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Area Development and Policy

ISSN: 2379-2949 (Print) 2379-2957 (Online) Journal homepage: www.tandfonline.com/journals/rard20

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To cite this article: Daniel Oviedo, Orlando Sabogal-Cardona & Lynn Scholl (2025) Transport and social (dis)advantage in ride-hailing, Area Development and Policy, 10:2, 295-325, DOI: 10.1080/23792949.2024.2404024

To link to this article: https://doi.org/10.1080/23792949.2024.2404024

Published online: 01 Nov 2024.

AREA DEVELOPMENT AND POLICY
2025, VOL. 10, NO. 2, 295–325
https://doi.org/10.1080/23792949.2024.2404024

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RSA Regional Studies Association

RESEARCH ARTICLE

Transport and social (dis)advantage in ride-hailing

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ABSTRACT

App-based mobility (ABM) is an umbrella term for several transport services enabled through a smartphone application. Ride-hailing is the most popular ABM service, and even more than a decade after its introduction, it continues to raise concerns about its impacts on urban mobility. Previous ride-hailing research has primarily focused on understanding such impacts. However, how ride-hailing affects accessibility and social exclusion remains an understudied topic. Prior research highlights this knowledge gap and proposes a framework linking ABM with transport poverty, (in)accessibility and the resulting transport-related social exclusion (TRSE). Yet, empirical evidence is lacking to test such a framework. This paper addresses this gap by providing empirical evidence on how ABM affects accessibility using survey data collected for three large metropolitan areas in Latin America. We follow three related lines of analysis. First, we compare ride-hailing to other transport modes based on the most regular trips reported in the survey. Second, we calculate novel social and transport (dis)advantage indices to extend the comparison of transport modes. Third, we shed light on why respondents have used ride-hailing services in the past.

ARTICLE HISTORY

Received 29 January 2024; Accepted 6 August 2024

KEYWORDS

Accessibility, ride-hailing, social exclusion, app-based mobility, ridesourcing

JEL

O18, O21, R23

摘要

网约车中的交通与社会（不)平等 *Area Development and Policy*. 基于应用程序的移动出行（App-Based Mobility, ABM)是指通过智能手机应用程序提供的多种交通服务的统称。其中,网约车作为最受欢迎的ABM服务,即使在引入十余年后,依然引发了对其对城市交通影响的广泛关注。现有关于网约车的研究主要聚焦于其对城市交通的影响,而对网约车如何影响交通可达性与社会排斥的研究仍显不足。已有文献指出了这一研究空白,并提出了一个将ABM与交通贫困、(不)可达性及交通相关的社会排斥(Transport-Related Social Exclusion, TRSE)联系起来的理论框架。然而,目前仍缺乏实证研究对该框架进行验证。本文基于对拉丁美洲三大都市地区的调查数据,提供了ABM对交通可达性影响的实证证据,以填补这一研究空白。研究包括三个方面的分析:首先,基于调查中报告的常规出行,对比网约车与其他交通方式;其次,计算社会与交通(不)平等指数,进一步扩展交通方式的比较;最后,分析受访者选择网约车的动机。

关键词

可达性, 网约车, 社会排斥, 基于应用程序的移动出行, 网约车服务

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RESUMEN

Transporte y (des)ventajas sociales en los servicios de transporte privado. *Area Development and Policy.* La movilidad basada en las aplicaciones es un término genérico para designar los diferentes servicios de transporte que se activan a través de una aplicación en el móvil. El servicio de transporte privado es, sin duda, la aplicación más utilizada; desde que se introdujo hace más de diez años, sus repercusiones en la movilidad urbana siguen siendo motivo de preocupación. Los estudios previos sobre el transporte privado se han centrado sobre todo en intentar comprender tales repercusiones. Sin embargo, todavía no se ha analizado a fondo cómo influyen estos servicios de transporte privado en la accesibilidad y la exclusión social. En estudios anteriores se pone de relieve esta laguna informativa y se propone un marco de trabajo que vincula las aplicaciones de transporte con la escasez de transporte, (in)accesibilidad, y la exclusión social consecuente vinculada al transporte. Sin embargo, faltan evidencias empíricas que lo comprueben. Con ayuda de datos recabados en estudios para tres grandes áreas metropolitanas en Latinoamérica, en este artículo analizamos esta laguna aportando evidencias empíricas que demuestran cómo la movilidad basada en las aplicaciones afecta a la accesibilidad. Para ello seguimos tres líneas de análisis relacionadas. Primero comparamos el servicio de transporte privado con otros medios de transporte basándonos en los viajes más regulares según los datos para este estudio. Después calculamos los nuevos indicadores de (des) ventajas sociales y de transporte para ampliar la comparación de los medios de transporte. Y por último, explicamos las razones que motivaron a los encuestados a utilizar los servicios de transporte privado.

PALABRAS CLAVE

accesibilidad, transporte privado, exclusión social, movilidad basada en las aplicaciones, redes de transporte privado

АННОТАЦИЯ

Транспортные и социальные преимущества и проблемы поездок на попутном транспорте *Area Development and Policy.* Мобильность на основе приложений (app-based mobility, ABM) - это обобщающий термин для нескольких транспортных сервисов, доступных с помощью приложения для смартфонов. Заказ такси - самая популярная услуга ABM, и даже спустя более десяти лет после ее внедрения она продолжает вызывать опасения по поводу своего влияния на городскую мобильность. Предыдущие исследования, связанные с организацией поездок на автомобиле, были в основном направлены на понимание такого воздействия. Однако вопрос о том, как организация поездок на автомобиле влияет на доступность и социальную изоляцию, остается недостаточно изученным. Предыдущие исследования выявили этот пробел в знаниях и предложили концепцию, связывающую ABM с транспортной бедностью, недостаточной доступностью и, как следствие, социальной изоляцией, связанной с транспортом. Однако для проверки такой концепции не хватает эмпирических данных. В настоящем документе этот пробел устранен путем предоставления эмпирических данных о том, как ABM влияет на доступность, с использованием данных опроса, собранных в трех крупных мегаполисах Латинской Америки. Мы проводим анализ по трем взаимосвязанным направлениям. Во-первых, мы сравниваем поездки на попутках с другими видами транспорта на основе наиболее регулярных поездок, о которых сообщалось в исследовании. Во-вторых, мы рассчитываем новые индексы социальных и транспортных преимуществ, чтобы расширить возможности сравнения видов транспорта. В-третьих, мы проливаем свет на то, почему респонденты в прошлом пользовались услугами попутного транспорта.

КЛЮЧЕВЫЕ СЛОВА

доступность, попутный транспорт, социальная изоляция, мобильность на основе приложений, райдсорсинг.

1. INTRODUCTION

Rapidly evolving urban mobility ecosystems have led to new practices, networks, services and interactions between users and urban transport providers. The introduction of app-based mobility (ABM) services, such as on-demand ride-hailing by companies like Uber, DiDi, Lyft and Cabify, has created new mobility solutions and problems in complex and often challenging transport environments. ABM encapsulates a diverse package of services that are often difficult to distinguish due to their common technological background but also because ABM services continuously evolve and adapt to specific contexts. For example, a study highlights that users do not necessarily differentiate the risk perceptions and functioning of express and ride-pooling services in Nanjing, China (Lu et al., 2024).

After more than a decade of research on ride-hailing (Tirachini, 2020), however, much scholarship remains more concerned with explaining the determinants of its adoption (Alemi, Circella, Handy et al., 2018; Alemi, Circella, Mokhtarian et al., 2018; Lavieri & Bhat, 2019; Sabogal-Cardona et al., 2021), its potential for substitution, competition or complementarity of public transit (Bedoya-Maya et al., 2022; Hall et al., 2018; Olayode et al., 2023; Scholl et al., 2021a; Young et al., 2020) and its impacts on congestion and vehicle miles travelled (VMT) (Tirachini & Gomez-Lobo, 2020). Other works have focused on the relationship of ride-hailing with the built environment (Barajas & Brown, 2020; Sabouri et al., 2020; Yu & Peng, 2020), and more recent studies have explored how crime and fear of crime might influence the generation of ride-hailing trips (Acheampong, 2021; Oviedo, Sabogal-Cardona et al., 2022; Scholl et al., 2021b; Weber, 2019).

In parallel with the emergence of ride-hailing and ABM, scholars and practitioners have started to recognise the multiple social implications of on-demand transportation. It is now widely accepted that accessibility, understood as the capacity to reach essential opportunities (e.g., employment, education or leisure), should be at the core of transport planning and that its benefits and burdens should be distributed equitably across population groups (Geurs & van Wee, 2004; Hernández & Hansz, 2024; Pereira et al., 2017). Moreover, transportation and accessibility are directly linked with how people participate in society, engage with the opportunities cities offer, and achieve and sustain well-being (Church et al., 2000; Jana et al., 2022; Lucas, 2012; Mackett & Thoreau, 2015; Stokenberga et al., 2024). Several of these ideas, among others, are addressed by an evolving research agenda on transport-related social exclusion (TRSE) (Delbosc & Currie, 2011; Lucas, 2012). This concept helps us understand how various transport systems and urban characteristics interact with individuals' social conditions, placing specific groups in society at either transport or social disadvantage and how the combination of these disadvantages can lead to transport poverty and social exclusion (Church et al., 2000; Delbosc & Currie, 2011; Lucas, 2012; Pereira et al., 2017).

Despite a growing body of studies concerning the effects of ride-hailing and other innovative urban mobility alternatives and progress in understanding TRSE, these two research threads have only recently started to speak. For example, recent research shows that ride-hailing can be a mechanism to integrate areas of the city with low car ownership rates and deficient public transport provision (Barajas & Brown, 2020; Brown, 2019).

Previous work by Oviedo, Sabogal-Cardona, et al. (2022) on the intersection of ABM and TRSE proposes an analytical framework where the social and transport (dis)advantage of urban dwellers is reshaped by ABM services (Oviedo, Sabogal-Cardona, Oviedo, Sabogal-Cardona et al., 2022). This effect on social and transport (dis)advantage is hypothesised to change levels of transport poverty, increase or decrease accessibility, and ultimately alleviate or reinforce social exclusion.

For the specific context of ride-hailing, the ABM-TRSE relationship has several implications. For example, the possibility of requesting rides to or from transit deserts or when public transit is not available increases the geographic coverage of transportation. Moreover, the expanded perceptions of security due to technological features might incentivise vulnerable social groups to make more trips. By the same token, ride-hailing could be perceived as a mobility alternative similar to car-based mobility but without the burden of searching and paying for parking, resulting in potentially more trips and increased accessibility.

However, the ABM-TRSE interactions proposed by Oviedo, Sabogal-Cardona, et al. (2022) do not assume all contributions from on-demand transport are positive. Adverse outcomes from ride-hailing on social exclusion are also considered. For example, individuals without access to electronic payment or without the ability to use a smartphone might be left out of the system.

