates into a concentration of opportunities and services that affect people's travel patterns which will be noticed later in the analysis.

With a total of 49 questions, the raw dataset of the survey encompassed 499 initial outputs that could be considered possible variables. Nevertheless, insomuch as not all of the outputs are relevant to this study, a first narrowing to 48 variables was made by following the conceptual framework and the previous literature review, and the main classification can be seen in *Table 2*. (See *Appendix 1* for a complete description of the initially selected variables).

It is of importance to highlight that the framework is used to disaggregate and decompose the factors that can specify certain levels of ride-hailing use from an exclusion perspective. Notwithstanding, the nature of the survey allows us to explore some dimensions more comprehensively than others. This first selection accounts for more variables that characterised the individuals, their homes and their trips rather than the space or physical environment. Additionally, the variables indicating the generation of safety and trust (18 variables) and perception of the service (10 variables) accounts for more than half of the dataset.

Table 2. Set of initial variables selected by the conceptual framework

TSRE Dimensions	Features of (dis)advantage for ride-hailing	Variables
Socio-Economic	Intersection of social identities	Age, education level, main mode of transport, relationship with the head of the household
	Affordability	Socio-economic level, vehicles available in the house, range of income, mobile data plan, productive sector/occupation
Physical	Facilities and practices of vulnerable users	Willingness to walk to the station, ease to access TNC services
Geographical	Spatial Coverage	Destination city
Time-based	Temporal Coverage	Time of travel, walking distance to the station, travel reasons
Fear-based	Crime prevention and response	Perception questions, safety and trust questions
	Sexual violence and harassment prevention	
Space	Discrimination prevention and response	Perception questions (comfort and cleanliness)
From facilities	Policies/restrictions to travel with packages	Distance to a public transport station
	Policies/restrictions to travel in groups	Number of companions, number of children in the home, number of elderly in the home

Following the first selection of relevant variables, multicollinearity testing was performed. Whereas definitions of collinearity fluctuate among the literature, in this work, collinearity is characterised by two factors with a Product Moment Correlation Coefficient (PMCC) esteem of 0.7 or over (Mansley & Demsar, 2015). To dodge the elimination of factors due to coincidental collinearity, the testing with correlation matrices was done with factors within the same group or category and acknowledging that correlation does not necessarily indicate causation (Aldrich,1995). For instance, in the group of 'perception', the variable of the comfort of TNC services on one side and cleanliness on the other are qualitative alike and, hence, collinearity among these factors and others similar to them in the group of 'safety and trust' was recognised in both datasets. Exclusion of variables was conducted after measuring the variable's collinearity against the dependent variable.

Any endeavour to make a model verifiably concurs to handle the variable determination problem, keeping an equilibrium between, first, the aim to make the foremost thorough and precise model conceivable and, second, the aim to have the fewer possible variables. Ultimately, the latter will guarantee that the variable's coefficients are preserved significant and that analysis and eventual data collection efforts can be more succinct (Bursak et al., 2008). The initial step to affront this issue was applying forward

variable selection developed upon lowering the Akaike's Information Criterion (AIC) (See *Appendix 2*).

Subsequently, further criteria were needed to warrant inclusion. The Pearson chi-square test was used as an additional test of model fit since the complete set of remaining variables from the forward variable selection based merely on the AIC presented significant test results, indicating poor fit to the data. Allison (2014, p.10) describes the Pearson chi-square test alongside the deviance chi-square test as "testing whether there are any non-linearities or interactions" that are not included in the model. According to Allison (2012, p.68), if it is decided to re-specify the model to include non-linearities or interactions given significant test results, one should be selective and focus "only on those variables in which you have the greatest interest, or the greatest suspicion that something more might be needed". Hence, a forward variable addition was made again, and those which made the test results significant were excluded for a better fit to the model.

4.2 Models description and analysis

All of the above allowed the models in *Table 3* and *Table 5* to be built. As one would have expected, the majority of the variables explaining both models are coincident. Notwithstanding, the variables of education level and the main mode of transport are present in the Bogota model, unlike CDMX's, and are highly significant. Additionally, it is worth stressing the dominance of the perception and safety variables groups, accounting for 10 out of 19 variables in the Bogota model and 11 out of 19 in the CDMX model.

Statistical significance was found in both cases in the likelihood ratio chi-square test; then, it can be inferred that the full models represent a significantly better fit than the null models. After adding the predictors, the deviance is reduced by 410.463 in the Bogota model and 331.588 in the CDMX one. In the output, both the Pearson chi-square and Deviance chi-square tests are non-significant, suggesting well-fitting models. At the same time, taking into account the McFadden Pseudo R-Square, the model containing the full set of predictors exhibits an 11.3% improvement in fit relative to an intercept-only model in Bogota and an improvement of 9.8% in the case of CDMX.

Finally, *Table 4* and *Table 6* exhibit non-significant results of the test of parallel lines, suggesting that the assumption of proportional odds is met in both cases, although with a better slack in the Bogota model. Hence, the alternative of approaching multinomial logistic regression is discarded. Nonetheless, a comparison of the AIC of the PO model

against a multinomial logistic regression model was still made to determine which parameterisation results better fit the data. In both cases, the AIC for the PO model was smaller. Therefore, the preferred model seems to be the proportional odds model.

A more detailed explanation of the effects of each predictor on the dependent variable for each model following the conceptual framework will be done next, alongside the descriptive analysis of the provided data to further explore the presence of each variable in the models.

Table 3. Results of the ordinal logistic regression – Bogota

Parameter	Coefficients			
	β	Std. Error	Sig.	Exp(β)
Age	0.017	0.0048	<0.001***	1.017
Socio_Economic	-0.281	0.0568	<0.001***	0.755
Total_Time	-0.003	0.0008	<0.001***	0.997
Companions_Number	0.081	0.0441	0.067*	1.084
[Main_Mode=Car]	-0.541	0.2046	0.008**	0.582
[Main_Mode=Motor]	-0.501	0.3446	0.146	0.606
[Main_Mode=Scooter]	-0.849	1.0846	0.434	0.428
[Main_Mode=Bicycle]	-0.109	0.3752	0.772	0.897
[Main_Mode=Walking]	-0.583	0.4790	0.224	0.558
[Main_Mode=Digital Plat]	-2.071	0.3101	<0.001***	0.126
[Main_Mode=Taxi]	-1.273	0.4330	0.003**	0.280
[Main_Mode=TransMilenio]	-0.313	0.1448	0.031**	0.731
[Main_Mode=Bus]	0[a]			1.000
[Plan_cel=Yes]	-0.499	0.1320	<0.001***	0.607
[Plan_cel=No]	0[a]			1.000
Education	-0.229	0.0662	<0.001***	0.795
PerceptionTNC_r1_c1	-0.466	0.0982	<0.001***	0.628
PerceptionTNC_r2_c1	-0.050	0.1354	0.712	0.951
PerceptionTNC_r3_c1	-0.234	0.1180	0.047	0.792
PerceptionTNC_r7_c1	-0.133	0.1544	0.388	0.875
PerceptionTNC_r10_c1	-0.167	0.1286	0.195	0.846
Security_Trust_gen_9	0.180	0.0702	0.010**	1.197
Security_Trust_gen_10	-0.155	0.0995	0.120	0.857
Security_Trust_gen_11	-0.159	0.0961	0.099*	0.853
Security_Trust_gen_18	-0.354	0.0928	<0.001***	0.702
Security_Trust_gen_21	-0.334	0.1005	<0.001***	0.716
Vehicles_home_moto	-0.121	0.0567	0.033**	0.886
Distance_Walk	0.117	0.0540	0.031**	1.124
a. Set to zero because this parameter is redundant.				
Notes: Chi-Square for the full model: 410.463, p: 0.000; McFadden Pseudo R2 for the full model: 0.113; Pearson Chi-Square: 5990.838, p: 0.337; Deviance Chi-Square: 3230.473, p: 1.000; AIC: 3294.473. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1				

Table 4. Test of Parallel Lines - Bogota

Test of Parallel Lines[a]			
Model	-2 Log Likelihood	Chi-Square	Sig.
Null Hypothesis	3230.473		
General	3091.265	139.209	0.274
The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.			
a Link function: Logit.			

Table 5. Results of the ordinal logistic regression – CDMX

Parameter	Coefficients			
	β	Std. Error	Sig.	Exp(β)
Age	0.024	0.0049	<0.000***	1.024
Total_Time	-0.001	0.0007	0.167	0.999
[Plan_cel=Yes]	-0.588	0.1317	<0.000***	0.556
[Plan_cel=No]	0[a]			1.000
Distance_Walk	0.039	0.0469	0.408	1.040
Companions_Number	0.060	0.0447	0.179	1.062
PerceptionTNC_r1_c1	-0.418	0.0944	<0.000***	0.658
PerceptionTNC_r2_c1	-0.036	0.1207	0.764	0.964
PerceptionTNC_r3_c1	-0.051	0.1196	0.672	0.951
PerceptionTNC_r4_c1	-0.171	0.0973	0.079*	0.843
Security_Trust_gen_8	-0.508	0.0993	<0.000***	0.601
Security_Trust_gen_9	0.224	0.0815	0.006**	1.251
Security_Trust_gen_16	-0.071	0.1159	0.543	0.932
Security_Trust_gen_18	-0.241	0.0959	0.012**	0.786
Security_Trust_gen_19	-0.200	0.0909	0.028**	0.819
Security_Trust_gen_20	-0.313	0.0791	<0.000***	0.732
Security_Trust_gen_21	-0.140	0.0897	0.118	0.869
Vehicles_home_moto	-0.089	0.0444	0.046**	0.915
Socio_Economic	-0.180	0.0337	<0.000***	0.835
a. Set to zero because this parameter is redundant.				
Notes: Chi-Square for the full model: 331.588, p: 0.000; McFadden Pseudo R2 for the full model: 0.098; Pearson Chi-Square: 6042.416, p: 0.085; Deviance Chi-Square: 3329.242, p: 1.000; AIC: 3348.497. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1			

Table 6. Test of Parallel Lines - CDMX

Test of Parallel Lines[a]			
Model	-2 Log Likelihood	Chi-Square	Sig.
Null Hypothesis	3329.242		
General	3226.745	102.498	0.095
The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.			
a. Link function: Logit.			

4.2.1 Socio-economic dimension

As envisaged based on previous studies, social and demographic predictors are present in both models and are influential determinants of TNC services' adoption. The 'Age' coefficients are positive and significant, indicating that older females are less frequent ride-hailing users. Furthermore, the odds ratio indicates that for each unit increased on 'Age', the odds of a woman falling into a level of less frequency of use increases 1.7% in Bogota and 2.4% in CDMX. Again, it is worth noting that the female sample in Bogota was moderately younger, which could explain the slight difference in the odds ratio.

