

# Bike-sharing and inequalities: the cases of São Paulo and Rio de Janeiro

*Bike-sharing* e desigualdades:  
os casos de São Paulo e do Rio de Janeiro

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## Abstract

This work sought to understand race, gender, income, and housing inequalities of users of bike-sharing systems in the cities of São Paulo and Rio de Janeiro. A face-to-face sample survey was carried out and the obtained data were compared with data from the two cities concerning the above-mentioned social markers. The results show that the systems are more accessible to some groups, such as women and black people, and less accessible to others, such as low-income people, and that, despite being in urban centers, they manage to maintain the inclusion of groups that do not live in the region. Based on the results, the insertion of these systems in Brazilian cities is discussed.

**Keywords:** active mobility; bicycle; urban inequality; urban mobility.

## Resumo

*Este trabalho buscou compreender as desigualdades de raça, gênero, renda e moradia dos usuários dos sistemas de compartilhamento de bicicleta nas cidades de São Paulo e do Rio de Janeiro. Uma pesquisa amostral presencial (survey) foi feita e os dados obtidos foram comparados com os dados das cidades em relação aos marcadores sociais mencionados. Os resultados mostram que os sistemas são mais acessíveis para alguns grupos, como mulheres e pessoas negras, e menos acessíveis para outros, como pessoas de baixa renda, e, apesar de estarem localizados nos centros urbanos, conseguem manter a inclusão de grupos que não moram nessa região. A partir dos resultados, foi feita uma discussão sobre a inserção desses sistemas nas cidades brasileiras.*

**Palavras-chave:** mobilidade ativa; bicicleta; desigualdade urbana; mobilidade urbana.



## Introduction

Recent literature on inequality and urban segregation has diversified, not only regarding the analysis units of inequalities, but also the themes and location of unequal urban phenomena. Within such diversification, one finds the studies on urban mobility, which discuss income, race, gender, and housing inequalities related to the use of and access to transport and the city as a whole.

Measures of travel time, access to transport infrastructure, and distances traveled have been used as indicators of inequalities and segregation in urban mobility. Among these dimensions, one data crossing regards the transport mode used. In other words, based on origin and destination data, many studies have investigated the socioeconomic demographics of the people who use each mode (such as individual motorized transport, public transport, and active modes). Nonetheless, such origin and destination surveys display methodological limits, as they end up privileging the central regions of the metropolises where they are carried out and are not as accurate in identifying trips by active modes (such as cycling and walking), which mainly affects the collection of data on women's trips (Lemos et al., 2017).

Given this limitation related to the available data to analyze inequalities and segregation in active mobility, this research addressed the inequalities in using shared bicycles, an active mode of transport in some Brazilian cities based on sharing bicycles through fixed docks.<sup>1</sup> Generally, these tend to be concentrated in the central regions of the cities where they operate. For eliminating the

need to own an individual bicycle and being located in central areas, in addition to usually being connected to the city's cycling network, shared bicycles display a more significant potential to be used by more women and more diverse demographics than private bicycles.

Therefore, this study aimed to understand the users of the shared bicycle system in two Brazilian capitals – São Paulo and Rio de Janeiro – and compared the socioeconomic profile of these users with the profile of the cities themselves, seeking to understand how much progress these systems make in including underrepresented demographics related to urban inequalities, such as women, black people and residents of the city's outskirts – or, in the case we present here, outside the system's operating perimeter.

To this end, we carried out a sample survey with users of the systems in São Paulo and Rio de Janeiro, and we analyzed its results using an indicator similar to the Location Quotient (LQ), which allowed comparison with city data. We chose São Paulo and Rio de Janeiro because they have the largest bike-sharing systems in Brazil. Furthermore, they are cities with complex urban configurations, involving different urban center and periphery dynamics, and with consolidated academic literature addressing race, gender, class, and housing inequalities.