The ABM-TRSE framework introduced by Oviedo, Sabogal-Cardona, et al. (2022) is a starting point for this paper. We take their theoretical elaboration and, based on survey data from three large urban agglomerations in the Latin American and Caribbean (LAC) region, we provide empirical evidence on how ride-hailing impacts accessibility and the associated consequences of social exclusion. For this, we follow three complementary analyses. First, we compare different transport modes of the most typical trip declared by survey respondents. We contrast modal share, modal share by gender, departure times, and travel times. As part of the first analysis group, we calculate travel times and distances of ride-hailing trips as if completed in public transit or walking. This information enables us to explore if ride-hailing is filling mobility gaps for trips that would be difficult to complete in transport modes other than ride-hailing. Second, we propose transport and social (dis)advantage indices and analyse how ride-hailing performs and the differences with other modes of transportation. Third, we shed light on why people have used ride-hailing services in the past to unpack the specific situations where ride-hailing is enhancing accessibility.

2. LITERATURE REVIEW

2.1. Accessibility and social exclusion

Accessibility can be understood in terms of the ease with which diverse populations can reach relevant opportunities (such as employment, education, leisure or social interactions) for full participation in society (Gallego Méndez et al., 2023; Lucas, 2012), addressing their primary needs and experiencing well-being (Chatterjee et al., 2020; Oviedo & Sabogal, 2020; Oviedo, Sabogal et al., 2022). Despite multiple definitions and approaches to measure accessibility (Geurs & van Wee, 2004), there is a consensus regarding the role of accessibility as a relevant policy outcome. Current academic and policy discourse champions the idea of interventions and investments oriented to increase accessibility, as framed in SDG 11.2, 'to provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons' (United Nations, 2021).

Scholars have argued that transport justice and equity must consider the distribution of the benefits and burdens of accessibility (Martens, 2012; Pereira et al., 2017). Accessibility is also linked with social inclusion (Lucas, 2012; Scholl et al., 2022). For example, people without access to affordable public transport or living in areas with low-quality public transport not connected to the main hotspots of activities might restrain themselves from integrating with society and from benefiting from all that society has to offer (Guzman & Oviedo, 2018; Oviedo & Titheridge, 2016). The Latin America region faces unique challenges related to accessibility, social and spatial inequalities, and social exclusion (Oviedo, 2021). Differentiated

provision of transport infrastructure and services based on power and wealth results in a divide between privileged spaces for the affluent and marginalised nodes where poor and disadvantaged groups live (Coutard, 2008; Oviedo Hernandez & Dávila, 2016). This fragmentation leads to limited connectivity and accessibility for socially vulnerable populations, exacerbating their spatial and social disadvantages. TRSE further deepens the divide, as inadequate means of travel hinder individuals from accessing opportunities for economic, political and social participation. In Latin America, where governance issues, historical imbalances, and rapid urbanisation shape the urban landscape, addressing transport-related social justice issues requires a comprehensive approach that integrates the needs of marginalised groups (Oviedo, 2021). By prioritising inclusive and equitable transport planning, policies and interventions, Latin American cities can foster mobility, reduce inequalities and cultivate more socially just urban environments (Bertucci et al., 2022).

Geurs and van Wee (2004) identified the four main components of accessibility of relevance for this study. The first component is linked with land-use and emphasises the geographical distribution of opportunities and the location of people demanding these opportunities. The second is the transport component that encompasses the features of transport modes and their associated costs in time, price, and comfort. The third is the temporal component accounting for the fact that availability of opportunities and the capacity of individuals to travel are bound to specific schedules. The last component, the individual component, reflects the multidimensional complexity of people based on elements like age, gender or abilities. Most of the conceptualisation around accessibility came way before ride-hailing services started operation. Nevertheless, ride-hailing has specific influence on most of the components introduced by Geurs and van Wee (2004). For example, it extends the temporal availability of transport options and provides an alternative to travel for people without access to private cars but with the economic capacity to afford it.

In 1959, Hansen gave one of the most recognised definitions for accessibility, related to the ease of interaction (Hansen, 1959). That means the capability to 'reach' social and economic opportunities that shape participation, socioeconomic and welfare outcomes. Handy (2020) reflected on this concept as how easy it is for people to get to where they need to be, and how easy it is to access the goods, services and other activities they need or want (Handy, 2020). In addition, she mentioned that this term has been indistinctly used with the notion of 'mobility', and this confusion has led to planners and decision-makers to resolve transport problems by only focusing on improving mobility but not accessibility. In this regard, the distinction between both concepts is well explained by Preston and Rajé (2007) indicating accessibility as 'ease of reaching' and mobility as 'ease of moving'. Accessibility must be considered in transport planning to guarantee its equitable distribution to individuals. Otherwise, this situation could address the appearance of advantaged and disadvantaged groups regarding access to the same vital opportunities and thus, deepen existing inequality problems.

2.2. Analytical framework: ABM TRSE

The emergence and acceptance of ABM services offers several opportunities and threats regarding TRSE (Oviedo, Sabogal-Cardona, Oviedo, Sabogal-Cardona et al., 2022). For example, services like ride-hailing and micromobility could be a way to reduce dependence on cars and enhance public transport's quality, coverage and complementarity (Cervero, 2017; Hensher, 2017), something that ultimately could benefit people more reliant on public transit that, in the case of Latin America, are often the poorest population groups. However, the achievement of these benefits and their impact on social equality, health and the environment are still a matter of debate, with conflicting research findings adding to the discussion. For example, while some researchers claim that ride-hailing services divert ridership away from public transport systems (Bruce Olayode et al., 2023; Schaller,

2018; Scholl et al., 2021a), others argue that they serve as a feeder for public transport trips' first or last mile (Hall et al., 2018).

Despite their perceived benefits, ABM services are largely inaccessible to those who are unable to use them due to factors such as income, educational attainment and digital literacy. Recent research indicates that the middle class often adopts ABM services, and there are notable barriers to usage for marginalised groups such as elderly people in rural areas, illiterate citizens and young girls in Pakistan (Malik & Wahaj, 2019). In other words, not everybody has the required preconditions to benefit fully from emerging technologies in transport. Additionally, emerging studies suggest that social equity and inclusion are not often considered when designing and implementing micromobility systems (Aman et al., 2021; Huang et al., 2024).

The discussion of the advantages and disadvantages of ABM is presented as a continuum (Oviedo, Sabogal-Cardona, Oviedo, Sabogal-Cardona et al., 2022), recognising that not all disadvantaged individuals are poor and that poverty is not the only constraint to accessibility. The framework presented in Figure 1 illustrates the relationships between ABM services and concepts such as (dis)advantage, inequality and TRSE (Church et al., 2000), taking into account the unique features of on-demand transport services assisted by technology while maintaining the core rationale of the relationships between concepts identified in previous research on transport and inequalities.

This framework illustrates the linkages between the geographic and temporal distribution of costs and benefits of app-based transport, their potential effects on specific population groups that may use such transport, and the dimensions of transport-related social exclusion. This extension also considers the potential discrimination or exclusion of individuals with specific social identities. This approach can help illustrate the actors' practices, perceptions and relationships in a rapidly changing industry and understand changes brought into play by broader external factors such as regulations, social and economic dynamics, and even global disruptions such as the COVID-19 pandemic.

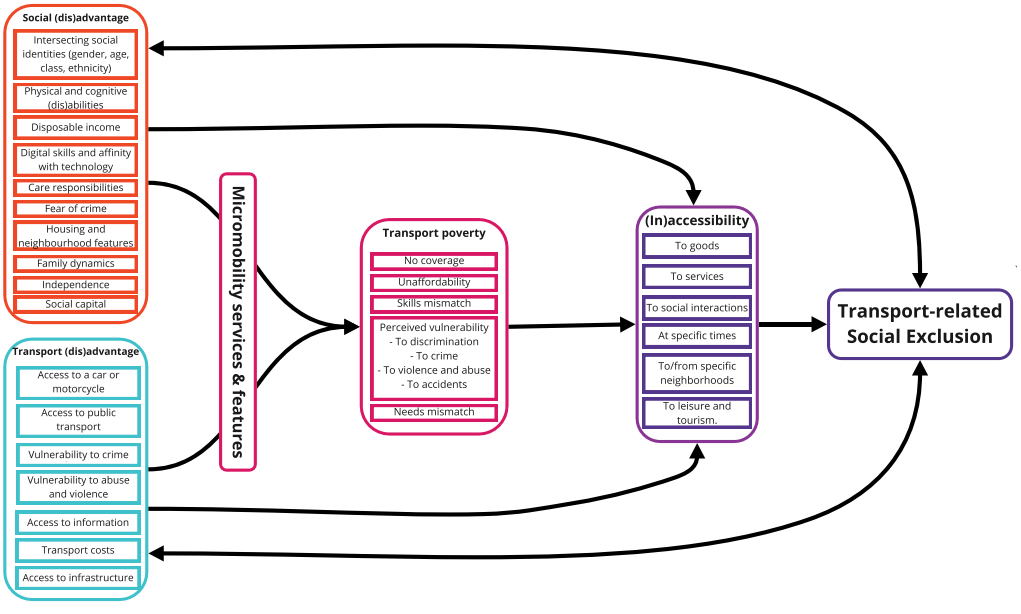

Figure 1. Theoretical framework of transport related social exclusion (TRSE) on the presence of app-based mobility (ABM) services.
Source: (Oviedo et al., 2022).

3. CASE STUDIES

Bogota (Colombia), Medellin (Colombia) and Mexico City (Mexico) were selected as case studies, considering that these are large urban agglomerations with diverse mass transit systems and where important innovations for transport systems in the region have taken place. In 2020, while the population of the metropolitan area of Bogota and Medellín was around 10 million and 4.1 million inhabitants, respectively (DANE, 2019), the metropolitan area of Mexico City was the largest population agglomeration in LAC with more than 21 million inhabitants (INEGI, 2020). The distribution of men and women was almost similar for the three cities, with the proportion of women slightly over 50%. Moreover, the median age for the three cities was for the age cohort between 30 and 53 years old (Figure 2).