The 'Socio_Economic' variable was also a highly significant predictor in both models. The coefficients point out that those falling in a higher economic level are more frequent users, and the odds ratio of being a less frequent user decreases by a factor of 0.755 in Bogota and by 0.835 in Mexico City for each economic strata increased (coded from 1 to 8). Moreover, both models were better explained when adding the variable 'Security_Trust_gen_21', representing how much agree a woman is with the statement "If I could pay, I would always use the app-based transport services". Although not highly significant, the coefficients show that women who agree more with the statement are more prone to be frequent users.

Ultimately, among the predictors directly related to cost, the variable 'PerceptionTNC_r1_c1' is highly significant in both models. Given the coding of the perception questions where 1=Bad, 2=Neither bad nor good, and 3=Good, for each unit higher that women perceive the cost of application-based transport services, their odds ratio decreases by a significant factor of 0.658 from being less frequent users.

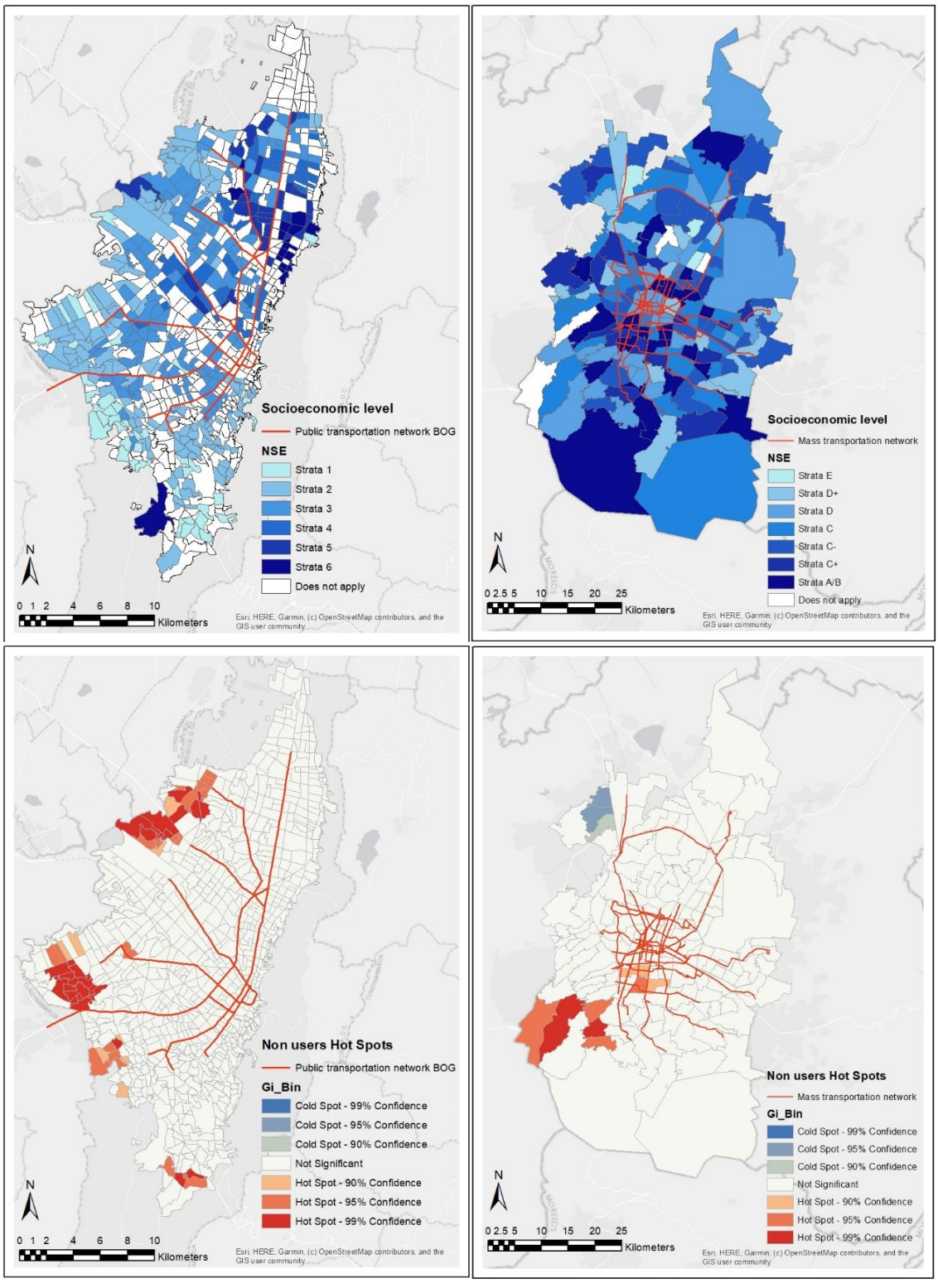
To confirm the mathematical projections, the data of the women interviewed in both cities were also analysed spatially (*Map 2*). Indeed, the socio-economic distribution also explained particular trends in the concentration of non-users with declared areas of higher and lower strata in both cities visualised via a Hot Spot analysis (Getis-Ord Gi*).

Multiple variables at the individual or micro level that are typically interrelated with socio-socioeconomic strata were also found in the models. For example, 'Education' is a highly significant variable in the Bogota model. For each higher degree that a woman achieved, her odds of being a less frequent user decrease by 26.9%. Curiously, this variable was not included in the CDMX model after the calibration process.

Likewise, not only women who had the opportunity to access higher education are more likely to be more frequent users, but also those who can access a mobile phone plan. For women who can get such a service, the odds of belonging to a category of less

frequent users is 0.556 times that for those who cannot. Once again, being a very significant predictor in both models.

Map 2. Up: Spatial distribution of socio-economic levels. Down: Non-users Hot Spots analysis



The importance of accessibility to the internet and technology on the dependent variable can also be remarkably appreciated through the presence of other independent factors belonging to the safety and trust group, especially in the CDMX model. 'Safety_Trust_gen_18', representing the level of agreement with the statement "Mobile apps are important for daily life", is a significant predictor in both models and even more for the one of Bogota. For each raw score increase in agreement with the importance of apps, the odds of being a less frequent user decrease by 21.4% for women in Mexico City and 29.8% for women in Bogota.

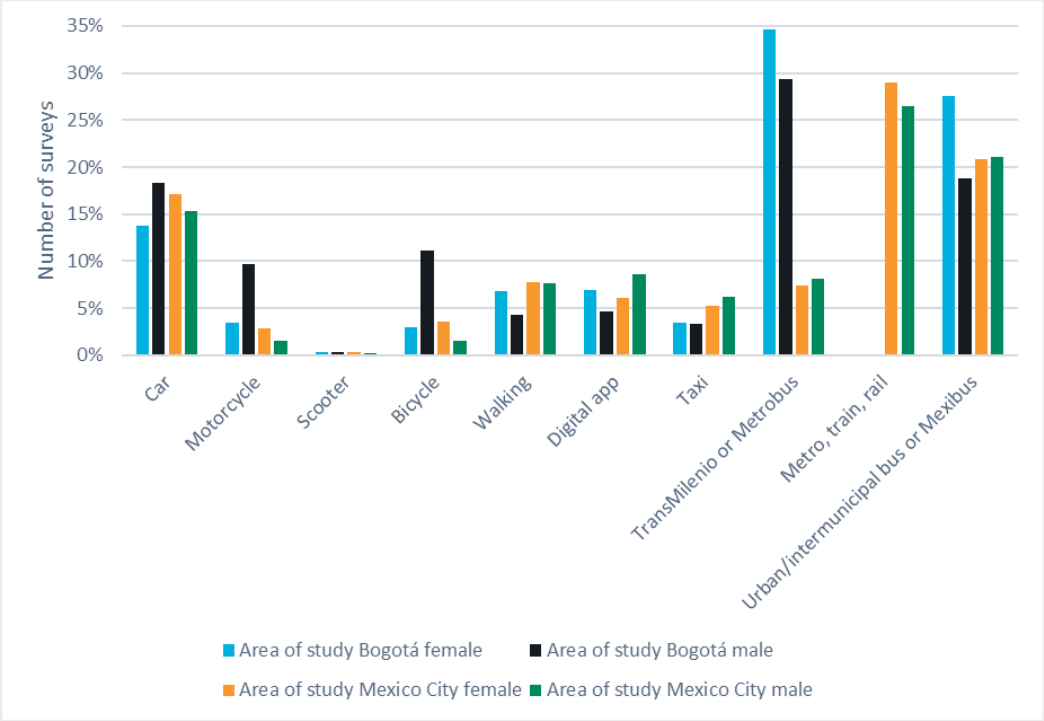
Additionally, in the CDMX model, other two similar predictors are present. 'Safety_Trust_gen_16' expressing the degree of conformity with the statement "Technology improved my daily life" provides better goodness of fit for the data, although non statistically significant. On the other hand, 'Safety_Trust_gen_19', reflecting the measure of agreement with the statement "I am a frequent user of electronic services (such as Spotify, Netflix, YouTube Music or Dropbox)", is a significant predictor, indicating that those women considering themselves as more frequent users of modern and electronic services are also more frequent users of ride-hailing.

Finally, two variables regarding the mode of transport can be encountered. 'Vehicles_home_moto' representing the existence of motorcycles in the home is a relatively significant predictor in both models. Interestingly, it indicates that more motorcycles in the homes means more likelihood of falling in a category of more frequent users. At the same time, 'Main_Mode', that shows which is the primary mode of transport during their most frequent trip, appears in the Bogota model. Nonetheless, only the ways of using the car, digital platforms, taxi and Transmilenio are significant, meaning that women using those modes are more likely to fall into a category of more frequent users than those that use the bus. Here, we note that women's particular use of motorcycles was non-significant in relation to bus users. What could be inferred from these two variables is that the presence of a motorcycle in their homes does not necessarily mean that women have access to it and need to find alternative modes of transport. Simultaneously, the convenience of motorcycle usage can be restrictive due to travel reasons, travelling with companions or carrying packages.

To further investigate the main mode of transport distribution, *Figure 6* shows the data separated by gender. There is high public transportation usage in both cities, although there are more women in Bogota using Transmilenio and buses. This might be due to the heavier use of cars, motorcycles and bicycles by men in the city, conversely to the

case of Mexico City, where females surpass the males in the use of the mentioned modes of transport.