The article is divided into five parts in addition to this introduction. The following sections discuss gender, race, housing inequalities, and their relationships with urban mobility. Next, we present our research methodology. In the following part, we review our results. Finally, we dedicate the last section to concluding remarks.

## Gender inequalities and urban mobility

The debate on gender inequalities, both within the city and in urban mobility, refers to one of the most significant arguments of feminist theorists: the restriction of women to social reproduction activities associated with home, men, and children care labor, which reproduces the workforce and is less valued in capitalist societies. The split of women and men between reproductive and productive activities, reconfigured with the transition from feudalism to capitalism (Federici, 2017), made male presence in public spaces more common. In contrast, women were frequently restricted to the private, domestic, and care space – even when that space was the home of other families where they worked.

This picture changed slightly over time, especially with the increase in the number of salaried women in factories and other commercial activities. This happened mainly during and after World War II in Europe and the United States, when men went to the war front, and women were obligated to carry out previously male occupations. However, in addition to women continuing to be primarily responsible for care work in society – including a perverse combination of neoliberalism and family values (Cooper, 2019) –, their presence in the city's public space has never been equivalent to that of men.

In modern European cities, some women were considered "public," seen as impure, and mixed with the urban chaos. This differed

from those who did not want to be considered public and kept their circulation restricted to private spaces (Kern, 2020). Thus, when present in the public space, the woman's body was seen as equally public, which led to the fact that the freedom, anonymity, and invisibility experienced by men in urban spaces and summarized in the figures of the *flâneur* (Benjamin, 1989) and the *blasé* (Simmel, 2005) could not be experienced by women in the same way.

Reinforcing this scenario, the urban planning of large cities has been predicated upon the male figure (mainly involved in productive activities) and has left aside cities designed for women (who are more active in undervalued reproductive activities), whether in large European cities, the United States, or Brazil (Harkot, 2018; Kern, 2020). Likewise, the scholarship on the topic identifies the reproduction of this logic in urban mobility planning in large cities (Harkot, 2018). As a general rule, transport infrastructure and urban mobility are designed to serve the most common trips made by men, which also materialized in large Brazilian cities.

This situation intensifies when one considers active mobility, as women are less encouraged to develop certain bodily skills – cycling included (*ibid.*) – already at a young age. When they walk on the streets, they are more likely to suffer violence and harassment than men (Kern, 2020). It is worth recalling that gender issues involve gender relations within and between each group. If a sexist social structure determines the subalternity of the woman's body in the eyes of society

(especially men) in public space, it is equally valid that, within each group (and the group of men as well), one's social stratum projects the individual and their body into a more or less disposable place. Ergo, the availability to cycle, which presupposes a risk to one's body and life, also involves accepting the risk that society also attributes, for example, to certain male bodies, naturalized as disposable. This can be observed mainly in the case of delivery couriers in recent years (Aliança Bike, 2019).

Women's trips also display different traits than those of men. Women tend to take shorter trips and more frequently take trips to serve passengers,<sup>2</sup> which is heightened when these trips are by bicycle. That is, despite cycling much less than men, when women do cycle, their trip pattern is marked by the sexual division of labor that pushes women to less valued spaces of social reproduction (Lemos et al., 2017).

Although urban mobility is typically planned for men's trips (that is, predominantly motorized and long-distance), the tendency is to witness an increase in women cycling when new infrastructure is implemented, despite the continued existence of all gender constraints for women who cycle on cycle paths – after all, they continue to be victims of harassment and subject to aesthetic pressures such as those linked to being "well-groomed" on the street and at work (ibid.). These constraints intersect with class and race issues, as with all social issues in Brazil. Addressing specifically bike-sharing, as we will see in the results, one

can witness more women cycling than the percentage found in the streets of São Paulo and Rio de Janeiro. This can be explained by several reasons yet to be investigated in greater depth.