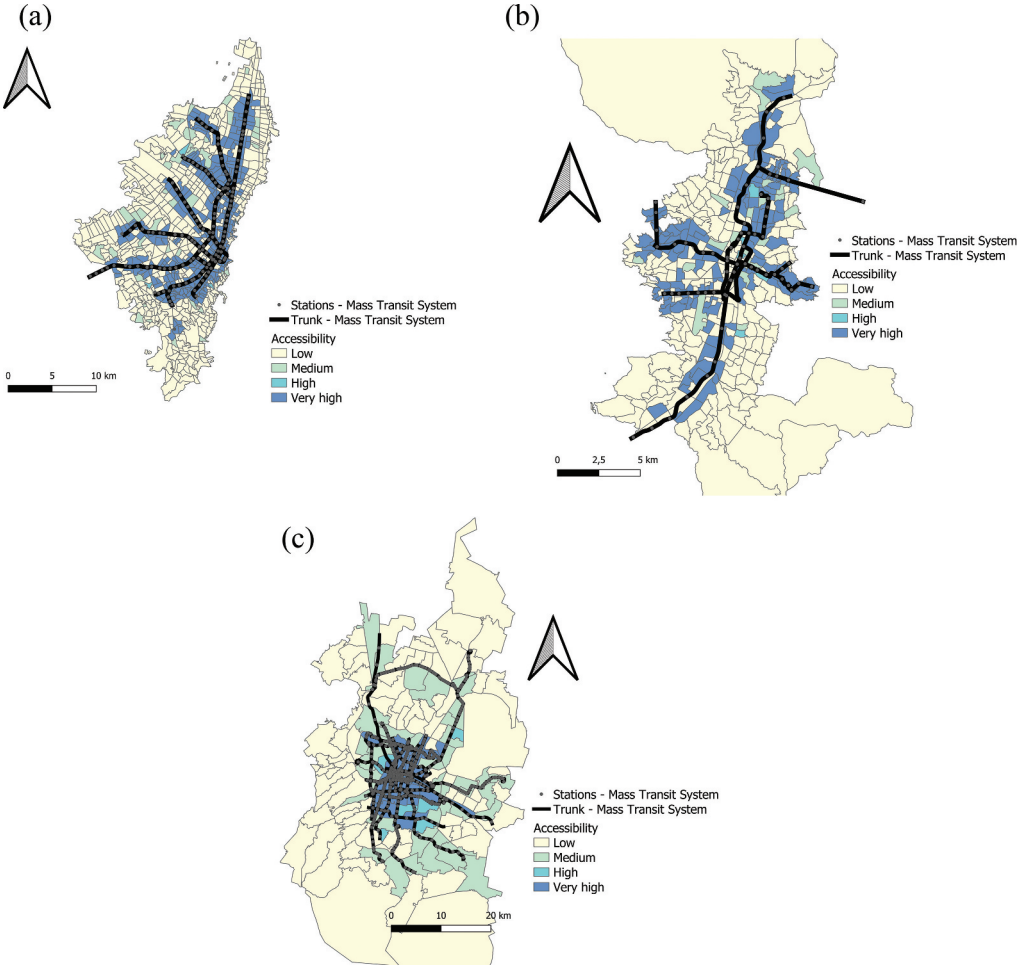

Figure 2. The three areas of study: (a) Bogota (Colombia); (b) Medellin (Colombia); (c) Mexico City (Mexico). Accessibility is calculated based on how well each zone is covered by public transportation.

Source: Own elaboration.

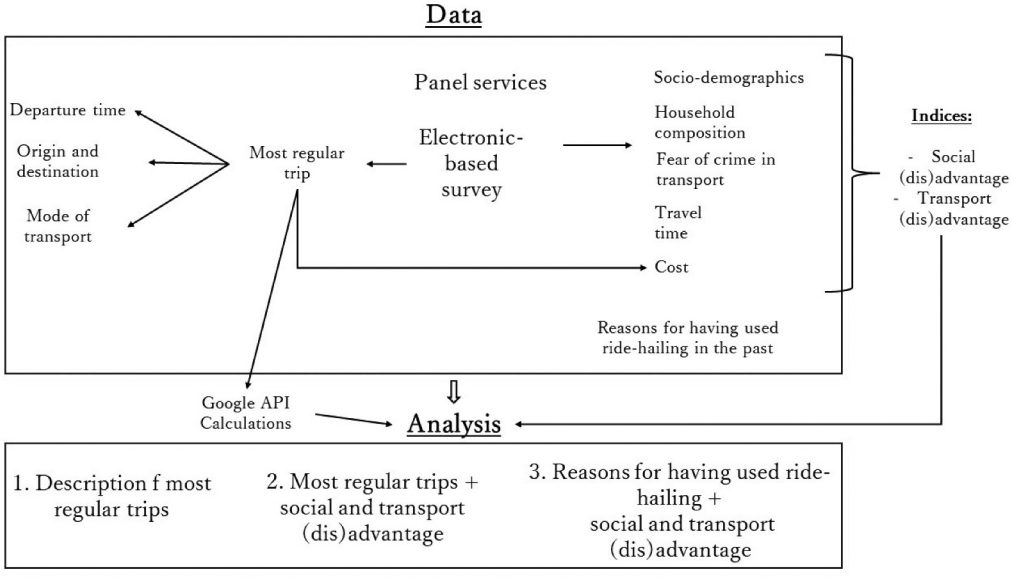

Figure 3. Methodology.
Source: Own elaboration.

Concerning the transport system, the three cities have a bus rapid transit (BRT) system. Bogotá was a pioneer in the implementation of this mode of transport after the launch of 'Transmilenio' in 2000. Since then, 114.4 km of exclusive BRT infrastructure on nine main corridors has been included in Bogota and today moves an average of 2.1 million passengers per day. In Medellín, The BRT system 'Metroplus' has two corridors that add up to 18 km and move 60,000 passengers per day. BRT Metroplus is part of the Valle de Aburrá Integrated Transport System (SITVA) that includes other transport modes as the Metro, the 'MetroCable' (the world's first urban mass transit aerial cable car), the trolley car and integrated regular public buses. Despite Medellin being smaller in relation to the other two, it has been recognised worldwide for its innovation and varied transport modes. Similarly, in the metropolitan area of México City, the BRT system 'Mexibús' is integrated into other transport modes such as the Metro, the urban aerial cable system known as 'Mexicable', the electric light rail, the suburban train, the electric trolley bus and the regular public buses system. According to BRT Data (2020), Mexico City and its metropolitan area have 10 corridors over a distance of 196 km and an average of 1.6 million passengers per day.

4. DATA AND METHODS

In Figure 3, we present a diagram of our methodology, starting with data collection and ending with the different analyses we conducted.

4.1. Data

We designed an electronic-based survey for the three selected case studies that could be filled from computers, smartphones or tablets. Since data was collected in late 2020 when some mobility constraints, social distancing recommendations, and stay-at-home policies were still in place or regularly re-activated due to the coronavirus pandemic, we used panel services data. Panel services are a way to recreate a representative sample of the actual population. They are

routinely used for market research and are becoming more popular in research and transport studies; even before the coronavirus pandemic, research on ride-hailing already used data panel services (Fu, 2020; Lee et al., 2019; Moody & Zhao, 2020). Respondents of panel service are paid to answer the survey, so it is considered that their answers are more reliable than those obtained from interception or household surveys. Moreover, panel services have strategies to identify people randomly filling the survey or filling the survey extremely fast. Panel services were instructed to recreate population quotas at a 95% confidence level on key demographics (age, income, gender) with a 5% margin of error. A pilot was conducted to ensure the understandability of the questions and completion time.

The survey included socio-demographic and household composition questions, questions about perception of ride-hailing services and a discrete choice experiment to evaluate willingness to use ride-hailing services or an integrated scheme of ride-hailing and mass public transport. A consequence of the interest in the discrete choice experiment is that people living close to mass transit stations should be more represented in the sample composition requested by the panel services. Results from the discrete choice experiment are not presented here.

Respondents of the survey were asked to provide details for their most regular trip before the pandemic started, considering that for some individuals, their most typical trip could be their commute and for others, the most typical trip could have any other purpose different from the commute. For example, for a small share of the population, health or care trips are the main reason for travelling. Details for the most regular trips included the departure time, mode of transport and geographic location for the origin and destination of the trip. Ride-hailing was an option for the transport mode, so a specific comparison can be computed between ride-hailing and any other transport mode. Even though the question was framed to retrieve information about the most regular trips before the pandemic, the lockdowns and mobility constraints that were in place during the first months of the pandemic are expected to induce some bias in the answers (Gallego Méndez et al., 2023). Moreover, we used the geolocation of the trip and the Google Maps application programming interface (API) to calculate travel times for the reported ride-hailing trips if done in ride-hailing and completed in public transit. That way, we can extend the comparison of typical ride-hailing trips and public transit.

Respondents were also asked to report how often they used ride-hailing services (before the pandemic started) for trips with any purpose, including regular and non-regular trips. Moreover, regardless of the original purpose of the trips, people were asked to select the reasons why they think they have used ride-hailing in the past. Reasons included alternatives such as because it was 'too slow in other modes', 'fear of robbery while walking', to complete a 'last-mile connection', or because it was too difficult to find parking at the destination.

We included a specific section in the survey intended to gather insights of issues of fear of crime in transport. People answering the survey were asked to rate, on a scale ranging from 1 (completely disagrees) to 5 (completely agrees), the following items: (i) I do not like waiting at the public transit station for fear of being the victim of robbery; (ii) I do not like waiting at the mass transit station for fear of being the victim of some violence or physical sexual assault (examples: physical abuse, touching or being photographed without approval); (iii) I do not like waiting at the mass transit station for fear of being the victim of some kind of violence and/or verbal sexual abuse (examples: slurs or obscene comments); (iv) I do not walk to the nearest public transit station for fear of being robbed; (v) I do not walk to the nearest public transit station for fear of being sexually abused.

4.2. Sample description

Despite the benefits of panel services and despite panel services offering a pragmatic solution at a moment when face-to-face surveys were challenging to do, there are some biases to

consider. For example, the sample does not fully represent people who need access to electronic devices or internet connection (often the more socially excluded). Table 1 provides a comprehensive overview of the final sample composition across three cities. The sample consisted of 5667 respondents, with similar surveys collected for each city. Regarding gender distribution, there was a slight imbalance favouring males in all three cities, although the difference was relatively small. Medellin exhibited a higher gender imbalance, with 52.6% males and 47.5% females.

Age distribution showed that most of the population in all cities fell within the 20–30 years and 30–40 years of age cohorts, indicating a concentration of younger individuals. Bogota had 53.179% of its population in the 20–40 years of age range, Medellin had 61.356%, and Mexico City had 55.647%. The population proportion decreased as the age cohorts increased, with the lowest percentages observed in the 60–70 years of age group.

Education levels varied across the cities. Bogota and Medellin had relatively homogeneous distributions, with slightly higher percentages of individuals reporting high levels of education (39.1% in Bogota and 35.3% in Medellin). In contrast, a significant proportion of individuals in Mexico City reported low levels of education (43.2%), but a substantial number (39.6%) still had high education levels. The socioeconomic stratum (SES) patterns differed among the cities. In Bogota, most of the population belonged to the low SES (49.6%) or medium SES (41.2%), while Medellin had a higher proportion in the medium SES (52.2%) and a lower percentage in the low SES (36.1%). Mexico City stood out with a significant portion of the population in the high SES (47.8%). Access to internet on phones, used as a proxy for wealth, showed similar distributions in Bogota and Mexico City, with approximately 64.7% and 63.3% of respondents having access, respectively. Medellin had a slightly lower proportion at 55.8%.

Regarding household composition, most respondents in all cities were the heads of their households. The prevalence of households without children and elders was evident, with percentages ranging from 61.5% to 66.5% across the cities.

4.3. Method of analysis

Methodologically, this study focuses on three central and complementary lines of analysis. In the first line, we describe the most regular trips people reported in the survey and contrast ride-hailing trips with trips in the other transport alternatives. This includes exploring the modal share composition and whether the main trip is a commute. Differentiated analyses by gender are also considered. As part of the first line of analysis, we filtered typical trips reported as completed in ride-hailing. Then, using the Google Maps API, we calculated the travel times for those trips if completed by walking and if completed in public transit. We considered the time of the day that individuals reported for their most usual trips and used Wednesday as the day of reference. With this information, we compared the efficiency of ride-hailing to that of public transit.