Figure 6. Main modes of transport used in the most frequent trip

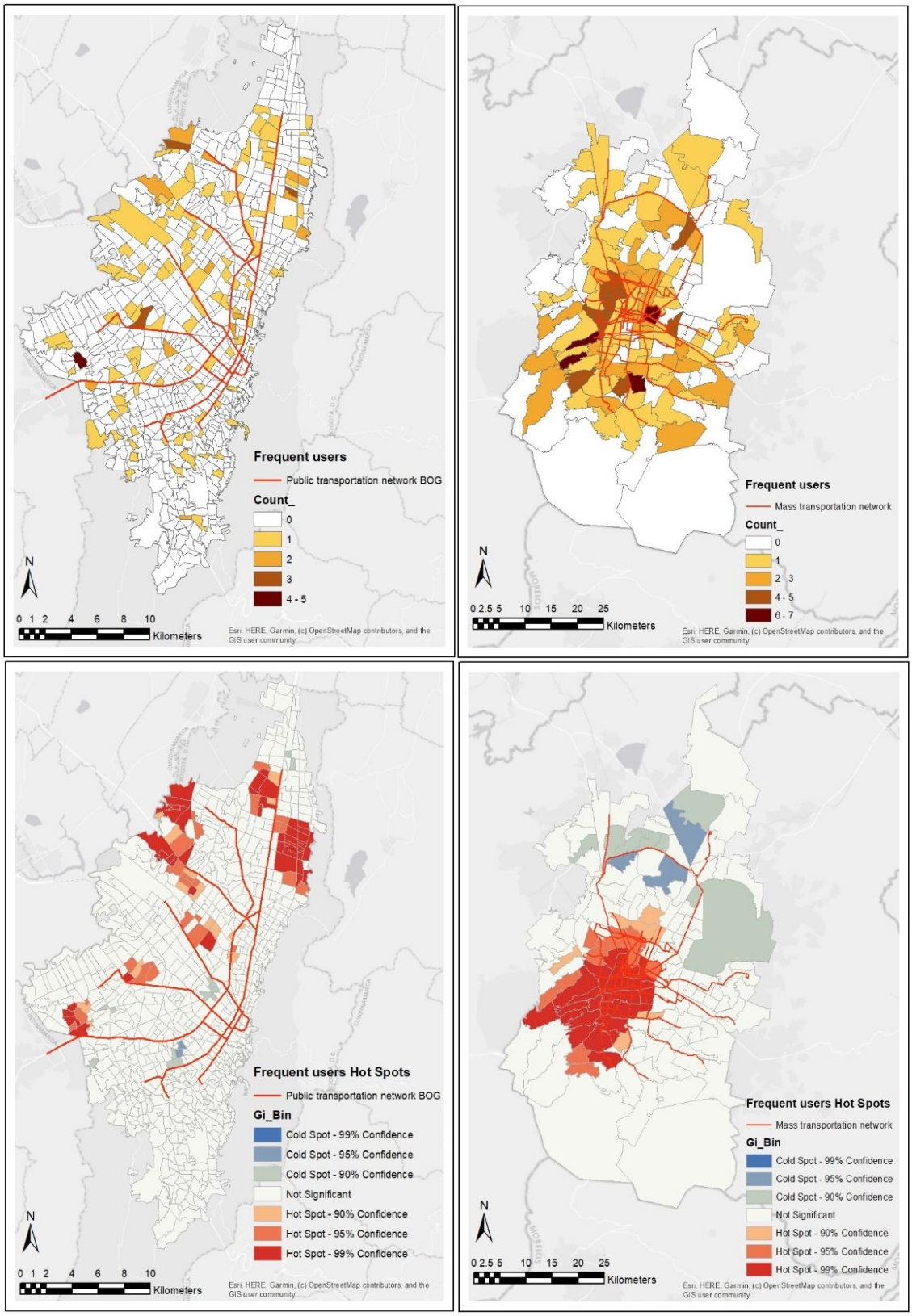


4.2.2. Geographical dimension

Regarding the data related to spatial isolation, the variable of 'Destination_City' was selected for the first set of variables following the framework. Still, it is not present in neither of the final models. Nevertheless, as saw in the previous dimension, interrelated factors in the transport process can cause multiple exclusions (Duran, 2019). In this sense, the spatial relationship with the economic dimension cannot be overlooked, as perceived in *Map 3,* where non-users presented a spatial clustering in the peripheries.

When analysing the frequent users geographically, the distribution of women who are the most frequent users in CDMX shows a concentration towards the centre and a distribution following the transport network in Bogota throughout the city. In the latter's Hot Spots Analysis, these are even more evident at the end of the principal mass transport network, highlighting the need for greater network coverage related to integration or feeder routes for mass public transport.

Map 3. Spatial distribution of frequent users. Down: Frequent users Hot Spots Analysis



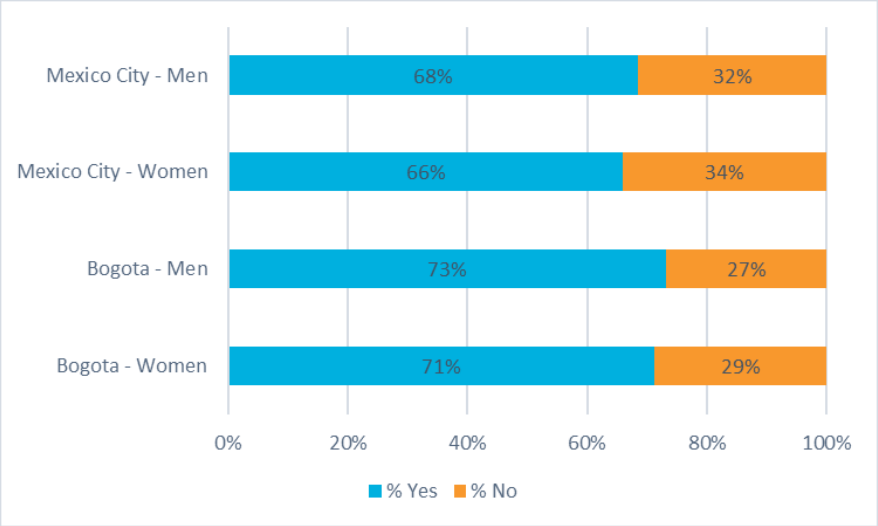
4.2.3 Physical dimension

In relation to physical barriers, 'PerceptionTNC_r10_c1' representing the impression towards "Ease to accessing the service" supports the explanation of the Bogota model, though it is non-significant. Therefore, in the absence of more specific questions in the survey regarding physical or even psychological/cognitive obstacles that could hinder access to transport, relation to other variables was examined.

The variable 'Willing_Walk_Station' was included in the first selection, considering that, other than time and safety, the willingness to reach the nearest station is affected by the condition of the built environment and individual capabilities. But, similarly to the case of geographical dimension, the variable was not present among the final predictors of the model.

However, when exploring the distribution of the data once again by gender (*Figure 7*), it can be observed that a more significant number of men interviewed are willing to walk to the nearest public transport station. Also, there is a greater willingness of those interviewed in Bogota than in CDMX to carry out such action. Even when accounting just for the most frequent ride-hailing users in each city, 60.85% of women in Bogota are willing to reach the public transport facilities, but only 53.65% of regular female users in CDMX are predisposed.

Figure 7. Willingness to walk to the nearest station



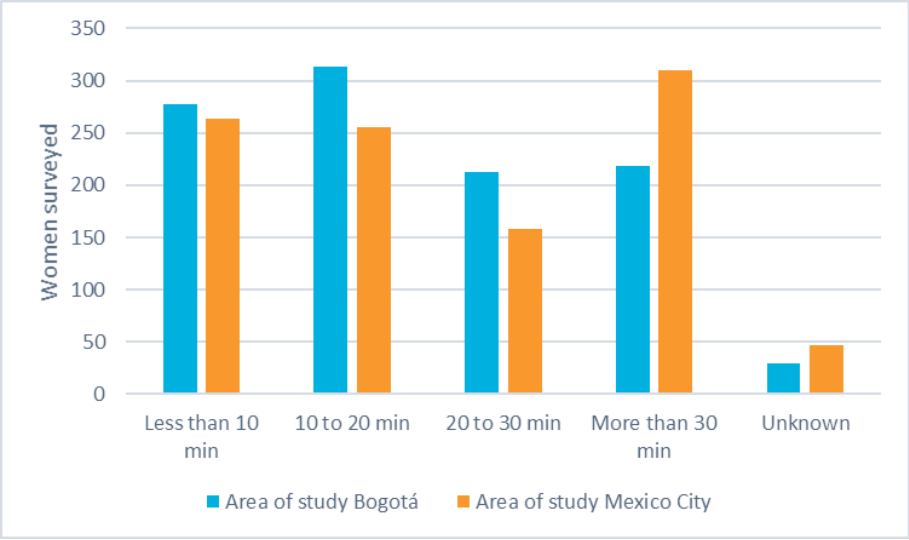
4.2.4 Time-based dimension

As stated before, the above variable encompassed sundry reasons for the individual to choose a particular mode of transport. Besides the built environment being more or less approachable by women in each city, there is also a strong relation with time and, consequently, distance.

The variable 'Distance_Walk', measuring the length in a range of minutes of the walk to reach the nearest mass transit station, is present in both models. Yet, it is only a significant predictor of the frequency of ride-hailing use in Bogota. Still, when the walking distance in time increases, the odds of falling into a category of less frequent users grow by 12.4% in Bogota and by 4% in CDMX.

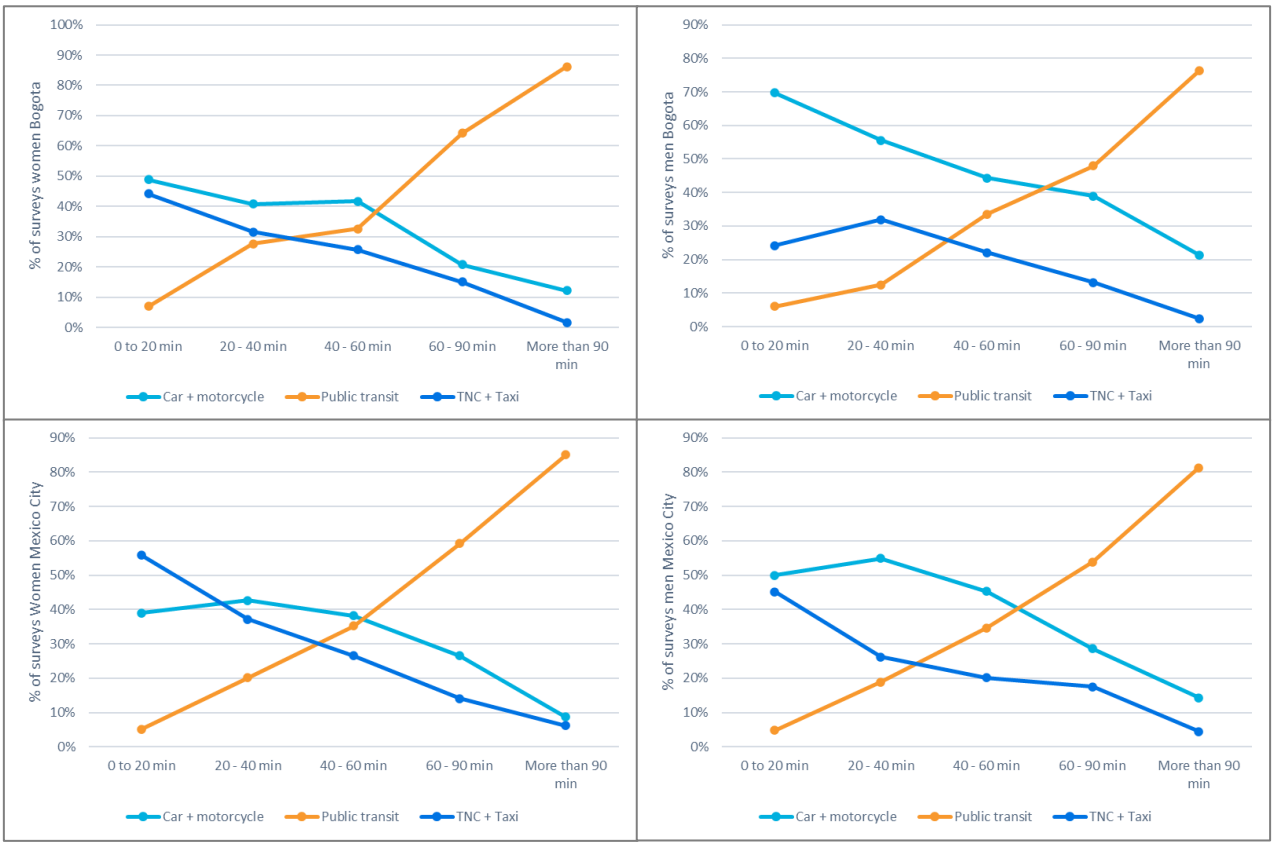
Moreover, when inspecting the answers of women in each city to the question of walking distance from their homes to the nearest mass transit station, a greater amount of women in Bogota stated that they have a close-by station, showing that these are within more than 30min to the houses of women living in CDMX, or even they do not know the distance in time to the stations (*Figure 8*).