To explain this higher percentage, we can raise the hypothesis of not needing to own a bicycle, the bike-sharing system's proximity to the infrastructure, and the ease of maintenance (which is carried out not by users, but rather by the operator). In other words, if, on the one hand, the shared bicycle "releases" cyclists from the need to own their own vehicle, on the other hand, this type of service requires a support structure (operation, maintenance, system rebalancing, etc.) that, when correctly implemented, can positively influence the choice to use the system. It is also worth mentioning that the operating company is solely responsible for robberies and property thefts (in this case, the bicycle), which can make the feeling of security concerning this issue greater. Moreover, shared bicycles in both cities have unique designs and parts, with no value in illegal or used-parts markets, since they cannot be sold for use on other bicycles (Tembici, 2022a and 2022b).

Thus, the studies discussed here highlight the inequalities that exist when we address the topic of urban mobility, especially active mobility, and the issue of gender. As a social activity, mobility produces and is impacted by inequalities inherent to other socioeconomic dimensions, including, as we will show below, race.

## Racial inequalities in urban mobility

Racial inequalities in urban mobility in Brazil originate largely from the cities' socio-spatial construction. Despite the problem's relevance, which is based on the legacies of a colonial and slavery past, data on race in official travel surveys (such as origin-destination surveys) are still scarce – even in capitals such as São Paulo, Rio de Janeiro, Belo Horizonte, and Curitiba. This results in more significant difficulties in formulating public policies. To understand the relationship between race/color and urban mobility, in addition to displacement, we also turn to the social characteristics of the territory, historically formed as places where the black population, jobs, services, and public facilities are concentrated (Monteiro, 2022).

The Brazilian socio-spatial structure goes back to the *Lei de Terras* (Land Law), enacted in 1850. This law granted mandatory land ownership through purchase only, in a context in which the Empire was under pressure from English commercial interests aiming to end enslaved labor and implement a salaried model instead. After the abolition of slavery in 1888, the black population, newly freed and without resources to acquire land, built collective and makeshift housing known as *cortiços* (tenements) in irregular and marginalized locations (Moura, 1988; Monteiro, 2022).

Throughout the 20<sup>th</sup> century, Brazil experienced a population growth that led to a disorderly occupation of cities, mainly São Paulo and Rio de Janeiro. The city of São Paulo, for example, is one of the most racially

segregated: with the expulsion of the black population from the center,<sup>3</sup> then a place of interest for the elites, and subsequent establishment in the peripheries, a distinctive center-periphery segregation pattern was formed. This led to significant inequality in access to urban mobility services, even more so because, historically, the capital prioritized the automobile (Logiodice, 2020), a mode less frequently used by those who live in peripheral regions (Monteiro, 2022). The concentration of opportunities, jobs, and equipment in the center also makes exclusive bicycle usage harder (Logiodice, 2020). Even with the implementation of public transport (such as the subway) in the most peripheral areas of the city, one observes qualitative differences in the infrastructure between the southwest (expanded center) lines and those that stretch to the other regions of the city. Furthermore, the experience of urban mobility is less favorable for the black population of São Paulo, as they experience more significant stress and are more anxious about being late (Monteiro, 2022).

Therefore, throughout history – and still today –, the construction of Brazilian cities has led to the occupation of urban peripheries by the black and poorer population. These locations are far from where opportunities are concentrated, and their infrastructure, urban mobility included, is scarce. The public transport service grants access to other essential social services, such as health, education, and leisure, in addition to promoting greater job opportunities; in other words, it is an instrument of social development

(Gomide, 2003). Similarly, the bicycle also harbors the potential to facilitate access to opportunities, but accessibility is compromised by distance, infrastructure, and even gender issues combined with racial issues (Logiodice, 2020; Guimarães, 2020). Therefore, spatial segregation and social discrimination hinder access to opportunities and rights, contributing to the worsening social exclusion of certain social groups (Gomide, 2003).