In the second line of analysis, we calculate a social (dis)advantage index and a transport (dis)advantage index for individuals in the survey and use these indices to compare the different transport alternatives. Once again, we focus on comparing ride-hailing with all the other modes of transport. Moreover, we introduce an analysis of each city and compare them.

For the social (dis)advantage index, we selected age, level of education, socioeconomic status, SES and whether or not people can access mobile internet on their phones. For the transport (dis)advantage index, we selected car ownership, walking distance to the closest transit station, travel time for the typical trip, cost for the typical trip and perceptions of fear of crime when using public transport. Both indices are an average of selected variables (fear of crime is simultaneously an average of the five items included in the fear of crime section). Each variable included in the calculation of the two indices was previously scaled to a range between '−1' to '1' in such a way that '−1' represents a disadvantageous pre-condition, '0' (when

Table 1. Sample description.

	Bogotá	Medellín	Mexico City
Sample size	1950	1902	1815
Percentage of total sample	34.4%	33.6%	32.0%
Gender			
Male	50.5%	52.6%	50.8%
Female	49.5%	47.4%	49.2%
Age			
15–20 years old	9.9%	11.2%	12.2%
20–30 years old	29.6%	36.4%	25.7%
30–40 years old	23.6%	25%	29.9%
40–50 years old	22.1%	17.7%	20.4%
50–60 years old	10.7%	7.8%	8.0%
60–70 years old	4.1%	1.9%	3.7%
Education level			
Low	28.7%	32.4%	43.2%
Medium	32.2%	32.3%	17.2%
High	39.1%	35.3%	39.6%
SES			
Low	49.6%	36.1%	13.9%
Medium	41.2%	52.2%	38.3%
High	9.1%	11.7%	47.8%
Internet in the phone			
No	35.3%	44.2%	36.7%
Yes	64.7%	55.8%	63.3%
Cars			
None	50.1%	57.098%	44.9%
One	37.5%	33.070%	39.8%
More than one	12.4%	9.832%	15.3%
Relationship with the head of household (RHH)			
Head of Household	49.8%	44.9%	47.6%
Partner	20.6%	18.6%	18.3%
Child	24.7%	30.8%	29.6%
Other	5%	5.8%	4.5%
Kids in the household			
None	61.5%	65%	62.7%

(*Continued*)

Table1. (Continued).

	Bogotá	Medellín	Mexico City
One	25.8%	24.4%	23.6%
Two	9.7%	8.7%	9.9%
More than two	2.9%	1.9%	3.7%
Elders in the household			
None	61.5%	66.5%	59.9%
One	26.4%	23.5%	24.6%
More Than one	12.1%	10.0%	15.4%
Main transport mode			
Car	17.8%	12.5%	19.2%
Public transit	58.4%	62.5%	62.5%
Other	23.8%	25%	18.3%
Willingness to walk to nearest transit station			
No	27.7%	23.1%	32.7%
Yes	72.3%	76.9%	67.3%
Distance to nearest station			
Do not know	1.8%	1.5%	3.9%
1–10 min	26.4%	29.9%	25.6%
10–20 min	31.0%	33.4%	25.6%
20–30 min	20.7%	19.1%	16%
more than 30 min	20.0%	16.0%	29%

Notes: First row has the number of surveys gathered and second row the percentage by city (out of the total 5667 surveys). All other rows show the distribution of the variable within the city
Source: Own elaboration

possible) a neutral pre-condition, and '1' for an advantageous pre-condition. For instance, age was scaled to '−1' for individuals older than 60 years and '1' for individuals younger than 60 years. The variable level of education was scaled to be '−1' for people with low levels, '0' for individuals with medium levels of education, and '1' for those with higher levels of education. By the same token, SES was scaled to '1' for high-income individuals, '0' for middle-income individuals, and '−1' for low-income individuals. If the respondents had access to the internet on their phones, they were assigned a '1' or '−1' otherwise. Similarly, not owning a car implies a value of '−1', having one or more vehicles means a value of '1', and the notion of neutral is absent. If the walking distance to the closest transit station is below 20 minutes, the variable is scaled to '1'. If the distance is between 20 and 30 minutes, it is scaled to '0'; if the distance is above 30 minutes or the respondents do not know, then the variables are scaled to '−1'. For travel times and costs we considered the distribution of these variables to make an informed decision. We decided to assign '−1' to trips taking more than 1 hour, '0' to trips taking between 20 and 60 minutes, and '1' to trips shorter than 20 minutes. Trips with a cost higher than US $1.4 were scaled to '−1', trips with a cost between US $0.7 and US $1.4 to '0', and trips below

US $0.7 to '1'. Lastly, the variables associated to fear of crime were scaled to '1' if the respondent initially marked '1' or '2', to '0' if the original response was '3', and '−1' if the original response was '4' or '5'.

Calculating the social and transport (dis)advantage indices is one of the main contributions of this paper. Nevertheless, this is a proposal intended to take advantage of the available variables in the survey and it is not based on an exhaustive consideration of all the elements that combine to produce plots of social or transport (dis)advantage. We hope that future research expands on our proposal of the indices. In general terms, if there are 'n' individuals and 'm' variables related to social (dis)advantage conditions, then for each 'i-th' individuals, we have a vector $Y_i = \{Y_{1i}, Y_{2i}, Y_{3i}, ..., Y_{mi}\}$ where Y_{mi} represents the value of the 'm' variable in the 'i-th' individual. Similarly, if there are 'p' variables associated with transport (dis)advantage, then for each individual we have a vector $X_i = \{X_{1i}, X_{2i}, X_{3i}, \ldots, X_{pi}\}$. Also, the calculation of the index is:

$$SD_i = \frac{\sum_{m=1}^{m} X_{mi}}{m} \tag{1}$$

$$TD_i = \frac{\sum_{p=1}^{p} X_{pi}}{p} \tag{2}$$

where SD_i and TD_i are the social dis(advantage) and transport dis(advantage) scores for the 'i-th' individual. Mean values $\overline{SD} = \frac{\sum_{i=1}^{n} SD_i}{n}$ and $\overline{TD} = \frac{\sum_{i=1}^{n} TD_i}{n}$ can also be calculated. We can make social dis(advantage) and transport (dis)advantage the horizontal and vertical axis of a Cartesian plane. We can also add $\overline{SD}$ and $\overline{TD}$ to produce the four quadrants outlined in Figure 4. The first quadrant corresponds to people experiencing higher levels of transport advantage than the average but, at the same time, experiencing lower levels of social advantage than the average. On the contrary the fourth quadrant is associated with high levels of social advantage but low levels of transport disadvantage. The second quadrant is reserved for individuals in transport and social advantage pre-conditions. Lastly, the third quadrant encompasses respondents who have lower levels of transport social disadvantage than the mean.

For the third line of analysis, we take the part of the survey asking people to report different reasons to having used ride-hailing services in the past. We explore these reasons why through the eyes of the social and transport (dis)advantage indices.

5. RESULTS

5.1. Main most regular trip

Figure 5 shows the modal distribution of the more frequent trips for each city (left side of the figure), including ride-hailing. The backbone of urban mobility for the three cities is public transport (considering any public transport service, mass transit systems and buses), accounting for 60.3% of trips in Bogota, 66% in Medellin, and 65.09% in Mexico City. Bogotá is the city reporting more sustainable (walking and bicycle-based trips), Medellin has fewer car trips and Mexico City has fewer motorbike trips.

Switching the focus to ride-hailing (see the right side of Figure 5), the mode studied in this work, we can see that even though it remains low, it already has an important participation in the modal share of the three cities: 3.91% for Bogota, 4.08% for Medellin, and 5.86% for Mexico City. These proportions become more relevant when highlighting that car trips do not

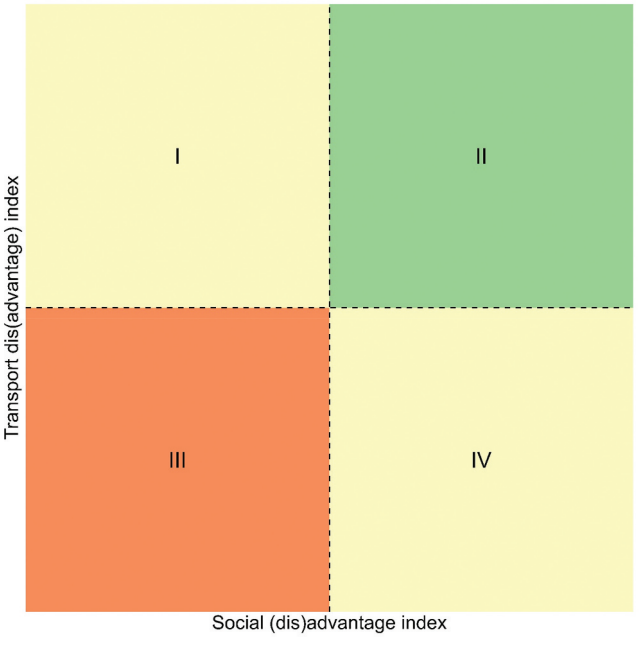

Figure 4. Quadrants of the social dis(advantage) and transport dis(advantage).
Source: Own elaboration.

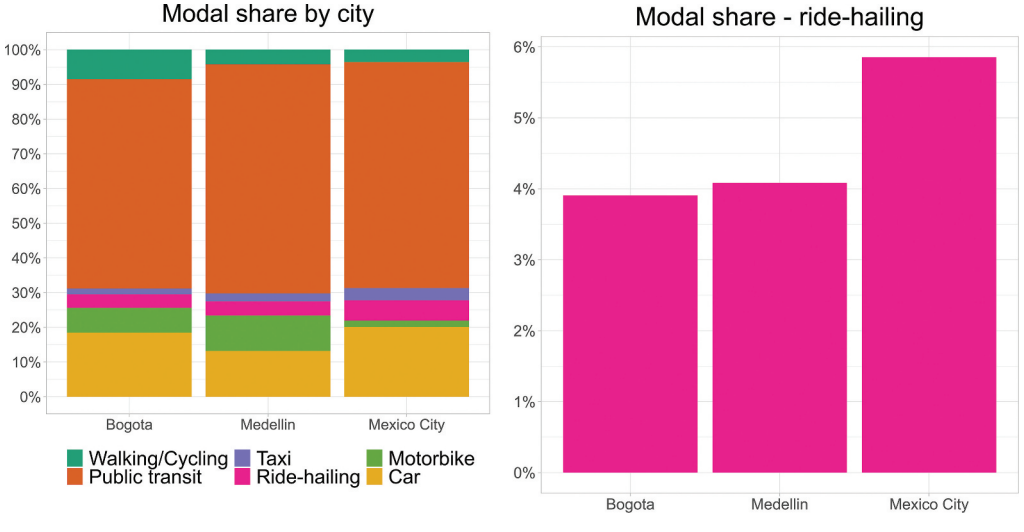

Figure 5. Modal share.
Source: Own elaboration.

account for more than 20% of total trips (in Medellin it is 13.19%) and that the share of ride-hailing trips is similar to the share of sustainable trips (the bigger difference is observed in Bogotá where sustainable trips are the 8.5% out of the total trips). Interestingly, the proportion of ride-hailing trips is larger than that of taxis (1.69% for Bogota, 2.32% for Medellin and 3.52% for Mexico City).