Figure 8. Walking distance to the nearest station



In addition, 'Total_Time', containing the commute's total time in minutes, including walks and waiting periods, also contributed to delivering a better fit to the data in both cases. However, it is significant in the Bogota model alone. To explore the adoption of ride-hailing services to travel time in more depth for each context, *Figure 9* shows the use tendency of the type of transport with respect to travel time by gender, presenting a few dissimilarities, especially in short trips.

Figure 9. Travel time by mode of transport



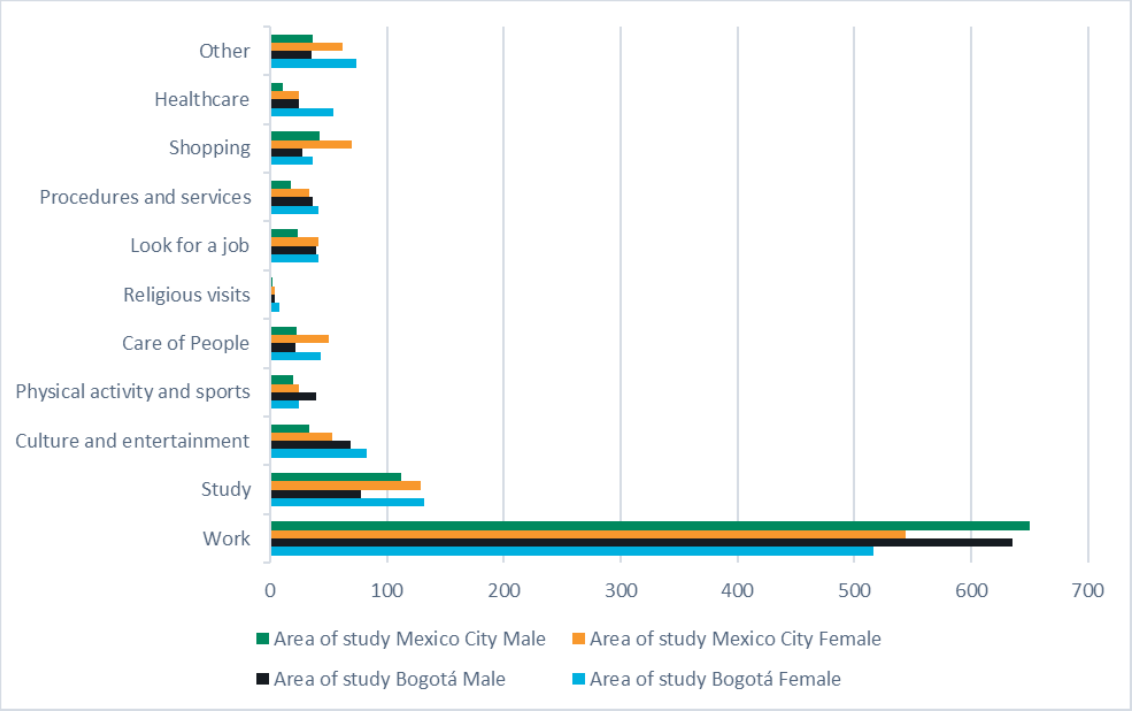
In Bogotá, a significant percentage of men make short trips (i.e., 0 to 20min) by car or motorcycle, while women use TNC or taxi service. This pattern is even more striking in the case of CDMX since a higher percentage of women choose TNC or taxi services over car, motorcycle or public transport when it comes to short trips. It is also observed that, in all cases, public transport is the most used mode for travel times that exceed 60min, which is likely due to cost's reasons.

The above suggests that TNC services primarily serve women's travel patterns in both cities. This is certainly confirmed by the presence of the variable 'PerceptionTNC_r2_c1' that describes the perception of "Reliability in travel times" of application-based transport services in both models, although not highly significant.

In order to acknowledge the temporal dimension of social exclusion, it is compulsory to consider also the "time patterns of people's lives and what these mean for their membership or non-membership of certain social categories" (Cass et al., 2005, p.543). In other words, the nature of households and their travel reasons/destinations might influence accessibility to transport modes. Thus, the main reasons for their most frequent trips were explored (*Figure 10*).

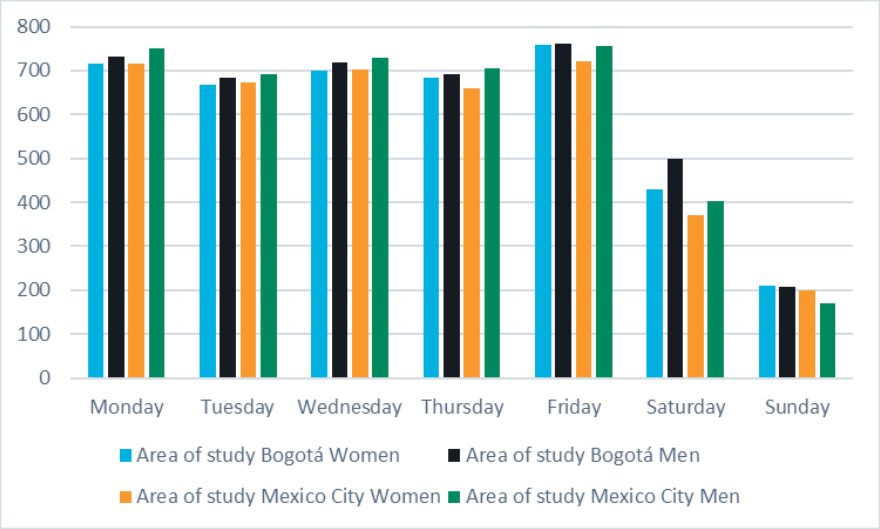
Even though work is the main reason for travel in the sample in general, a percentage difference between men and women can be observed in both cities. Among the rest of the motives, prominent variations by gender exist between the options involving the care of people, healthcare and shopping. Likewise, a considerable percentage selected the option "others", where the most recurrent response was "family visit", and only in the group of women from both cities was the reason for "taking their children to school" found among the answers.

Figure 10. Main reason for the most frequent trip



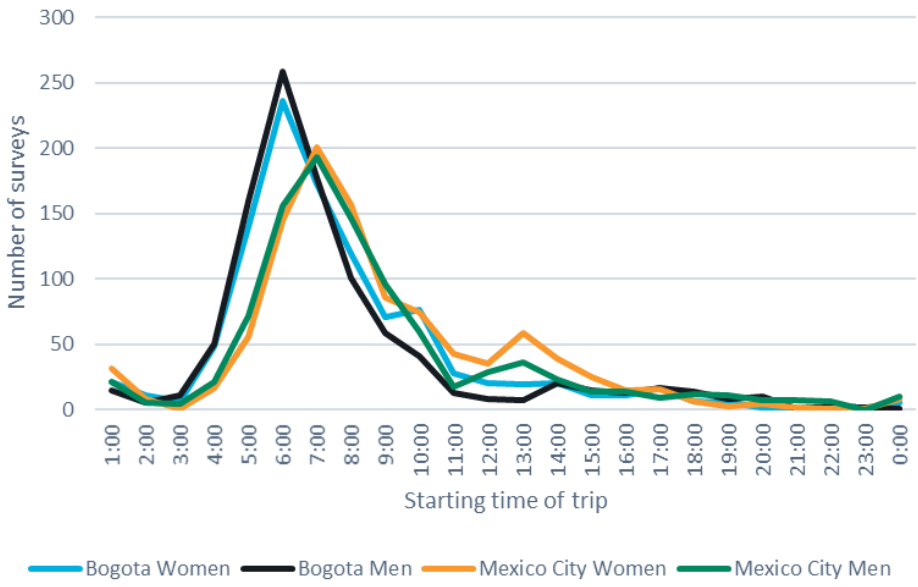
Nevertheless, women still make their most frequent trips during weekdays similarly to men (*Figure 11*). A particular difference can be noticed on Saturdays, this could be due to the fact that a higher number of women stated that their main reason for the most frequent trip is study rather than work and that care duties may be less on weekends. This presupposes that women are compelled to have more temporal flexibility, negotiating time and space, while men stick to a more conservative predictable or pendular schedule on the same days.

Figure 11. Days of the most frequent trip



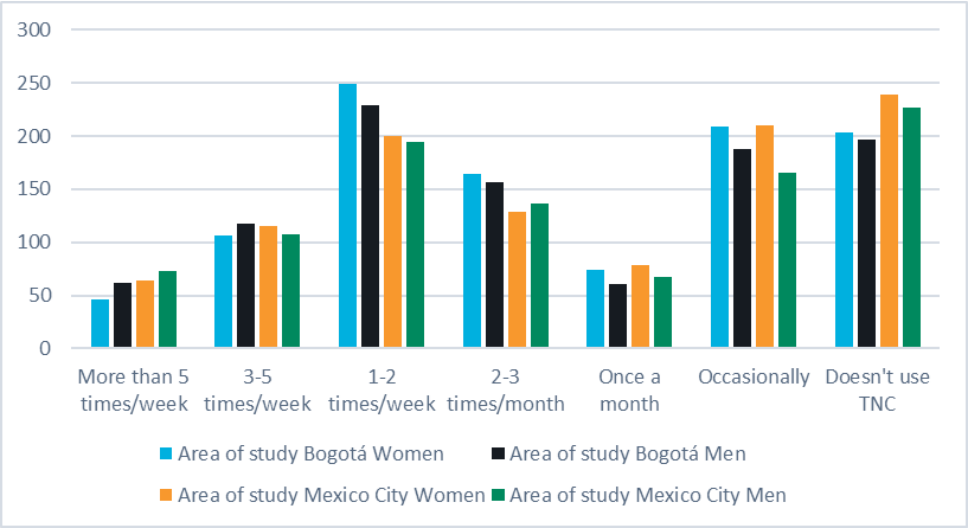
When looking at the starting time of their most frequent trip, this time is earlier in Bogota, which could be associated with the mode of transport or travel time. More importantly, women's trips present other peaks in both cities and are more distributed at different day hours, confirming that they arrange and organise more diverse trips (*Figure 12*).