## Housing and income inequalities in urban mobility

Housing and income inequalities in relation to urban mobility, as racial inequalities, are closely associated with the configuration of the city and its spatial segregation. The construction of an "informal city," that is, a city comprised of marginalized and "irregular" areas (from the point of view of legal norms), has its origins in Latin America since the Portuguese and Spanish colonial period. However, it was mainly in the 20th century, after the abolition of slavery and the consolidation of urbanization and cities' industrialization, that this phenomenon intensified (Abramo, 2007).

The accumulation of wealth and income concentration, conceived by the economist Abramo (*ibid.*) as "exclusionary Fordist," guided a development model for Latin American cities having the occupation of land based on a "logic of need" as one of its cornerstones, that is, the establishment in specific regions and locations according to the criteria of supplying basic human needs; in other words, the right to housing, but for those with little purchase power.

It is worth noting that Rio de Janeiro has a unique geomorphological trait compared to São Paulo. The large massifs and mountains in the urban area, which concentrate a densely built and poorly permeable zone in the flat region of the municipality, generate, on the one hand, slopes subject to landslides and, on the other, plains subject to flooding (Fernandes et al., 2001).

The public housing provision system was somewhat fragile, especially after the 1980s crisis. At that time, particularly in the case of the city of Rio de Janeiro, there was an increase in the informal market for urban land, which led to a double movement, forming a "com-fusa" city, that is, one that boosts the households' and families' aggregation at the same time as it promotes their diffusion (Abramo, 2007).

On the one hand, irregular lots in locations far from central regions, on urban outskirts with little or no public services, equipment, and transport (contributing to the spread of homes and families) were sold for lower values, becoming a target for low-income social groups. On the other hand, the aggregation of households and families, also notable in this context, was influenced by the commercialization of consolidated settlements in the regions closest to the urban center. These were primarily targeted for lower classes, since they were considered subnormal agglomerations, making their prices more affordable for those seeking better access to public transport and job opportunities (*ibid.*). A further hypothesis that would strengthen the consolidation of this scenario is that Rio's dominant classes did not accept the risk of residing in areas subject to landslides and floods.

Concerning the diffusion movement towards the concentration of families and households, historian Marins (2002) recalls that some individuals who lived in the peripheral regions of Rio de Janeiro worked in the urban center, where their bosses resided. This scenario, combined with the inefficiency of urban mobility, led the upper classes to more "comfortably" accept the coexistence between high-end and more modest housing.

According to the same author, industrialization kept this from taking place with such emphasis on the formation of the city of São Paulo. In this capital, which assumed significant economic proportions, the homogenization of the neighborhood was more efficient than in other Brazilian cities. As in the housing diffusion movement in Rio de Janeiro, low-income São Paulo families were allocated to working-class villages and popular housing in regions furthest from the commercial center, such as the East Zone of the city. Higher- and middle-class families, in turn, concentrated in the most central regions and used zoning legislation to defend themselves and stay away from areas where poverty was concentrated (*ibid.*).

The historical construction of these cities is still reflected today in how one experiences social opportunities. In the capital of São Paulo, families living at the regional extremes earn lower incomes, are further away from where formal jobs are available, and continue to face difficulties accessing mass public transport and cycling infrastructure, therefore taking longer

to commute (Rede Nossa São Paulo, 2022). The data shows that the lower the income, the worse the housing conditions and access to services, including urban mobility.

## Methodology

To analyze inequalities in the use of bike-sharing systems in São Paulo and Rio de Janeiro, we designed and applied a survey in both cities. The sample was based on the number of trips (bicycle return) per docking station, and we only interviewed users who utilized the system from Monday to Saturday and made at least one trip other than pick-up and return at the same dock. That is why our researchers approached users when they were returning their bicycles.