This is an important first finding of the present work: for a part of the population, ride-hailing is a mechanism to perform their most typical trip. As hypothesised (see Sections 1 and 2), this reflects a change in how people adopt ride-hailing. As opposed to the mainstream idea that ride-hailing is used for not usual trips such as health, care or leisure trips, even though these probably remain the main motivations behind ride-hailing trips, using ride-hailing for daily regular mobility is now also part of the equation. From a policy perspective, and with the idea of shedding light on who benefits the most from ride-hailing, it is essential to conduct a disaggregated analysis.

Figure 6 (top left) shows the distribution of regular ride-hailing trips by gender. Consistently across the three cities, women are performing more ride-hailing trips for their most regular trips. In Bogotá, 64.86% of typical ride-hailing trips are done by women. Medellin and Mexico City the numbers are 55.41% and 62.14%, respectively. Figure 6 (top

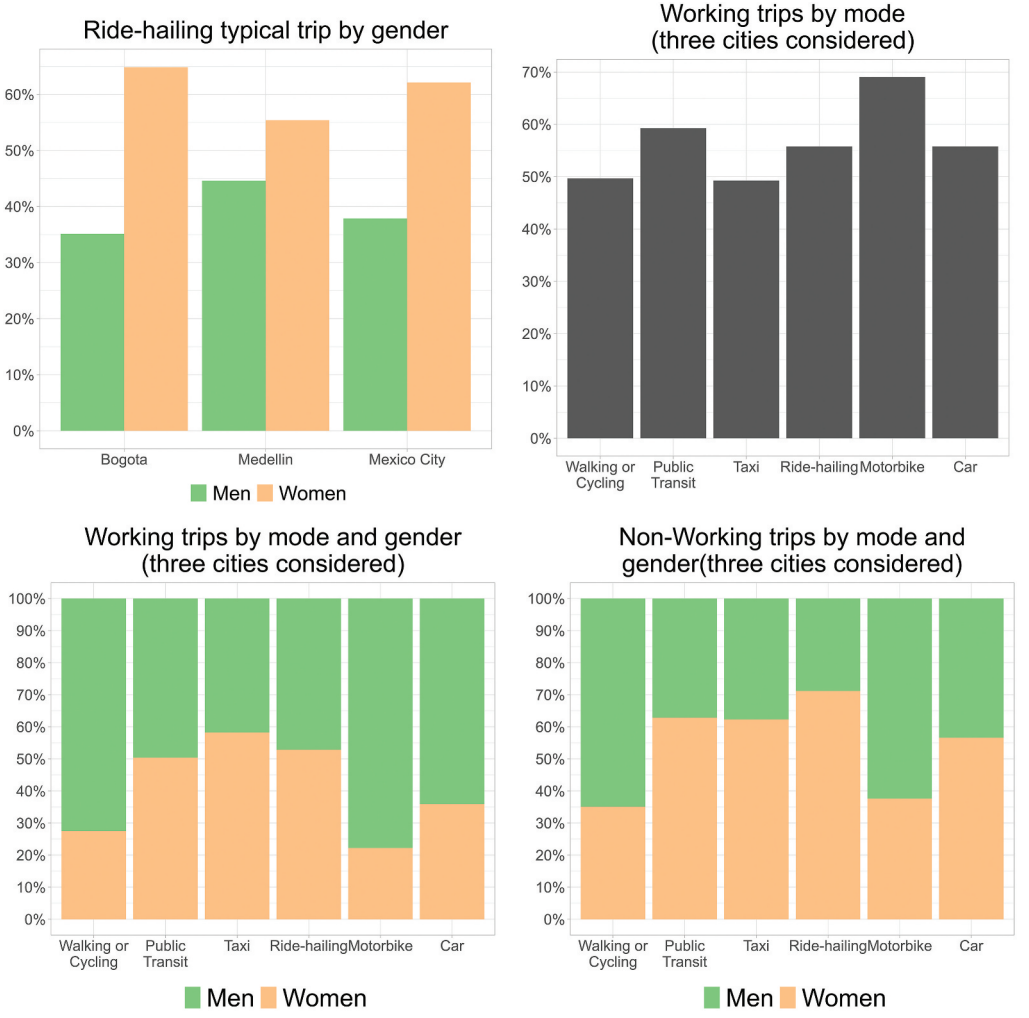

Figure 6. Modal share.
Source: Own elaboration.

right) also presents the percentage of regular work-oriented trips (commute) considering the three cities. This shows a dimension of the diversity of travel; in each mode, less than 60% of the trips are working trips. The only exception is motorbikes (69.03%). The proportion of ride-hailing trips for going to work (55.78%) is higher than the proportions for sustainable trips (49.67%) and taxi trips (49.26%), similar to the proportion for cars (55.78%), and lower than the proportion for public transport (59.26%).

When considering mode and gender, it is clear that there is a slight difference in work-based ride-hailing trips (Figure 6, bottom left), given that the distribution of the trips is 52.86% for women and 47.14% for men. Interestingly, there is a very large difference for non-working ride-hailing trips (71.17% for women and only 28.83% for men). To wrap up, women are relying more on ride-hailing for their most regular trips, and these trips are mainly non-working trips. A complementary way to interpret this part of the results is that ride-hailing offers a mobility solution for women with no access to a private vehicle in their homes and more complex mobilities. This is consistent with recent research on ride-hailing in the Global South pointing at a gendered dimension of ride-hailing.

Another relevant characteristic of ride-hailing trips compared to other transport modes is their temporal distribution. As shown in Figure 7, the departure time distribution throughout

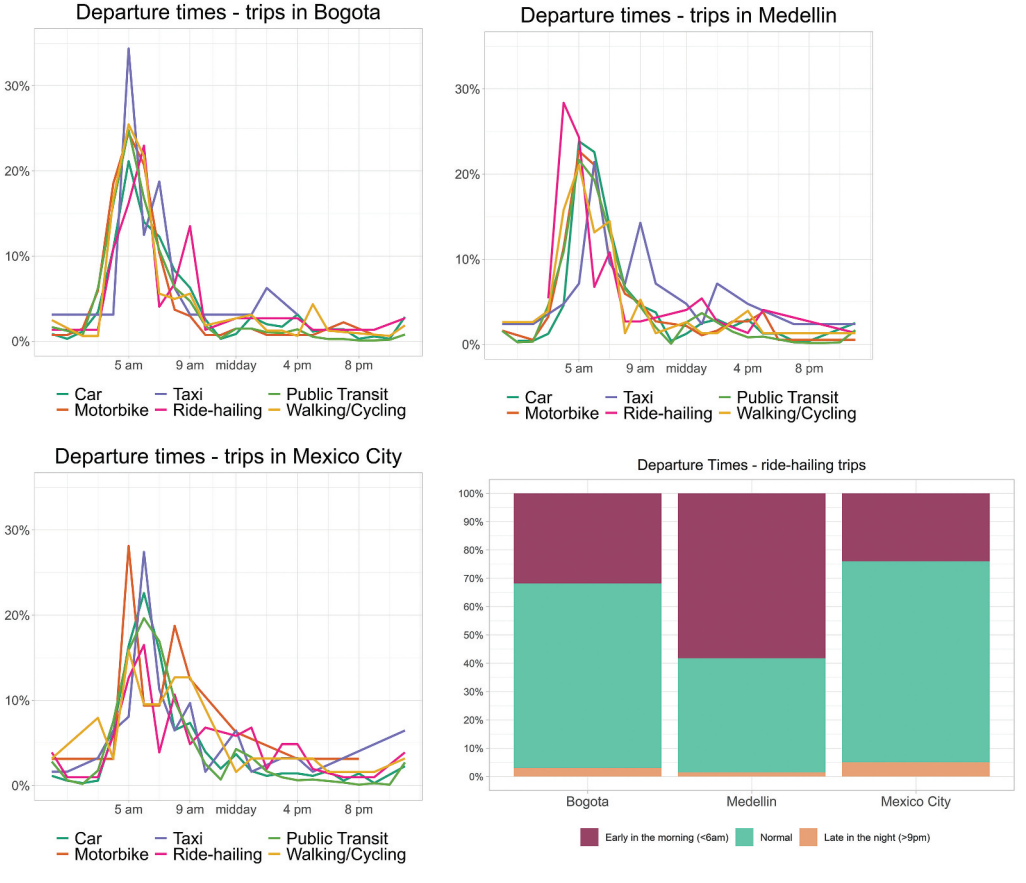

Figure 7. Departure times of ride-hailing trips.
Source: Own elaboration.

the day is similar for all transport modes (ride-hailing included) in the three cities. There are only nuance differences to mention. The central peak in Bogota and Medellin is around 5 am, while in Mexico City, the main peak seems to be centred around 6 am. The peak of taxi trips in Bogota is higher than the peak of any other transport mode, and ride-hailing appears to have a second smaller peak around 9 am, which is absent in Medellin and Mexico City. Nevertheless, there is a second smaller peak of taxis around 9 am in Medellin. The main difference in Figure 7 is that the peak of ride-hailing trips in Medellin happens earlier than other transport modes; this pattern is not repeated in Bogota and Mexico City.

Two relevant social inclusion and policy questions are if current ride-hailing trips (for the most regular trips) compete with public transit and if they can be transferred to transit. Figure 7 (bottom left) shows that a slight percentage of trips occur later than 9 pm, a schedule where public transport might still operate but where people could perceive using public transport, walking, or biking as dangerous or inconvenient. Moreover, a significant proportion occur early in the morning (no later than 6 am), another schedule that people might perceive as dangerous and inconvenient other transport alternatives. Late and early trips would be difficult to transfer to more sustainable alternatives. The conclusion of Figure 7 is that an important part of the composition of regular ride-hailing trips is not doable in other alternatives, mainly in Medellin, which has almost 60% of regular ride-hailing trips before 6 am.

To compare travel times for regular ride-hailing trips with public transit, we utilised the Google Maps API. We inputted the origin, destination, and departure time for each trip, simulating travel times for ride-hailing, walking, and public transport modes. In Figure 8, we present the distribution of ride-hailing trip travel times (top left) and travelled distance (top right). We also present travel times if the ride-hailing trips were made in public transit (middle left) or walking (middle right), as well as differences when compared to ride-hailing travel times (bottom). Results indicate that 4.2% of ride-hailing trips take at most 10 minutes and that most trips take between 10–20 minutes (35.3%) or between 20–30 minutes (24.8%). Moreover, 35.7% of trips take longer than 30 minutes, and 5.9% have travel times above one hour. By the same token, only 4.2% of trips are below 10 km of travelled distance, while 35.7% are above 30 km. Most trips take between 10 and 20 km (35.3%) or between 20 and 30 km (24.8%).

Results presented in Figure 8 show that regular ride-hailing trips outperform the walking and public transport counterparts so much that it would be difficult for users to think about transferability scenarios. Most trips would take more than one hour if done by walking, and the average added travel time if done by public transport is almost 40 minutes, with some trips increasing by more than one hour the travel time. Here, we only consider travel and departure times as constraints for a potential modal shift. Nevertheless, other issues of comfort, security, and sexual harassment are also probably making ride-hailing more attractive.