Figure 12. Starting time of the trip



At the same time, the frequency of use of TNC services shows that men are more likely not to use these services, although a greater number of men than women stated that they use it very frequently (i.e. more than five times a week). Nonetheless, women use this mode of transportation more when it is or, relatively frequently (i.e. one or two times a week) or occasionally, particularly women in Bogota (*Figure 13*).

Figure 13. Frequency of use of TNC



4.2.5 Fear-based dimension

As indicated by the literature, several variables concerning the nature of individual fear that can restrict mobility and inclusion bolstered the goodness of fit of both models. But peculiarly, these were not exactly the same. In the case of CDMX,' PerceptionTNC_r4_c1', which represents the judgement of "Theft security" that TNC offers to the users, is a significant variable. Correspondingly, 'Safety_Trust_10', showing the agreement to the statement "I do not like waiting at the public transit station for fear of being a victim of robbery", is latent in the Bogota model without being a significant predictor.

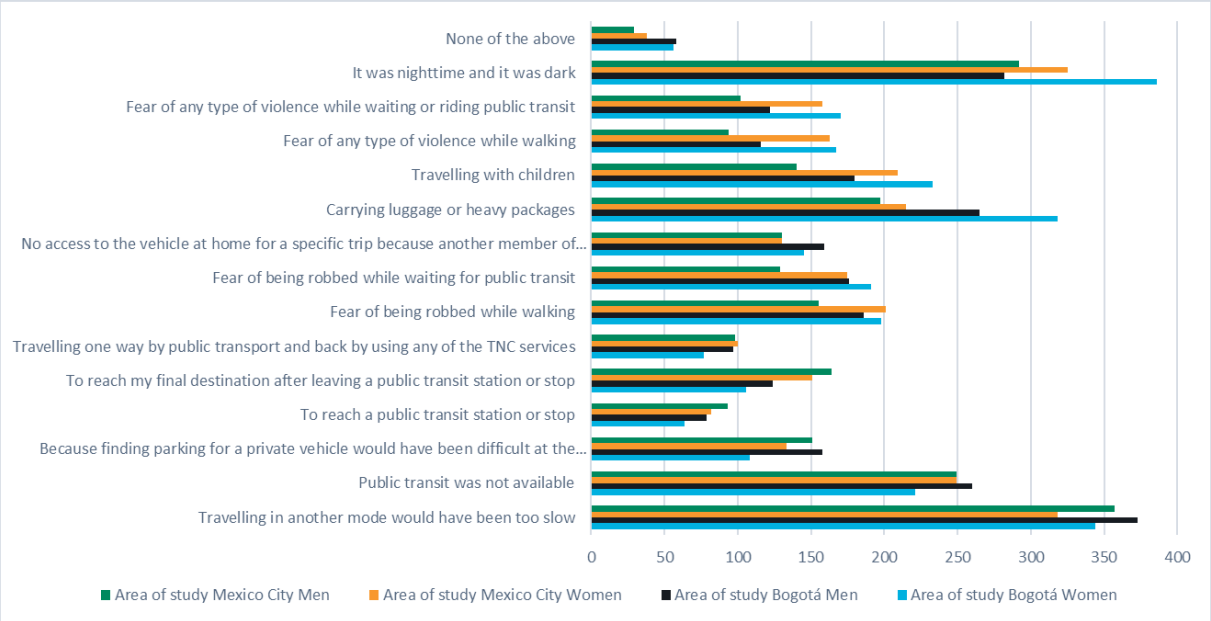
Besides the fear of crime, factors concerning violence and sexual abuse also predict the frequency of ride-hailing use. On the one hand, 'Safety_Trust_8' as the congruity with the statement "At night I prefer to use app-based services because I feel safer in case of sexual assault" is highly significant in the CDMX model. On the other hand, 'Safety_Trust_11' as the appreciation to "I do not like waiting at the mass transit station for fear of being a victim of some kind of violence or physical/sexual assault (examples: physical abuse, touching or being photographed without approval)" is a significant predictor at the 0.05 level of the probability of being a more frequent user in the Bogota model.

Fear of traffic accidents and illegality are added to the concerns that describe the frequency of use of ride-hailing in both models. 'Safety_Trust_9', in response to "I am afraid of using app-based services that are not legally approved", is equally significant at the 0.01 level. Nevertheless, the odds ratio of being a more frequent user changes by a

higher ratio in CDMX than in Bogota. The characteristic of people in CDMX choosing more traditional modes of on-demand transportation like the taxi than people in Bogota is also seen in *Figure 6*. Besides, the driver's professionalism (represented by 'PerceptionTNC_r3_c1') also contribute to the fitness but is a non-significant predictor for both models.

If the reasons for using TNC are directly explored in the survey's data by gender, the interviewees confirmed several assumptions generated through the models (*Figure 14*). The main reason for using these services for women in Bogota is that it was night and dark. Unlike the motives of men, where time or speed to reach their destination predominates. Furthermore, all the reasons in reference to fear present considerable differences by sex, and even more so in CDMX (e.g. fear of any type of violence while walking, while waiting or riding public transport, and fear of being robbed).

Figure 14. Travel reason in TNC



4.2.6 Space dimension

The single variable found in relation to space management was 'PerceptionTNC_r7_c1' in the Bogota model, showing that the perception of quality of comfort of TNC services helps explain the model but is non-significant. Still, it displays the relevance of the perception of the well-being offered by the space while using ride-hailing that is typically not provided by other models of transport in the city.

Ultimately, the nature of comfort can be related not only to the pleasant experience of trips but also to the opportunity of accessing important destinations in particular ways

that by using other alternatives would have felt unwelcome. The latter is further described in the next and last dimension.

4.2.7 From facilities dimension

One additional variable that facilitated the description of ride-hailing use frequency in both models was 'Companions_Number'. Its coefficients point out that the greater the number of companions in their most usual trip, the more probable to be a less frequent user. Nonetheless, it is statistically significant only in the Bogota model. The results for this variable could be because women use TNC services more occasionally, as saw in *Figure 13*, meaning that their most usual trip could depend on vehicle-sharing with ride-hailing serving for more specific and sporadic purposes to women.

The data relating to the question of whether they travelled with companions on their most recurring trips was directly broken down. And, it was certainly identified that there is a difference by gender since 45.02% of women and 35.53% of men travel with at least one companion in CDMX, and 44.34% of women and 42.57% of men travel with at least one companion in Bogota.

Yet, *Figure 14* also showed the difference by sex between the reasons chosen for TNC services use that could be a consequence of exclusion due to restrictions from other facilities (e.g. involving carrying packages and travelling with children or elderly). These differences are heavily more prevalent in one city than in another. In the case of travelling with children, the difference between men and women in choosing this reason is greater in CDMX. While when referring to carrying luggage or heavy packages, the percentage variation by gender is more prominent in Bogota.

4.3 Discussion by accessibility scales

At the micro-scale, social, demographic and economic variables such as age and socio-economic level were expected variables that were predicted several times by previous studies. Still, some interesting novel variables in the models included the individual importance given to technology and mobile apps to improve daily life. The level of education, age and socio-economic strata, in this regard, play a key role in literacy and capacity of engaging with technological tools required for ride-hailing use (Fu, 2020). The analysis indicates that it could be a higher relation of socio-economic level and higher education in Bogota than in CDMX. Furthermore, the possibility of accessing a mobile

phone plan for internet connectivity is a highly significant factor for ride-hailing use in both cities.

At the same time, an interesting common factor was related to the existence of motorcycles in the dwellings. It has been pointed out before that men have priority over private vehicles in Latin American houses (Montulet and Hubert, 2008), but strong power relations and sexual division have been revealed in both cities through the significant effect of this variable on the frequency of use of ride-hailing over more conventional ones that were also included.

Individual experiences, perceptions, and fear related to social exclusion at the micro-scale are somewhat inseparable from factors involving the meso-scale. Undoubtedly, the built environment and streets are more hostile for women resulting in their further exclusion of the public realm. The responses showed that more men than women are willing to walk to reach the nearest station in both cities, highlighting the disparities in the ease of to access the city. Conversely, women still use walking more as a main mode of transport than by bicycle, motorcycle, digital app or taxi, demonstrating that it could be the only option left to them as a means of mobility against their will. Moreover, the less predisposition of women in CDMX than those in Bogota to walk to the station can be strongly related to the fact that the latter offers these facilities within shorter distances and, therefore, less time. This has an observed effect on ride-hailing use since women in Mexico choose app-based services a lot more for short trips.

Total travel time was highly more significant in Bogota to predict the odds of being a more frequent user. This could be explained when seeing the average travel times for both cities, marked by a great difference between 97 minutes in Bogota versus 43 minutes in CDMX (Transport gender lab, n.d.). Hence, the lack of integral developments in the Colombian capital exacerbated the inaccessibility to the city and opportunities.

The main reasons for the most frequent trip and the travel reasons in TNC shed light on the traditional stereotype of the "Mobility of care" (Sánchez de Madariaga, 2013), to which women are condemned. The ease of accessing the service and the comfort it offers are identified as important determinants for the use of ride-hailing in these cities. Even though the data exhibited that women use public transportation more than men, they have little loyalty to it and would leave it easily if they could afford it, according to the models. Thus, ride-hailing is seen as a more appealing option over the poor-quality public transportation services, which are usually marked by overcrowding, stations with a lack of family restrooms with baby changers, and difficulty when bearing baby carriage and shopping bags. In addition, women require spaces for unique needs such as

breastfeeding. Some obstacles with the latter requirements include limited or difficult accessibility and the influx of users that restrict and even make it impossible to get on wagons and vehicles. The greatest difficulty of feeding the baby in transit lies in the lack of empathy, solidarity, and social awareness (Montoya-Robledo et al., 2021).

Both the models and the survey responses also exposed the fear-based inaccessibility that women experience in both regions. Fear of crime and violence were present in both models, and the variables' significance was already described above. Even though "high crime rates are seen in countries or areas with high poverty levels and low job availability" (World Population Review, 2021), which are shared characteristics among both regions, it was identified that there was a higher impact of these phenomena in CDMX. Evidently, as Mexico is considered one of the most violent and dangerous countries in the Americas, the sense of insecurity highly affects the mobility of its inhabitants. What is more, because most people are hesitant to report crimes, the crime rate is thought to be higher, and there is a general lack of trust in the authorities responsible for security. On the other hand, Colombia experienced a dramatic decrease in the homicide rate in the past two decades (El Nuevo Siglo, 2020).