We prioritized trips with pick-up and drop-off at different stations, intending to collect displacement trips and not wander cycling. A displacement trip can also be made for leisure purposes (for example, going to the movies), but in this case, the system was used to go from one place to another. We collected the data at the stations through an interview completed on a tablet by the interviewers between July 25th and August 10th, 2021.

Seven hundred fifty-eight (758) people responded to the survey, 355 of them utilizing the São Paulo system (Bike Sampa) and 403 using the Rio system (Bike 0Rio). The sample is representative of each system individually,

allowing for results comparability. The margin of error is 5.1% for the São Paulo system and 4.9% for the one operating in Rio de Janeiro, considering a 95% confidence interval<sup>4</sup> in both.

The survey consists of questions about the bicycle trip in the form of origin and destination research – including modal integration – and a socioeconomic section including questions from the *Critério Brasil* (Brazil Criterion) as well as regarding income, work, reproductive work, and place of residence.

To assess how unequal is the shared bicycle system vis-à-vis the city, we compared data on users' race, gender, and social class with those from *Pnad Contínua*<sup>5</sup> 2021, 2<sup>nd</sup> quarter

(IBGE, 2021), *Pnad Contínua* 2019 annual (IBGE, 2019) and the 2010 Census for both cities. We compared the demographic data of the cities with system users by employing the Location Quotient (LQ), an indicator commonly used in the regional economy to measure the concentration and dispersion of certain economic activities (Crocco et al., 2006). We believe the LQ is useful for analyzing city trip inequalities because it is a simple indicator for comparing sample profiles. In this case, we compared the bike-sharing system's users with the inhabitants of the cities where the system is installed, checking whether there is under- or over-representation of any specific group.

The LQ formula is as follows:

$$\begin{array}{l}
 \text{Location Quotient} \\
 \text{of variable } i \\
 \text{and system } j
 \end{array}
 \quad = \quad
 \frac{
 \begin{array}{l}
 E_{ij} \\
 \hline
 E_{.j} \\
 \hline
 E_{i.} \\
 \hline
 E_{..}
 \end{array}
 }{
 \begin{array}{l}
 \text{Frequency of the value of the analysis} \\
 \text{category of variable } i \text{ in system } j \\
 \\
 \text{Total frequency of all categories of} \\
 \text{variable } i \text{ in system } j \\
 \\
 \text{Frequency of the value of the analysis} \\
 \text{category } i \text{ in the municipality} \\
 \\
 \text{Total frequency of all categories of} \\
 \text{variable } i \text{ in the municipality}
 \end{array}
 }{
 \begin{array}{l}
 = \sum_j E_{.j} \\
 \\
 = \sum_i E_{i.} \\
 \\
 = \sum_i \sum_j E_{ij}
 \end{array}
 }$$

If the index is lower than 1, this means that the system is underrepresenting the analysis group; if the index is equal to 1, this means that the system has the same proportion of users in the analysis group as in the city; if the index is greater than 1, this means that there is an overrepresentation of the analysis group in the system in comparison

with the city. An overrepresentation of the groups analyzed here is not a problem, as these groups suffer the most from urban inequalities during their trips. For example, having more women than men using a shared bike system would be a positive indicator, since, historically, this is a primarily male mode of transport, with less inclusion among women.



## Results and discussion

As we have argued above, due to their historical and social construction, the cities of Rio de Janeiro and São Paulo display different urban mobility configurations contingent upon gender, race, income, and housing inequalities. Access to transport expands the possibility of the right to the city (Lefebvre, 2001), which is essential for full citizenship and other opportunities. Depending on the transport mode used, one finds different impacts on urban mobility, but also on other spheres, both at an individual level – such as health, well-being, and expenses – and at a social or collective level – such as the environment, the health system, and the economy (Torres-Freire, Callil and Castello, 2018).

In addition to slower traffic, the massive use of individual motorized transport in urban settings produces negative impacts, especially in environmental terms (Li and Hensher, 2012). When climate change is an urgent issue to ensure the planet's sustainability, active modes (biking and walking) become quite advantageous, as they represent not only an alternative for greater fluidity in urban mobility, but also contribute to more harmonious relations with the environment.