5.2. Social and transport (dis)advantage

As explained in the methods section, we propose indices for capturing levels of social (dis) advantage and transport (dis)advantage. We calculated mean values for both indices by transport mode (see Figure 9). Along the horizontal axis of social (dis)advantage, high values are associated with people with social advantage and low values are associated with socially disadvantaged people. Similarly, along the vertical axis of transport (dis)advantage, high values are related to people with good transport capabilities, and low values are associated with people experiencing transport poverty. In the case of regular ride-hailing users, they are, on average, people with social advantages but facing disadvantageous transport conditions. This is one of the main findings of the research and has multiple implications. For example, the result suggests that ride-hailing might be filling mobility gaps for people with the economic capacity

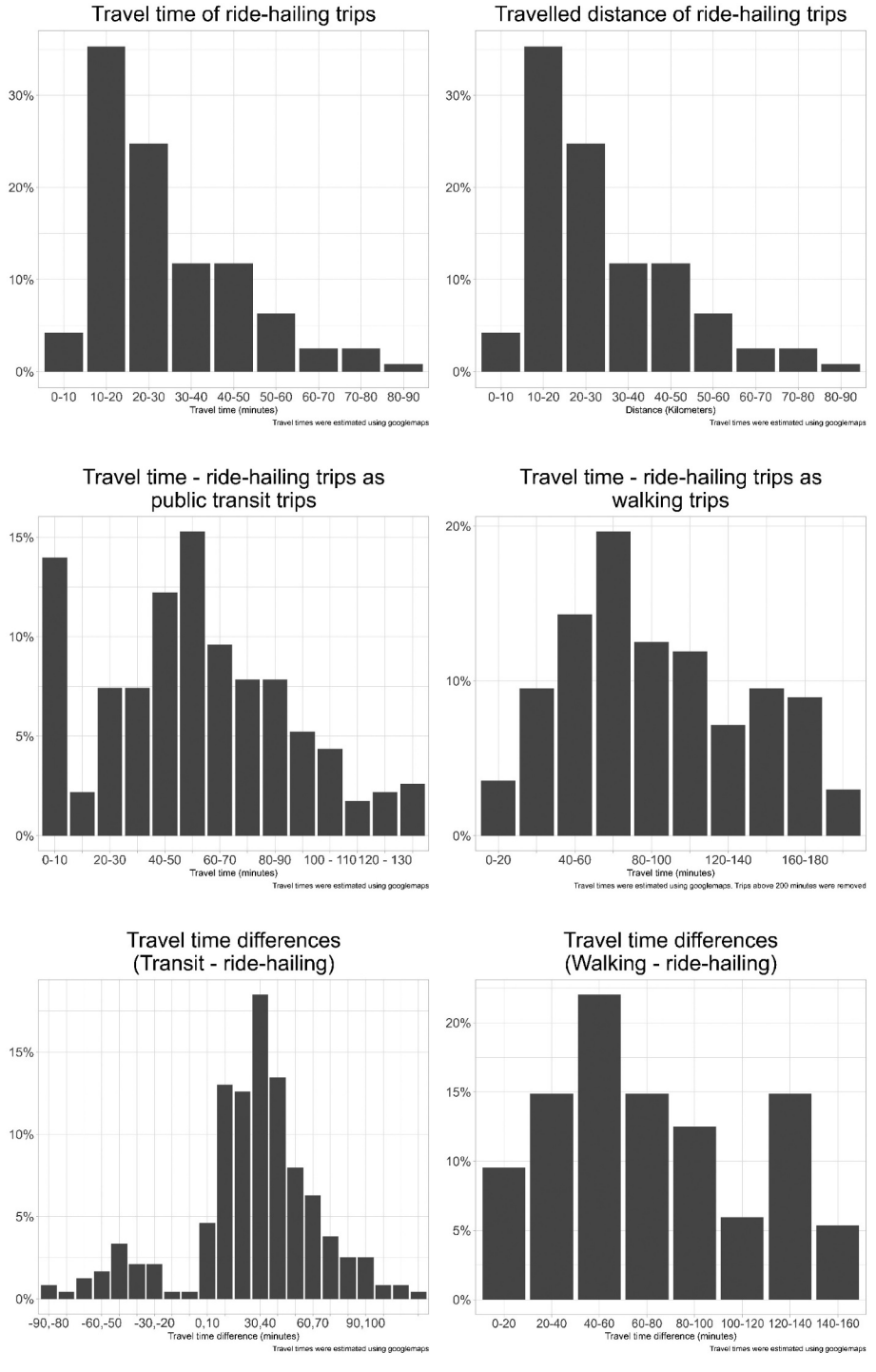

Figure 8. Travel time differences.
Source: Own elaboration.

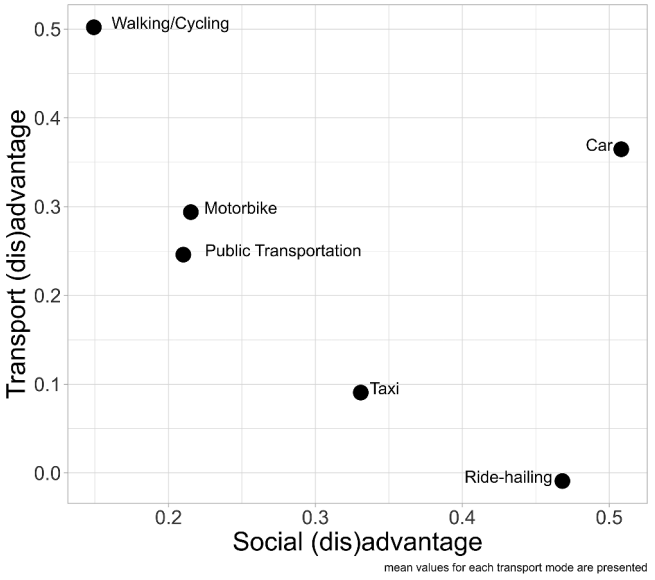

Figure 9. Transport (dis)advantage and social (dis)advantage indices (for the three case studies). Source: Own elaboration.

to afford ride-hailing. On the contrary, people who are socially disadvantaged and have similar levels of transport disadvantage might not be able to benefit from ride-hailing.

Three other elements are relevant to highlight in Figure 9. First, taxis follow a similar behaviour to the pattern just described for ride-hailing. It is also used by transport-disadvantaged people in socially advantageous conditions, though ride-hailing users are slightly more transport-disadvantaged and more socially advantaged. Second, people who regularly walk and cycle are the more socially disadvantaged group in the population, but at the same time, the group experiences higher levels of transport advantage. Third, car users are, in general terms, the more socially advantaged group in the population, with the second mean value for transport advantage. Results for sustainable modes and car users in the transport (dis) advantage index are influenced by the fact that travel time and distance travelled for the most regular trip are included in the index computation.

Figure 10 presents the mean values of social and transport (dis)advantage indices by mode for each city. Results are coherent with the results just described for the aggregated analysis of the three cities, and, in each case study, regular ride-hailing users are always people at a transport disadvantage but in social advantage.

5.3. Reasons for using ride-hailing

In Figure 11, we present, by city, why people have used ride-hailing services in the past. The main reason for the three cities is that the trip would have been 'too slow on other modes', with 42.75% in Bogota, 44.04% in Medellin, and 43.77% in Mexico City. The three cities share the other three main reasons, though not necessarily in the same order. The second most frequent reason in Bogota and Mexico City is because 'it was night and too dark', with 39.49% and 39.87%, respectively. For Medellin, this reason was reported by 29.87% of respondents, putting it in third place. Also, the second place in Medellin is occupied by 'no public transit

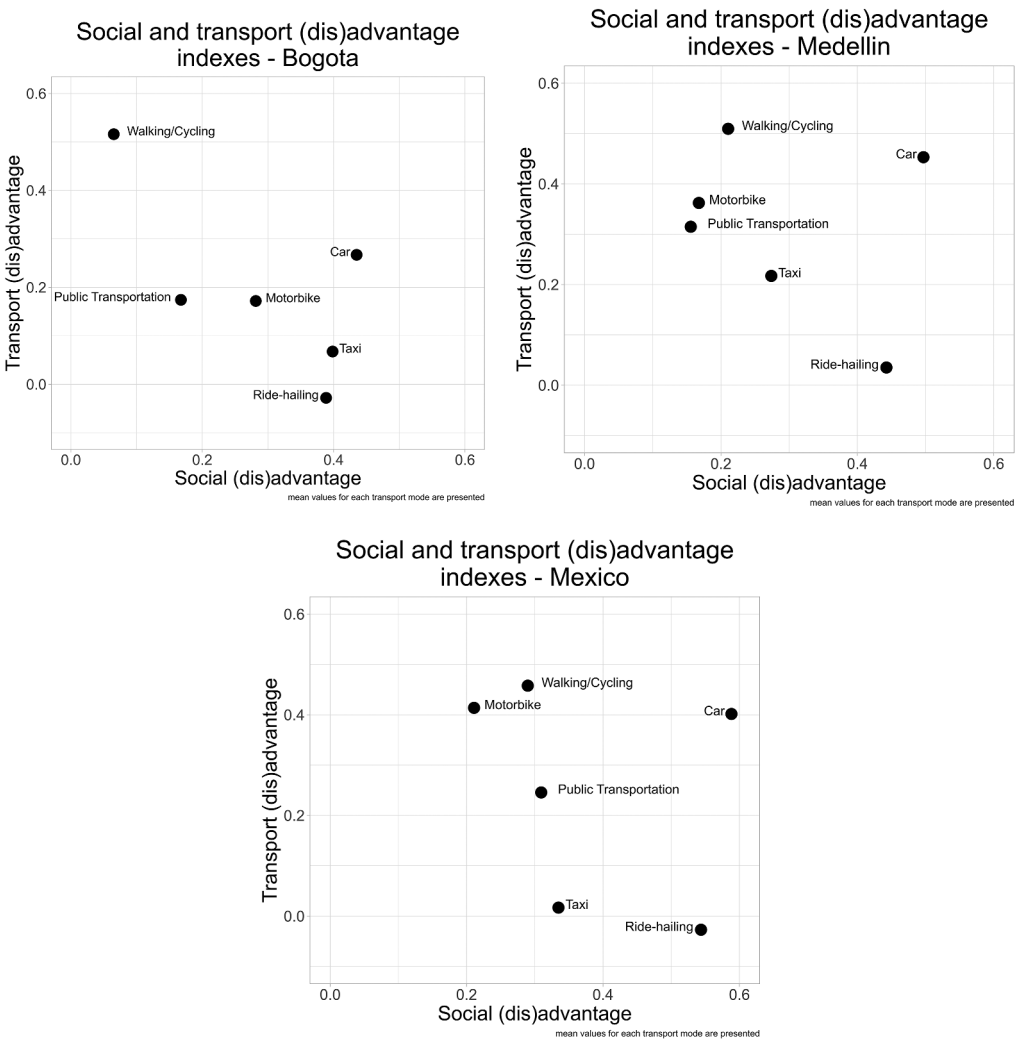

Figure 10. Transport (dis)advantage and social (dis)advantage indices (for each city).
Source: Own elaboration.

available' with 30.01%. In Bogota, 'no public transit available' occupies the fourth place (28.5%), and in Mexico City, the third place with 31.52%. The reason 'carrying bags or heavy luggage' is 34.97% in Bogota, 29.31% in Medellin and 26.24% in Mexico City (fourth place in the two cities).