Further women-exclusive inaccessibility is also due to sexual harassment or assault for women in both cities. The anguish of being attacked limits their mobility and transport distances to their local areas and neighbourhoods; therefore, a companion is often required or preferred while walking, waiting or travelling. In this sense, ride-hailing companies usually take the approach of positioning themselves in the face of local realities as a safer alternative. The rapid response of these private companies to identified issues and the perception of people towards them could also be seen during the recent Covid-19 pandemic, where trips in ride-hailing increased by 3% since they provided a sense of protection (International Transport Forum, 2021).

Lastly, at the macro-scale, geographical or spatial factors and infrastructure development were related to access to transport and ride-hailing use. Even though CDMX accounts for a greater range of mass rapid transport options such as metro, light rail and suburban train, these are not well distributed spatially across de metropolitan area. Frequent users of ride-hailing are more spread out in the case of Bogota, unlike in CDMX, since TNC serve mainly short trips. It seems that even the distances to reach a main mass transport network in CDMX are too long, which is translated into not using ride-hailing at all due to high costs. Consequently, the concentration of opportunities and facilities exacerbates the exclusion and inaccessibility of people living in the peripheries and could be linked with highly capitalistic practices.

The above can disproportionally affect women, specifically domestic workers in Bogota that account for a fair share of working adult females. According to Montoya-Robledo & Escovar-Álvarez (2020, pp.401), "one out of every thirteen adult women are paid domestic workers". The authors found that domestic workers have the longest commutes among all urban workers and face an underserved trip in terms of public transportation at both ends. Hence, specific movement patterns, especially in the case of women, need to be taken into account when developing infrastructure strategies and planning for a more just and accessible city.

Chapter 5 – Conclusions

5.1 Evaluation and recommendations

This research used two statistical models for a categorical dependent variable to investigate the predictors of the frequency of use of ride-hailing by women in two crucial Latin American metropolises. The value relied on the comparative analysis, which permitted the learning and exchanges between cities, providing significant insights compared to an individual study. Additionally, the inclusion of attitudinal variables regarding the perception of the services and generation of safety and trust, which is not usually considered in other analyses, provided unique insights and proved their importance in transport studies.

The results of the statistical modelling, data description, and spatial visualisation helped confirm the gender-based inequalities and patterns initially suggested by previous studies on the subject. To answer the first research question, what drives the demand for ride-hailing services among women are factors such as age, socio-economic level, total travel time, number of companions, availability of motorcycles in the dwelling, walking distance to the nearest mass transport station, access to a mobile phone plan, education, and main mode of transport. Among the variables regarding the perception of TNC services were found total cost, reliability in travel time, driver professionalism, comfort, ease to access the service and theft security. Finally, among the safety and trust variables, sense of life improvement by technology, the importance of mobile apps, frequency of use of electronic services, fear of illegality, fear of being robbed or sexually harassed while waiting in the transport station, fear of using other modes at night, and service appealing over different modes were encountered.

While most of the variables were the same or reasonably similar, the differences that can be highlighted are, first, the significance of factors between men and women involving fear of crime and violence that shed light on a local reality in CDMX, and second, the importance of comfort and ease to accessing the service among women in Bogota which appear to be more strongly affected by the "mobility of care" that hinder their right to access the city. Furthermore, time poverty seems to affect Colombian women more.

Personal safety and complex mobility are just two of the barriers that prevent women from taking advantage of the city's opportunities in the same way. Therefore, it is necessary to understand the problems through a comprehensive perspective at all scales to work effectively to promote inclusion and gender equity within transport accessibility.

To answer the second research question, it was clear that the framework of social exclusion was an effective tool for the variables selection that explained the frequency of use of ride-hailing by women in both cities. And, at the same time, offering a comprehensive approach for their analysis and comparison. Particularly the variables belonging to the socio-economic, time-based and fear-based dimensions influence the use of TNC services by females in these cities. Furthermore, the classification of the results by scales helped provide insights for a better understanding and possibilities of interventions at different levels to improve accessibility.

Additionally, other conclusions that could be shared are that, according to the data collected, women use public transport more than men in both cities, even though their trips may be shorter. It is important to evaluate the characteristics of ride-hailing services that can be incorporated into the resumption of demand for public transport after the Covid-19 pandemic. Among them, the availability of information in real-time, the flexibility of routes, and the ease of payment can be mentioned.

Moreover, strategies for more affordable and accessible internet plans should be considered to reduce the substantial inequalities present in Latin American cities. Likewise, particularly in Bogota, actions that decrease women and society's long average travel time need to be studied. Some examples could include increasing the frequency of passage of public transport, improving service during peak hours, and reviewing and improving drivers' recruitment and training processes. When comparing these times with CDMX, the main difference is the need for rapid transport systems, alongside the essential tackling of the concentration of opportunities and services or severely capitalistic policies.

In particular on violence and sexual harassment, policies with a gender perspective and programs that promote female participation should be designed and implemented, allocating financial, economic and human resources to implement and reinforce initiatives against gender-based violence in space and public transport. The finding that more women in CDMX use bicycles and motorcycles than men, unlike Bogota, is an example of possible results of the robust strategies to promote women's safety against sexual harassment that the Mexican city implemented. Finally, the institutionalisation of the gender perspective in mobility, through more specific regulations in macro laws and specific regulations, is vital for the measures to be maintained over time.

Finally, from a sustainable point of view, it is necessary to maintain and increase the current use of public transport by women. Even with current technology, well-financed public transport allows reducing emissions and more equitable connectivity in a city.

Keeping women in the systems, and satisfied, addressing their needs and especially their growing concerns about personal safety, is unquestionably part of the solution.

5.2 Limitations and future research

Even though the methodology contributes to the use of characteristics of individuals, targeted data collection that comprises all the aspects of each dimension of TRSE sufficiently can improve the deepening of analysis through these lenses. In this sense, built environment characteristics can be added to assess this relationship with the adoption of ride-hailing at the physical and space dimensions.

The models built were only with the gathered data for females, following the findings of previous studies in which the variable of gender is a determining factor for ride-hailing services use. However, other models for understanding the particularities of the determinants of ride-hailing use by men could offer greater insights and comparability.

Lastly, the inclusion of attitudinal and perception variables gave a quantitative value to the possible qualitative data. However, to have a more holistic vision and understanding, it would be necessary to delve more deeply into the motives and decision patterns of women's use of a type of transport. In addition, the survey did not have data on environmental preferences that may affect the adoption of TNC services.

References

Aldrich, J. (1995). Correlations Genuine and Spurious in Pearson and Yule. *Statistical Science*. 10(4).

Allison, P.S. (2012). *Logistic regression using SAS: Theory and application* (2nd ed). Cary, NC: SAS Institute.

Allison, P. D. (2014). *Measures of fit for logistic regression*. SAS Global Forum, Washington, DC. [Online] Available at: <: https://statisticalhorizons.com/wp-content/uploads/GOFForLogisticRegression-Paper.pdf > [Accessed 23 August 2021].

Alvarez, F., & Estrada, R. (2018). Mobility for accessibility. In CAF (Ed). Urban growth and access to opportunities: A challenge for Latin America. pp. 117-170.

BANCO INTERAMERICANO DE DESARROLLO (BID). (2016). El porqué de la relación entre género y transporte. [Online] Available at: <: https://publications.iadb.org/publications/spanish/document/El-porqu%C3%A9-de-la-relaci%C3%B3n-entre-g%C3%A9nero-y-transporte.pdf > [Accessed 10 July 2021].

Brown, A. (2018). Ridehail revolution: Ridehail travel and equity in Los Angeles. *UCLA*. Retrieved from ProQuest database.

Brown, A. & LaValle, W. (2020). Hailing a change: comparing taxi and ridehail service quality in Los Angeles. *Transportation*. 38(2), pp.1007-1031.

Brussel, M., Zuidgeest, M., Pfeffer, K., & van Maarseveen, M. (2019). Access or Accessibility? A Critique of the Urban Transport SDG Indicator. *ISPRS International Journal of Geo-Information*. 8(2), 67.

Buchardt, T., Le Grand, J. & Piachaud, D. (1999) Social Exclusion in Britain 1991-1995. Social Policy and Administration. 33(3), pp. 227-244.

Bursac, Z., Gauss, C., Williams, D. and Hosmer, D., 2008. Purposeful selection of variables in logistic regression. *Source Code for Biology and Medicine*. 3(1).

Bürkner, P.-C. & Vuorre, M. (2019). Ordinal regression models in psychology: A tutorial. *Advances in Methods and Practices in Psychological Science*. 2(1), pp.77–101.

Cass, N., Shove, E. & Urry, J. (2005). Social exclusion, mobility and access. *The Sociological review (Keele)*. 53(3), pp.539–555.

Church, A., Frost, M. & Sullivan, K. (2000). Transport and social exclusion in London. *Transport policy.* 7(3), pp.195–205.

De Souza Silva, L. A., de Andrade, M. O., & Maia, M. L. A. (2018). How does the ride-hailing systems demand affect individual transport regulation? *Research in Transportation Economics.*

Dias, F. F. et al. (2017). A behavioral choice model of the use of car-sharing and ride-sourcing services. *Transportation*, 33(6), pp. 1307–1323.

Dunckel-Graglia, A. (2014). Dissertation: Stony Brook University. Dr. Michael Kimmel – Dissertation Advisor Distinguished Professor, Department of Sociology.

Dunckel Graglia, A. (2016). Finding mobility: women negotiating fear and violence in Mexico City's public transit system. *Gender, Place Cult*. 23, pp. 623–630.

Duran, D. (2019). Dissertation: *Closing the gap: Linking social exclusion and accessibility with urban transport policies in Colombia*. University College London.

El Nuevo Siglo (2020). *América Latina concentra el 90% de las ciudades más violentas e inseguras* [Online] <https://www.elnuevosiglo.com.co/articulos/09-2020-latina-concentra-el-90-de-las-ciudades-mas-violentas-e-inseguras> [Accessed September 2, 2021].

England, K. (1991). Gender Relations and the Spatial Structure of the City. *Geoforum.* 22(2). pp. 135- 147.

Etminani-Ghasrodashti, R. & Hamidi, S. (2019). Individuals' Demand for Ride-hailing Services: Investigating the Combined Effects of Attitudinal Factors, Land Use, and Travel Attributes on Demand for App-based Taxis in Tehran, Iran. *Sustainability*. 11(20).

Fu, X.-mei, 2020. Does heavy ICT usage contribute to the adoption of ride-hailing app? *Travel Behaviour and Society*. 21, pp.101–108.

Hall, J. V. & Krueger, A. B. (2017). An analysis of the labor market for Uber's driver-partners in the United States. *ILR Review*. 71(3), pp. 705–732.