Aside from these social benefits, cyclists have a more positive relationship with the city at the individual level than the population that utilizes other transportation both in Rio de Janeiro and São Paulo. This is due to more effective use of public space and greater well-being (Torres-Freire, Callil, and Castello, 2018; Torres, Callil, and Picanço, 2019).

In addition to these findings, one may also mention the data collected by the "Pesquisa Nacional Perfil Ciclista 2021" [National Cyclist

Profile Survey 2021], conducted by the Federal University of Rio de Janeiro (UFRJ) and the NGO *Transporte Ativo* (TA), which, through a cyclists-oriented survey, identified the characteristics of circulation and the benefits associated with bicycle usage. It is worth highlighting that over 60% of cyclists mentioned they use a bicycle five days a week or more and that over 35% said they cycle because it is faster.

Bike-sharing, inserted in these urban contexts, is an opportunity to promote the strengthening of cycling culture and introduce people to urban cycling. It thus represents an access opportunity to a transport mode that favors urban mobility and collective and individual life quality. In this sense, the *Bike Itaú*, a shared bicycle system operating in the cities this study investigated, provides benefits of different natures, especially when used for commuting purposes.

Regarding the environmental impact, greenhouse gas emissions are reduced if the individual motorized mode is replaced by bicycles, which do not use a combustion engine. Based on the data collected for this study, we estimate that the city of Rio de Janeiro, using Bike Itaú in urban mobility, saved 780 tons of CO<sub>2</sub> per year in emissions. Concerning the city of São Paulo, we estimate that 170 tons of CO<sub>2</sub> per year in emissions were prevented.

Another advantage of bicycle usage is the health benefits associated with exercising. According to the World Health Organization (WHO), an adult should perform 150 to 300 minutes of moderate physical activity a week to benefit from reduced mortality from various diseases, such as heart disease, diabetes, cancer, and hypertension. Preventing these diseases through physical exercise also entails collective benefits by reducing the need for

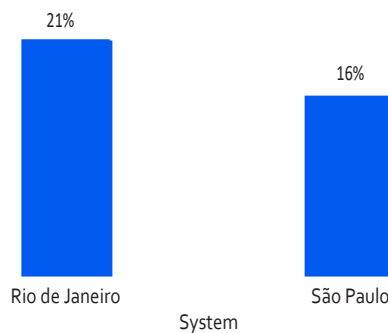
medical care and enabling more active and healthy people in society. With the data captured, we determined that the average physical activity time performed with *Bike Itaú* is 76 minutes in Rio de Janeiro and 80 minutes in São Paulo, i.e., more than 50% of the bottom time recommended by the WHO.

The use of the shared bicycle system, even if non-gratuitous in these cities, guarantees individual and collective benefits for the economy, such as the availability of more significant income for other expenses, enabling greater dynamism for the local economy, in addition to collaborating with more considerable access to the city made possible by cheaper travels. The financial savings for *Bike Itaú* users, considering costs for another means of transport, is R\$23 weekly and R\$1,488 annually in Rio de Janeiro, and R\$26 weekly and R\$1,371 annually in São Paulo.

Considering the purpose for which shared bicycle systems exist (that is, to be an efficient and city-connected mode of transport, warranting positive impacts on urban mobility, quality of life, and favoring access to opportunities), it is expected that such system is used by the broadest possible variety of people, taking into account the cities' social diversity. To measure the potential for inclusion of the shared bicycle system in these cities, we will now analyze the LQ based on the female, black, and low-income populations.

According to the LQ, the proportion of women using shared bicycles is lower than that of women residing in cities. The index reaches 0.39 in the capital of Rio de Janeiro and 0.29 in the capital of São Paulo, which means an underrepresentation of women using the system. It is worth noting, however,

Graph 1 – Proportion of women using the bike-sharing system – 2021



Source: own elaboration, in 2023.