Other reasons that we were expecting to be very frequent reasons, or that are frequent reasons in other studies, show low percentages in the three cities. For example, using ride-hailing as a 'first-mile connection' had lower rates in Bogota (8.6%) and Mexico City (11.06%) and a 9.26% in Medellin. Similarly, using ride-hailing as a 'last-mile connection' had a low percentage in Medellin (12.9%), a slightly higher value for Bogota (14.06%) and a considerable (but still low) 20.6% in Mexico City. The reason to make a trip in public transit and then return using ride-hailing (outward trip in transit and return using transport network companies (TNCs)) also reported lower percentages

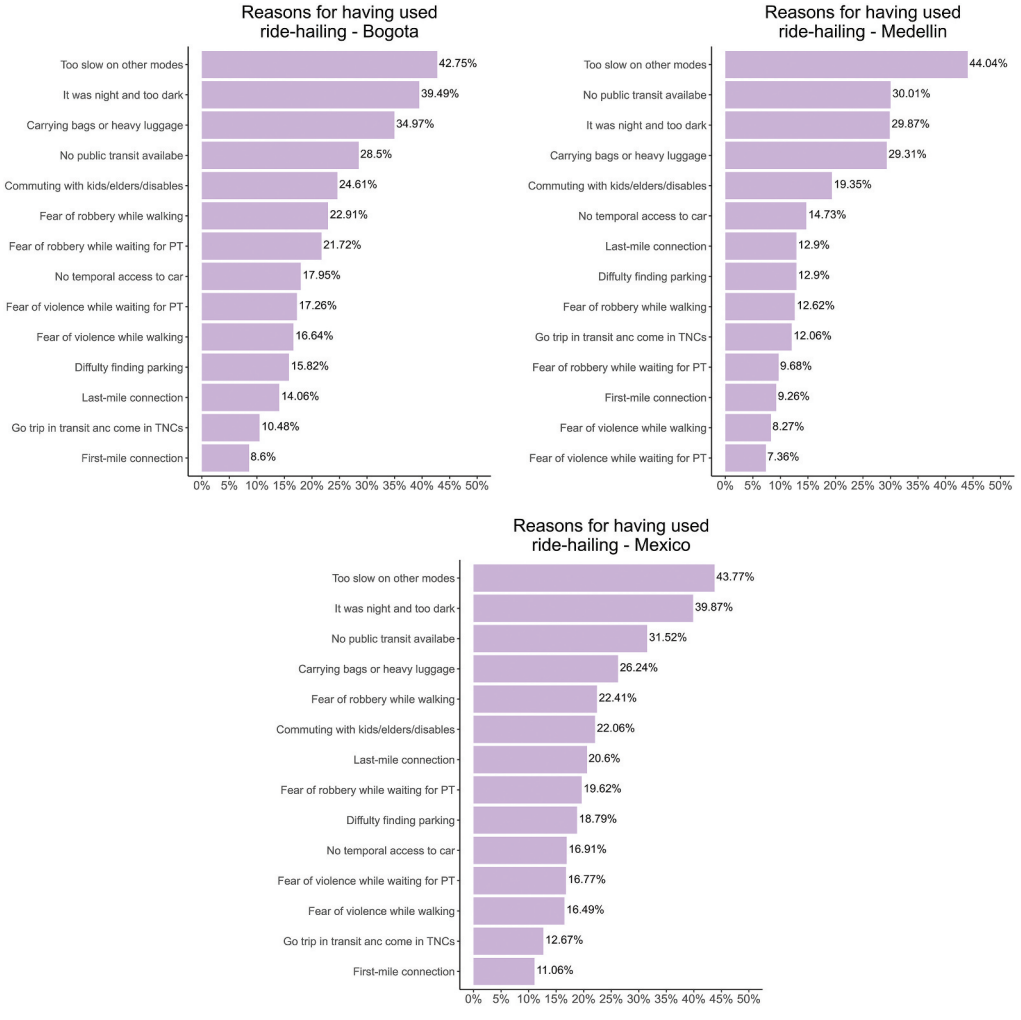

Figure 11. Reasons for having used ride-hailing (for each city).
Source: Own elaboration.

than what we were anticipating (10.48% in Bogota, 12.06% in Medellin, and 12.67% in Mexico City).

We took each reason in Figure 11 and explored the distribution and difference of the social and transport (dis)advantage indices by people reporting the reason and people not doing so. From Figures 12–15, we show the boxplot of the variables showing more meaningful differences. Consistently, people saying that any of the reasons have been a cause for having used ride-hailing services in the past have, on average, higher levels of social (dis)advantage than people saying it has not been a reason. On the other hand, the transport (dis)advantage index does not show relevant differences.

Figure 11 illustrates the prevalence of the social (dis)advantage and the transport (dis) advantage indices for individuals who cited and did not cite 'Traveling on other modes was too slow' as a reason for having used ride-hailing services in the past. We find that the average social (dis)advantage index for individuals who did not declare 'Traveling on other modes was too slow' as a reason is 0.2, while the average for those who did declare it as a reason is 0.35.

Figure 12. 'Traveling on other modes was too slow'.
Source: Own elaboration.

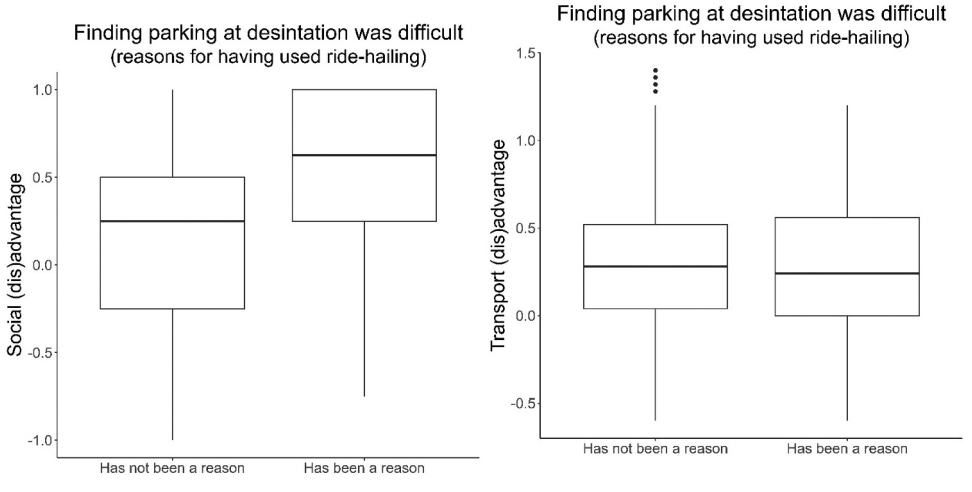

Figure 13. 'Finding parking at the destination was difficult'.
Source: Own elaboration.

The mean values of the social (dis)advantage index for Bogota and Medellin are 0.18 and 0.17, respectively, for individuals who did not cite this reason, and 0.29 for both cities for those who did cite this reason. In contrast, the mean value for the social (dis)advantage index is higher for both subgroups in Mexico City, with values of 0.30 and 0.49 for individuals who did not cite this reason and those who did, respectively. Furthermore, the mean value for the transport (dis)advantage index is slightly higher for individuals who did not cite 'Traveling on other modes was too slow' as a reason (0.30) than for those who did (0.25), considering all three cities.

Figure 13 portrays the distribution of two indices, namely social (dis)advantage index and transport (dis)advantage index, in relation to the reason 'Finding parking at the destination was difficult'. It is observed that the mean values (considering the three cities) for the social

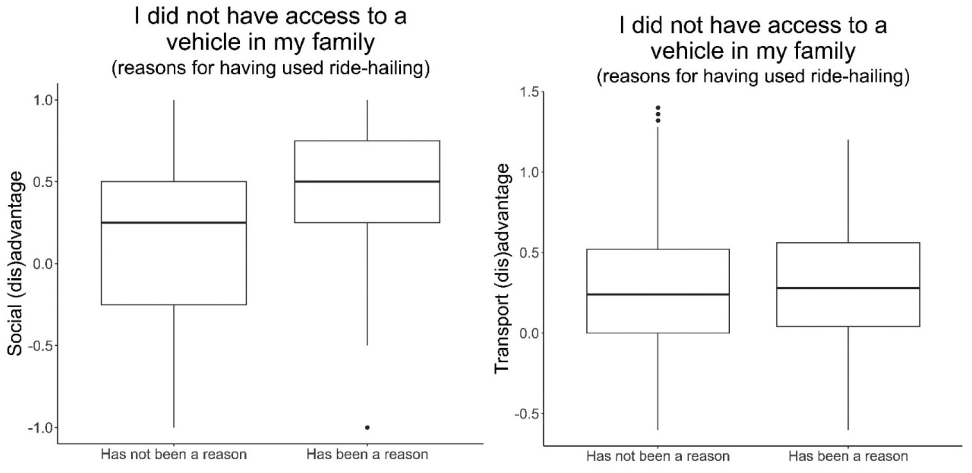

Figure 14. 'I did not have access to a vehicle in my household'.
Source: Own elaboration.

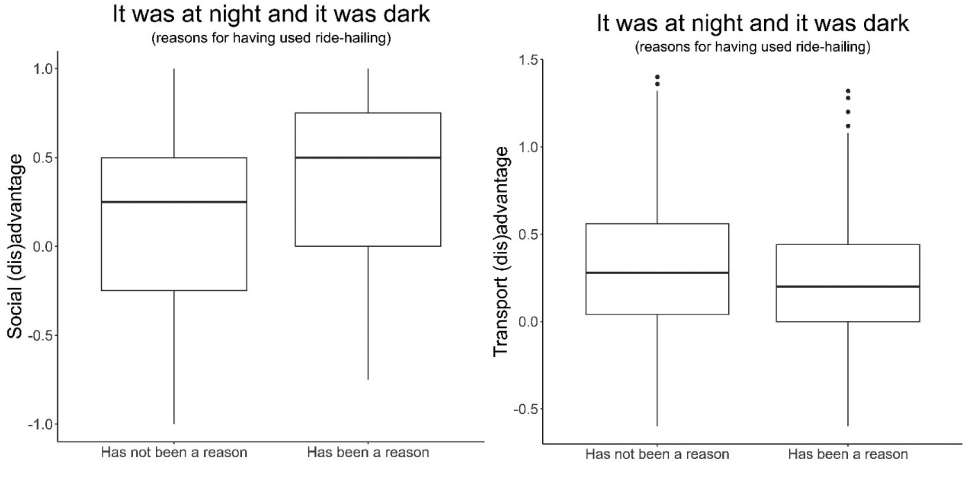

Figure 15. 'It was at night, and it was dark'.
Source: Own elaboration.