Hanson, S. (2010). Gender and mobility: new approaches for informing sustainability, *Gender, Place & Culture*. 17(1), pp. 5-23.

Heck, R.H., Thomas, S.L., & Tabata, L.N. (2012). Multilevel modeling of categorical outcomes using IBM SPSS. New York: Routledge.

International Transport Forum. (2021). *Transport Innovation for Sustainable Development: A Gender Perspective*. [Online] Available at: < https://www.itf-oecd.org/sites/default/files/docs/transport-innovation-sustainable-development-gender.pdf > [Accessed September 3, 2021].

Jones, P. & Lucas, K. (2012). The social consequences of transport decision-making: Clarifying concepts, synthesising knowledge and assessing implications. *Journal of Transport Geography*. 21, pp. 4-16.

Kenyon, S., Lyons, G. & Rafferty, J. (2002). Transport and social exclusion: investigating the possibility of promoting inclusion through virtual mobility. *Journal of Transport Geography*. 10(3), pp. 207-219.

Knecht, A. (2020). Dissertation: *Women-only transportation modes in Mexico City: The emergence of new platforms for feminist activism*. University College London.

Law, R. (1999). Beyond 'women and transport': towards new geographies of gender and daily mobility. *Progress in Human Geography*. 23(4), pp. 567–588.

Levy, C. (2013) Travel choice reframed: "deep distribution" and gender in urban transport. *Environment and urbanisation.* 25(1). pp. 47-63.

Levy, C. & Dávila, J. (2017). Planning for mobility and Socio-Environmental Justice: The case of Medellín, Colombia. In Environmental Justice and Urban Resilience in the Global South, pp. 1-3017.

Linkvist Scholten, C. & Joelsson, T. (eds) (2019). Integrating Gender into Transport Planning. From One to Many Tracks. Switzerland: Palgrave Macmillan.

Liu, X., O'Connell, A.A. & Koirala, H. (2011). Ordinal regression analysis: Predicting mathematics proficiency using the continuation ratio model. *Journal of Modern Applied Statistical Methods*. 10(2), pp. 513–527.

Lubitow, A., Abelson, M.J. & Carpenter, E. (2020). Transforming mobility justice: Gendered harassment and violence on transit. *Journal of Transport Geography*. 82. pp. 1-7.

Lucas, K. (2012). Transport and social exclusion: Where are we now? *Transport Policy*. 20, pp. 105-113.

Mansley, E., & Demšar, U. (2015). Space matters: Geographic variability of electoral turnout determinants in the 2012 London mayoral election. *Electoral Studies*. 40, 322-334.

Marquet, O. (2020). Spatial distribution of ride-hailing trip demand and its association with walkability and neighborhood characteristics. *Cities*, 106.

Montoya-Robledo, V. et al. (2021). "¿Y ahora cómo alimento a mi bebé?": Cabinas de lactancia para trabajadoras y usuarias del transporte público. *Moviliblog*. [Online] Available at: <https://blogs.iadb.org/transporte/es/y-ahora-como-alimento-a-mi-bebe-cabinas-de-lactancia-para-trabajadoras-y-usuarias-del-transporte-publico/> [Accessed September 5, 2021].

Montoya-Robledo, V. & Escovar-Álvarez, G., (2020). Domestic worker' commutes in Bogotá: Transportation, gender and social exclusion. *Transportation Research Part A: Policy and Practice*. 139, pp.400–411.

Montulet, B. & Hubert, M. (2008). Travelling with children in Brussels? A sociological study of experiences of time and the use of modes of transport. *Brussels Studies*. 15, pp. 1–14.

ONU Mujeres (2017). Diagnóstico sobre la violencia contra las mujeres y las niñas en el transporte público de la Ciudad de México. Programa global ciudades y espacios públicos seguros para mujeres y niñas. [Online] Available at: < https://mexico.unwomen.org/es/digiteca/publicaciones/2017/03/diagnostico-ciudades-seguras> [Accessed August 5, 2021].

Osborne, J. (2017). Simple Linear Models With Polytomous Categorical Dependent Variables: Multinomial and Ordinal Logistic Regression. In: Regression & Linear Modeling: Best Practices and Modern Methods, Thousand Oaks, CA: SAGE Publications, Inc pp. 133-156.

Oviedo, D., Saud, V., Rodríguez M., Pinto, A. M., Paez, D., Ortiz, M. A., & Bocarejo, J.P. (2017). *La bicicleta: Vehículo hacia la equidad: Recomendaciones para la equidad, el acceso e inclusión social en la promoción del uso de la bicicleta en América Latina y el Caribe.* In IDB Publication.

Oviedo, D., Scholl, L., & Scorcia, Y. (2021). Ride-hailing and transport-related social exclusion: Qualitative analysis of practices and implications. *Unpublished.*

Páramo, P. & Burbano, A. (2011). Género y especialidad: análisis de factores que condicionan la equidad en el espacio público urbano. *Universitas Psychologica*. 10(1), pp. 61-70.

Pavlovskaya, M., Gerrard, S. & Aure, M. (2018). Introduction: guest editorial for special issue 'gender and im(mobilities). *Gender, Place & Culture*. 25(8), pp.1115-1120.

Rayle, L., Dai, D., & Chan, N. (2016). Just a better taxi? A survey-based comparison of taxis, transit, and ridesourcing services in San Francisco. *Transport Policy,* 45, pp. 168–178.

Rozas, P. & Salazar, L. (2015). Violencia de género en el transporte público: una regulación pendiente. Comisión Económica para América Latina y el Caribe de las Naciones Unidas (CEPAL).

Sánchez de Madariaga, I. (2013). "The mobility of care: Introducing new concepts in urban transportation", in Fair Shared Cities. The Impact of Gender Planning in Europe, Ashgate, New York.

Social Exclusion Unit. (2003). Making the connections: Final report on Transport and Social Exclusion. Office of the Deputy Prime Minister, London.

Soto Villagrán, P. (2012). El Miedo de Las Mujeres a la Violencia en la Ciudad de México. Una Cuestión de Justicia Espacial. *Revista INVI.* 27(75). pp.145-169.

Steer. (2020). Encuestas de uso de TNC en Medellín, Bogotá y Ciudad de México. Informe 2: Informe de diseño, planeación y desarrollo de la encuesta sobre uso del TNC

Stuart, L. (2021). *Why women need to be involved in transport planning*. [online] Building. Available at: <https://www.building.co.uk/comment/why-women-need-to-be-involved-in-transport-planning/5112441.article> [Accessed 17 July 2021].

Transport gender lab (TGL). (n.d.) Available at: <https://tglab.iadb.org/en/cities> [Accessed 15 July 2021].

Uber. (2021). About us: We ignite opportunity by setting the world in motion. [online] Available at: <https://www.uber.com/en-CA/about/ > [Accessed 15 July 2021].

Uber Mexico. (2021). *La nueva función 'Ellas' permite a socias conductoras viajar exclusivamente con usuarias mujeres | Uber Newsroom.* [online] Uber Newsroom. Available at: <https://www.uber.com/es-MX/newsroom/la-nueva-funcion-ellas-permite-

a-socias-conductoras-viajar-exclusivamente-con-usuarias-mujeres/> [Accessed 19 July 2021].

UN-Habitat. (2018). Tracking Progress Towards Inclusive, Safe, Resilient and Sustainable Cities and Human Settlements. [Online] Available at: < https://unhabitat.org/sites/default/files/2019/05/sdg_11_synthesis_report_web2_0.pdf> [Accessed 11 July 2021].

Wakabayashi, B. (2018). *Former Uber engineer's lawsuit claims sexual harassment*. [online] The New York Times. Available at: < https://www.nytimes.com/2018/05/21/technology/uber-sexual-harassment-lawsuit.html> [Accessed 18 July 2021].

Wang, M. & Mu, L. (2018). Spatial disparities of Uber accessibility: An exploratory analysis in Atlanta, USA. *Computers, Environment and Urban Systems*, 67, pp.169-175.

World Population Review. (2021). Crime Rate by country 2021. [Online] Available at: https://worldpopulationreview.com/country-rankings/crime-rate-by-country [Accessed 4 September 2021].

Young, M. & Farber, S. (2019). Ride-hailing platforms are shaping the future of mobility, but for whom? *OSF Preprints pz7fk*, Center for Open Science.

Yu, H. & Peng, Z. (2019). Exploring the spatial variation of ridesourcing demand and its relationship to built environment and socioeconomic factors with the geographically weighted Poisson regression. *Journal of Transport Geography*, 75, pp.137-163.

Appendices

Appendix 1 – Description of initial selected variables

N	Variable Type	Variable Code	Variable Label	Description/Question
1	number		Age	Age of the person
2	coded	1=D+	Socio_Economic	Socioeconomic status of the person
		2=D		
		3=E		
		4=C		
		5=C-		
		6=C+		
		8=A/D		
3	coded	1=Less than 10 min walk	Distance_Walk	How long walking distance is the nearest mass transit station to your home?
		2=Between 10 and 20 min walk		
		3= Between 20 and 30 min walk		
		4= more than 30 min walk		
4	coded	1=Yes	Willing_Walk_Station	Before the COVID 19 pandemic (January and February), were you willing to walk from your home to the mass transit station closest to your home for a trip?
		2=No		
5	coded	1=More than 5 times per week	Frequency_Of_Use	Before the COVID 19 pandemic (January and February), how often did you use the Uber, Beat, Cabify, Didi, Indriver and Picap services?
		2=Between 3 and 5 times per week		
		3=Between 1 and 2 times per week		
		4=Between 2 and 3 times per week		
		5=Once a moth		
		6=Very occasionally		
		7=Do not use		

6	coded		Destination_City	In which city does the route of your most frequent trip end?
7	coded	1=Work	Travel_Reasons	What was the main reason for your most frequent trip in a typical week before the COVID 19 pandemic (January and February)?
		2=Study		
		3=Culture and entertainment		
		4=Physical activity and sports		
		5=Care of people (Accompaniment to children, the elderly or people with some type of disability)		
		6=Religious activities		
		7=Job searching		
		8=Procedures and services		
		9=Shopping		
		10=Healthcare		
		11=Others		
8	coded	1=AM	Start_Time_AM	What time did you start this journey from home?
		2=PM		
9	number		Total_Time	Total time of trip including waiting and/or walks (min)
10	coded	1=Car	Main_Mode	What was the mode in which you covered the greatest distance on the journey you just described?
		2=Motorcycle		
		3=Scooter		
		4=Bicycle		
		5=Walking		
		6=Digital Platform (Uber, Cabify, Didi,etc)		
		7=Taxi		
		8=TransMilenio		
		9=Bus (SITP, SITP Provisional)		
		10=Trolley car		
		11=Cable car		

		12=Metroplus		
		13=Metro		
		14=Suburban train		
		15=Light train		
		16=Metrobus		
		17=Mexibus		
		18=Urban or intermunicipal bus		
		19=Would not have made the trip		
		20=Do not remember		
11	coded	1=Did not travel with companion	Companions_Number	Number of companions with whom you made the trip
		2=1 companion		
		3=2 companions		
		4=3 companions		
		5=4 companions		
		6=More than 4 companions		
12	coded	1=Disagree	Security_Trust_gen_7	Knowing my real-time location while using app-based services makes me feel safe
		2=Neither disagree nor agree		
		3=Agree		
13	coded	1=Disagree	Security_Trust_gen_8	At night I prefer to use app-based services because I feel safer in case of sexual assault
		2=Neither disagree nor agree		
		3=Agree		
14	coded	1=Disagree	Security_Trust_gen_9	I am afraid of using app-based services that are not legally approved
		2=Neither disagree nor agree		
		3=Agree		
15	coded	1=Disagree	Security_Trust_gen_10	I do not like waiting at the public transit station for fear of being victim of robbery
		2=Neither disagree nor agree		
		3=Agree		
16	coded	1=Disagree	Security_Trust_gen_11	I do not like waiting at the mass transit station for fear of being victim of some

		2=Neither disagree nor agree 3=Agree		kind of violence or physical sexual assault (examples: physical abuse, touching or being photographed without approval)
17	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_12	I do not like waiting at the mass transit station for fear of being victim of some kind of violence and/or verbal sexual abuse (examples: slurs or obscene comments)
18	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_13	I do not walk to the nearest public transit station for fear of being robbed
19	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_14	I do not walk to the nearest public transit station for fear of being sexually abused
20	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_15	I do not trust the pricing of the transport services that are not app-based
21	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_16	Technology improved my daily life
22	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_17	I like being updated in terms of technology
23	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_18	Mobile apps are important for daily life
24	coded	1=Disagree 2=Neither disagree nor agree 3=Agree	Security_Trust_gen_19	I am a frequent used of electronic services (such as Spotify, Netflix, YouTube Music or Dropbox)
25	coded	1=Disagree	Security_Trust_gen_20	

		2=Neither disagree nor agree		I prefer using app-based services even if they are more expensive
		3=Agree		
26	coded	1=Disagree	Security_Trust_gen_21	If I could pay, I would always ise the app-based transport services
		2=Neither disagree nor agree		
		3=Agree		
27	coded	1=Disagree	Security_Trust_gen_22	With the current offer of app-based services for transport it is not necessary to own a vehicle
		2=Neither disagree nor agree		
		3=Agree		
28	coded	1=Disagree	Security_Trust_gen_23	I do not trust the drivers of app-based services for fear of them being criminals
		2=Neither disagree nor agree		
		3=Agree		
29	coded	1=Disagree	Security_Trust_gen_24	Being able to share the details of my trip with someone else while using another app makes me feel safer (examples: WhatsApp, text messages)
		2=Neither disagree nor agree		
		3=Agree		
30	coded	1=Bad	PerceptionTNC_r1_c1	Total cost (affordability) of the trip
		2=Neither bad nor good		
		3=Good		
31	coded	1=Bad	PerceptionTNC_r2_c1	Reliability in travel time
		2=Neither bad nor good		
		3=Good		
32	coded	1=Bad	PerceptionTNC_r3_c1	Driver professionalism
		2=Neither bad nor good		
		3=Good		
33	coded	1=Bad	PerceptionTNC_r4_c1	Theft security
		2=Neither bad nor good		
		3=Good		
34	coded	1=Bad	PerceptionTNC_r5_c1	Safety against traffic accidents
		2=Neither bad nor good		

		3=Good		
35	coded	1=Bad 2=Neither bad nor good 3=Good	PerceptionTNC_r6_c1	Security against any type of sexual violence and/or sexual harassment
36	coded	1=Bad 2=Neither bad nor good 3=Good	PerceptionTNC_r7_c1	Comfort
37	coded	1=Bad 2=Neither bad nor good 3=Good	PerceptionTNC_r8_c1	Cleanliness
38	coded	1=Bad 2=Neither bad nor good 3=Good	PerceptionTNC_r9_c1	Ease of transferring to other modes
39	coded	1=Bad 2=Neither bad nor good 3=Good	PerceptionTNC_r10_c1	Ease of accessing the service
40	number		Children	How many children 5 years and younger live in your household?
41	number		Elderly	How many people over 65 live in your household?
42	coded	1=I am the head of the household 2=Head of household's partner 3=Son/Daughter 4=Other	Relationship_Household	What is your relationship with the head of the household?
43	coded	1=Yes 2=No	Plan_cel	Do you have a data plan on your cell phone?
44	number		Vehicles_home_car	Number of cars that you have available in your home for your daily mobility
45	number		Vehicles_home_moto	Number of motorcycles that you have available in your home for your daily mobility

46	coded	1=Employee	Occupation_Sector	What was your main occupation <b> <i> before the COVID 19 pandemic (months of January and February)
		2=Employer		
		3=Independent worker		
		4=Student		
		5=Home work		
		6=Unemployed		
		7=Pensioner		
		8=Other		
47	coded	1=Primary School	Education	What is the highest level of education you have completed?
		2=Secondary School		
		3=Technical		
		4=University/professional		
		5=Graduate/postgraduate		
		6=None of the above		
48	coded	1=Between $0 and $500,000	Income_Level	What was your household's monthly income level in the last 6 months?
		2=Between $500,000 and $1,000,000		
		3=Between $1,000,000 and $2,000,000		
		4=Between $2,000,000 and $3,000,000		
		5=Between $3,000,000 and $4,000,000		
		6=Between $4,000,000 and $5,000,000		
		7=Between $5,000,000 and $6,000,000		
		8=More than $ 6,000,000		
		9=Less than $5,400		
		10=Between $5,401 and $7,400		
		11=Between $7,401 and $9,400		
		12=Between $9,401 and $11,400		
		13=Between $11,401 and $13,400		
		14=Between $13,401 and $15,400		
		15=Between $15,401 and $17,400		

		16=Between $17,401 and $19,400		
		17=Between $19,401 and $21,400		
		18=Between $21,401 and $23,400		
		19=Between $23,401 and $25,400		
		20=Between $25,401 and $27,400		
		21=Between $27,401 and $30,000		
		22=More than $30,001		
		23=Did not have income		
		24=Do not want to answer		

Appendix 2 – Variables selection process

Variable selection process Bogota model			
AIC value	Added Variable (AIC criterion)	Eliminated Variable (AIC Criterion)	Eliminated Variable (Pearson Coef. Criterion)
3647.669	Age, Total_Time, Socio_Economic		
3703.769		Willing_Walk_Station	
3727.318		Destination_City	
3707.251		Travel_Reasons	
3668.699		Start_Time_AM	
3536.949	Companions_Number		
3487.248	Main_Mode		
3451.160	Plan_cel		
3459.901		Elderly	
3448.794	Relationship_Household		Relationship_Household
3440.445	Occupation_Sector		Occupation_Sector
3434.245	Education		
3350.387	PerceptionTNC_r1_c1		
3336.362	PerceptionTNC_r2_c1		
3327.934	PerceptionTNC_r3_c1		
3326.490	PerceptionTNC_r4_c1		PerceptionTNC_r4_c1
3327.504		PerceptionTNC_r5_c1	
3327.243		PerceptionTNC_r6_c1	
3325.725	PerceptionTNC_r7_c1		
3327.553		PerceptionTNC_r8_c1	
3326.330		PerceptionTNC_r9_c1	
3325.503	PerceptionTNC_r10_c1		
3327.241		Children	
3323.450	Income_Level		Income_Level
3311.157	Safety_Trust_gen_7		Safety_Trust_gen_7
3269.452	Safety_Trust_gen_8		Safety_Trust_gen_8
3264.278	Safety_Trust_gen_9		
3261.727	Safety_Trust_gen_10		
3261.391	Safety_Trust_gen_11		
3262.124		Safety_Trust_gen_12	
3263.387		Safety_Trust_gen_13	
3259.877	Safety_Trust_gen_14		Safety_Trust_gen_14
3261.589		Safety_Trust_gen_15	
3245.673	Safety_Trust_gen_16		Safety_Trust_gen_16
3247.596		Safety_Trust_gen_17	
3244.969	Safety_Trust_gen_18		
3242.845	Safety_Trust_gen_19		Safety_Trust_gen_19
3223.185	Safety_Trust_gen_20		Safety_Trust_gen_20
3222.293	Safety_Trust_gen_21		
3220.931	Safety_Trust_gen_22		Safety_Trust_gen_22
3222.789		Safety_Trust_gen_23	

3222.577		Safety_Trust_gen_24	
3219.491	Vehicles_home_car		Vehicles_home_car
3216.541	Vehicles_home_moto		
3215.617	Distance_Walk_Station		

Variable selection process CDMX model			
AIC value	Added Variable (AIC criterion)	Eliminated Variable (AIC Criterion)	Eliminated Variable (Pearson Coef. Criterion)
3601.278	Age, Total_Time, Socio_Economic		
3567.047	Distance_Walk		
3572.984		Willing_Walk_Station	
3572.494		Destination_City	
3724.636		Travel_Reasons	
3704.551		Start_Time_AM	
3562.086	Companions_Number		
3473.540	Main_Mode		Main_Mode
3436.207	Plan_cel		
3440.215		Elderly	
3445.909		Relationship_Household	
3417.701	Occupation_Sector		Occupation_Sector
3420.223		Education	
3362.308	PerceptionTNC_r1_c1		
3359.341	PerceptionTNC_r2_c1		
3354.757	PerceptionTNC_r3_c1		
3353.238	PerceptionTNC_r4_c1		
3354.179		PerceptionTNC_r5_c1	
3355.716		PerceptionTNC_r6_c1	
3355.200		PerceptionTNC_r7_c1	
3355.045		PerceptionTNC_r8_c1	
3354.886		PerceptionTNC_r9_c1	
3354.223		PerceptionTNC_r10_c1	
3354.916		Children	
3353.753		Income_Level	
3352.427	Safety_Trust_gen_7		Safety_Trust_gen_7
3307.663	Safety_Trust_gen_8		
3307.452	Safety_Trust_gen_9		
3309.333		Safety_Trust_gen_10	
3309.020		Safety_Trust_gen_11	
3309.433		Safety_Trust_gen_12	
3309.426		Safety_Trust_gen_13	
3307.962		Safety_Trust_gen_14	
3309.021		Safety_Trust_gen_15	
3302.840	Safety_Trust_gen_16		
3304.349		Safety_Trust_gen_17	
3292.049	Safety_Trust_gen_18		

3286.444	Safety_Trust_gen_19		
3276.848	Safety_Trust_gen_20		
3275.560	Safety_Trust_gen_21		
3277.130		Safety_Trust_gen_22	
3274.978	Safety_Trust_gen_23		Safety_Trust_gen_23
3276.933		Safety_Trust_gen_24	
3278.908		Vehiculoshogar1_auto	
3273.882	Vehiculoshogar1_moto		