(dis)advantage index differ considerably between the two subgroups, i.e., individuals who cited the reason and individuals who did not. Specifically, the mean values are 0.22 and 0.55, respectively. It is noteworthy that the magnitude of the difference in mean values is higher than that observed for the previous reason examined. In terms of the comparison between the mean values of the social (dis)advantage index for the two cities, Bogota and Medellin exhibit similar mean values of 0.18 and 0.17, respectively, among individuals who did not cite the reason, while Bogota has a lower average (0.49) than Medellin (0.52) among those who did cite the reason. In contrast, Mexico City shows higher mean values for both subgroups, with values of 0.32 and 0.63 for individuals who did not cite the reason and those who did, respectively. Overall, the transport (dis)advantage index average is 0.28 for both subgroups when considering all three cities.

Figure 14 presents the distribution of the social (dis)advantage index and the transport (dis)advantage index (for the three cities) in relation to the reason 'I did not have access to a vehicle in my family'. The analysis reveals that individuals who did not cite this reason as a motivation for their ride-hailing trips have a lower level of social (dis)advantage on average than those who did (0.47). In terms of the social (dis)advantage index, residents of Bogota and Medellin who did not cite this reason exhibit similar values (0.19 and 0.18, respectively), while those in Mexico City have higher values on average (0.33). For individuals who cited this reason as a motivation for their ride-hailing trips, the mean values for the social (dis)advantage index are 0.39 in Bogota, 0.44 in Medellin, and 0.58 in Mexico City. In Figure 14, the distribution of the two indices is shown for the reason 'It was at night and it was dark'. Notably, the difference between the mean values of the social (dis)advantage index for individuals who cited the reason and those who did not is significant, with values of 0.22 and 0.35, respectively. Additionally, the mean value of the transport (dis)advantage index slightly decreases from 0.30 to 0.25 in the citing group.

6. DISCUSSION

While literature about ride-hailing continues to grow steadily, evidence such as the one presented in this paper remains scarce (Levine, 2020; Vecchio et al., 2020). This is more so in LAC and the Global South, where technology-assisted on-demand transport continues to thrive.

Three main arguments are derived from our analysis. First, ride-hailing services are now meeting the needs of a growing segment of urban populations in Latin America, which signals a change in local trends in using these modes for regular trips. This is different from previous research finding opposite behaviours in other regions, including cities of the Global South (Acheampong, 2021; Alemi, Circella, Handy et al., 2018; Lesteven & Samadzad, 2021; Tirachini, 2020; Vanderschuren & Baufeldt, 2018). Despite their comparatively low share of the total transport demand in the studied cities (between 4% and 6%), ride-hailing has become the preferred mode of transport for the typical trip to work or study for over half of their users due to the reliability and accessibility of the service. Furthermore, the most cited reason for using ride-hailing across Bogotá, Medellin and Mexico City was the relative slowness of other modes. This underscores ride-hailing's efficiency and time-saving aspects, resonating with previous findings by Levine (2020) and Vecchio et al. (2020). This first argument challenges the widely accepted view that ride-hailing constitutes premium services affordable and accessible only for a selected share of the urban population, showing the relevance of contextual transport conditions in the choice of on-demand transport beyond affordability and availability (Alemi, Circella, Handy et al., 2018; Sabogal-Cardona et al., 2021).

The factors influencing ride-hailing adoption and usage are better explained when social, cultural, spatial and functional drivers are considered. This leads to our second argument. We found that regular users of ride-hailing services are typically individuals in a socially advantageous position but facing transport disadvantages. This is a very significant result because, different to other modes, the composition of ride-hailing users from a perspective of their levels of social and transport advantages and disadvantages is not frequently studied (Brown, 2019; Oviedo et al., 2021).

Our second argument shows the potential of applying the social and transport (dis) advantages framework for research and policymaking. It adds an analytical dimension to observations that, although identified by previous research in other contexts, lacked an adequate framing for discussing their social consequences (Barajas & Brown, 2020; Kong et al., 2020; Lesteven & Samadzad, 2021; Sabogal-Cardona et al., 2021). Figure 9 revealed that ride-hailing is filling critical mobility gaps for those with the economic means to afford it

but for whom lack of other alternatives plays a more significant role in the decision to use ABM, contributing to a burgeoning debate that has grown in recent years (Anyachebelu, 2019; Currie & Delbosc, 2011; Newburn, 2016). In contrast, those who are socially disadvantaged and face similar transport challenges are less likely to access these services, which aligns with previous research in the region (Oviedo et al., 2021).

Third, our exploration of the role of ride-hailing in meeting the mobility needs of residents in Bogotá, Medellin and Mexico City enabled us to focus on the specific features of the system that align with the preferences and experiences of specific users such as women and other (dis) advantaged users. These services offer several advantages over traditional modes of transport, including convenience, flexibility, and security, making them a preferred option for specific residents in Bogotá, Medellin, and Mexico City, most of whom meet the conditions to belong to our third quadrant in Figure 4. This argument also contrasts with the first highlight of this section. While ride-hailing is slowly consolidating its role as the preferred mode of transport for commuting trips for some of its more frequent users, it has also become a popular choice for non-commuting trips, especially for women. Many women in these cities undertake mobilities of care, including trips to care for family members, attending to household needs, and accessing services. Transport disadvantage often complicates these trips due to lack of access to a private vehicle and inaccessible or unaffordable public transport services. For women, ride-hailing offers a safe and convenient alternative to traditional modes of transport, especially in contexts where their mobility is restricted by social norms or gender-based restrictions often driven by censure and social control (Levy, 2013)

The third finding highlights the role of ride-hailing and on-demand transport in addressing some of the relative mobility and accessibility inequalities within households, even those in relatively advantaged social positions. Residents of areas without temporal or spatial availability of public transport and those willing to pay are finding ride-hailing services a viable solution for otherwise unfeasible trips (Levy, 2013; Montoya-Robledo et al., 2020; Neutens, 2015; Rest & Hirsch, 2016). Simulated comparisons with modes such as walking, cycling, and public transport support the role of unequally distributed transport disadvantages in enabling ride-hailing adoption for a growing share of the population.

The comparison of ride-hailing with other transport modes, as illustrated in Figure 8, provides further insights. Taxis, for instance, exhibit a similar pattern to ride-hailing, utilised by socially advantaged but transport disadvantaged individuals. However, ride-hailing users tend to be more transport-disadvantaged and socially advantaged than taxi users. Specific modes of transport, such as cycling and traditional taxis, have higher use barriers for non-able-bodied citizens, those travelling in groups, or those with higher perceived vulnerability to crime, which make them unfeasible, even if their travel times and affordability are better than ride-hailing. In specific contexts, such as Bogotá, perceptions of (in)security also play a significant role in preventing some potential users from preferring traditional taxis over perceived safer ride-hailing, as it has been repeatedly found by previous research (Acheampong, 2021; Oviedo, Sabogal-Cardona et al., 2022; Scholl; Scholl et al., 2021b; Weber, 2019).

Other significant reasons include the absence of public transit options, the need to travel at night, and the difficulty of carrying bags or heavy luggage, highlighting the gaps in existing transport systems that ride-hailing services address. This finding aligns with the broader narrative that ride-hailing is often a convenient and efficient service. Still, its advantages are usually only accessible to those in a socially advantageous position.

7. CONCLUSIONS

This paper examined the contributions of ride-hailing services to accessibility through the lens of transport and social (dis)advantage in major cities in Latin America. Our exploration

centred on understanding ride-hailing's role in two scenarios: first when it is used for the most regular trips, and second when it is employed for occasional and non-regular trips.

Our research indicates that ride-hailing is more than a premium transport alternative for occasional use. It is progressively becoming an integral part of the urban mobility ecosystem, particularly for segments of the population whose travel needs remain unmet by traditional transport methods and who meet the socioeconomic conditions to afford and use the service. This is a significant finding in the context of ongoing efforts for transport decarbonisation and reducing car dependency. Through this research, we have uncovered several key insights that have the potential to inform ongoing discussions in contemporary transport policy and practice in LAC and other parts of the Global South.

Our findings highlight that ride-hailing services benefit individuals in various social (dis) advantage conditions. This is more so for women, particularly their care mobilities and regular non-work travel. This underscores the value of the flexible nature of these services for adapting to conditions of disadvantage imposed both by the configuration of the transport ecosystem and the socioeconomic makeup of many urban societies in Latin America. It emerges as a vital transport option for socially advantaged individuals facing transport disadvantages, effectively bridging a gap in the existing transport network. The case of women illustrates this added value from a perspective of (dis)advantage as ride-hailing provides critical mobility solutions that address specific challenges faced by women in urban environments.

The reasons for opting for ride-hailing services are multifaceted, encompassing convenience, safety, and reliability. These factors are critical in contexts where traditional transport options fail to meet commuter needs. Factors like enhanced safety and time efficiency often outweigh the pure transport-related benefits, highlighting the relevance of situating the analysis of transport decisions in the social and cultural context where services such as ride-hailing operate.

This claims further relevance in contexts where caring policies have become a priority in current urban agendas, as ride-hailing services play a critical role in enhancing accessibility, particularly for women and those who are socially advantaged yet transport-disadvantaged. As such, policymakers and urban planners must consider these nuanced dynamics in rethinking the characteristics of truly inclusive and equitable transport policies that cater sustainably to the diverse needs of urban populations in LAC cities.

In conclusion, this study highlights the importance of considering the relative positions of individuals when examining the role of on-demand services such as ride-hailing. While these services play a crucial role in meeting the transport needs of a select group of residents in LAC cities, their impact on the broader transport ecosystem and urban mobility patterns and the changing of existing social and connectivity gaps warrants further investigation. The findings of this study contribute to the current debates about the place of ride-hailing in the mobility landscape of Latin American cities, emphasising the need for a deeper understanding of the socio-economic and cultural factors influencing its adoption and use.

8. LIMITATIONS AND FUTURE WORKS

This paper contributes to the study of the interaction between ABM and TRSE by providing empirical evidence and proposing transport and social (dis)advantage indices. Nevertheless, some limitations in the work presented open the door for future research. For example, we consider our social and transport (dis)advantage indices calculations as a preliminary proposal that must be refined in at least two elements. The first element is associated with the nature of the variables included in the indices. In this research, we took advantage of an already existing database that, even though practical, was not explicitly designed to explore in detail social and transport (dis)advantage. Future research should

revisit the variables considered in this research and propose additional or complementary variables. Second, our indices are computed as a weighted average of measured variables in the survey. This implies that all variables are treated similarly and assigned the same level of importance. An alternative to explore in the future is to create indices based on other statistical methods (Ochoa-Covarrubias et al., 2021).

Another limitation of this work is that data was collected during the Coronavirus pandemic. Even though the survey was disseminated during a period when lockdowns were already over, there were still some mobility constraints and stay-at-home recommendations. Moreover, vaccines were still not being developed, and some of the respondents were expected to be biased by the situation and the fear of getting the disease. Apart from that, this research focuses on three large Latina-American urban agglomerations with extensive investments in public transit and where TNCs have been operating for over a decade, launching several services. How ABM and TRSE are associated might change in cities with different scales and following other development trajectories.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

FUNDING

This work was supported by the Inter-American Development Bank.

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