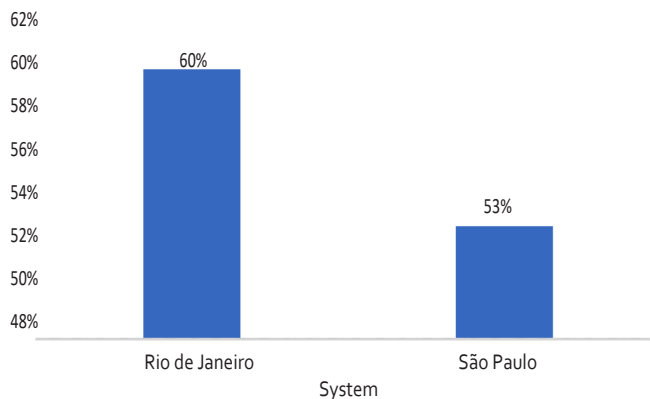
that the percentage of women in the system is just over 20% in Rio de Janeiro and 15% in São Paulo. Still, this is more than general cyclist counts (no greater than 13%).<sup>6</sup> In other words, even though bike sharing does not achieve the ideal of gender representation according to the LQ, the percentage of use indicates that shared bikes attract more women than urban cycling in general.

As we have formerly argued, the use of bicycles by women is not encouraged due to a social and cultural context of inequality and violence (whether gender, domestic, sexual, or road violence). Therefore, the data indicate that shared cycling may represent a safer form of using this mode even in a scenario that demands many improvements. If bicycle mobility is safe for women, it is also safe for other cyclist demographics. In other words,

ensuring the safety of cyclists in urban mobility is a way of including everyone who, to some extent, has historically struggled to move around and access the city.

To analyze the race LQ, we divided two groups according to the race categories used by the Brazilian Institute of Geography and Statistics (IBGE): 1) black, mixed race, and indigenous people, and 2) white and yellow. In this case, the LQ presents an overrepresentation of black, brown, and indigenous people in Rio de Janeiro (with an index of 1.4) and São Paulo (index of 1.5). This appears to be positive, as this population has historically been excluded from urban opportunities. In addition, the survey data indicates that the use of the shared bicycle system in both cities is mainly carried out by this population, with more than half in both places (Graph 2).

Graph 2 – Proportion of black, brown, and indigenous people using the bike-sharing system – 2021



Source: own elaboration, in 2023.

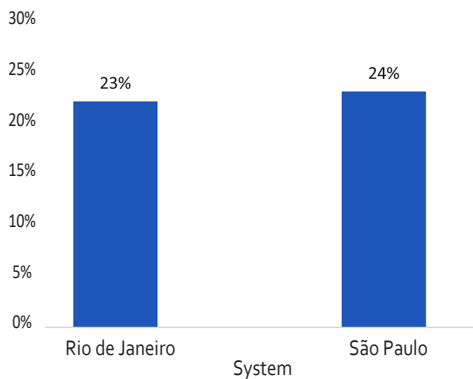
That said, one can argue that using the bike-sharing system seems to comply with the representation of racial diversity in these cities. Although far from abolishing racial inequalities, built and reinforced throughout the country's history, as previously mentioned, the data indicate that access to commuting through shared bicycles by black people contributes to and facilitates access to other opportunities, such as work and places of income generation.

Speaking of income, the proportion of low-income people (those who earn a family income up to 2 minimum wages) in the cities is higher than that of the bike-sharing system. LQ is underrepresented in Rio de Janeiro and São Paulo, corresponding to an index of 0.7 and 0.8, respectively. Despite not representing

the low-income population of these cities, one notes that the index achieved is relatively close to the ideal. In percentage terms, around ¼ of users earn a family income of up to 2 minimum wages (Graph 3).

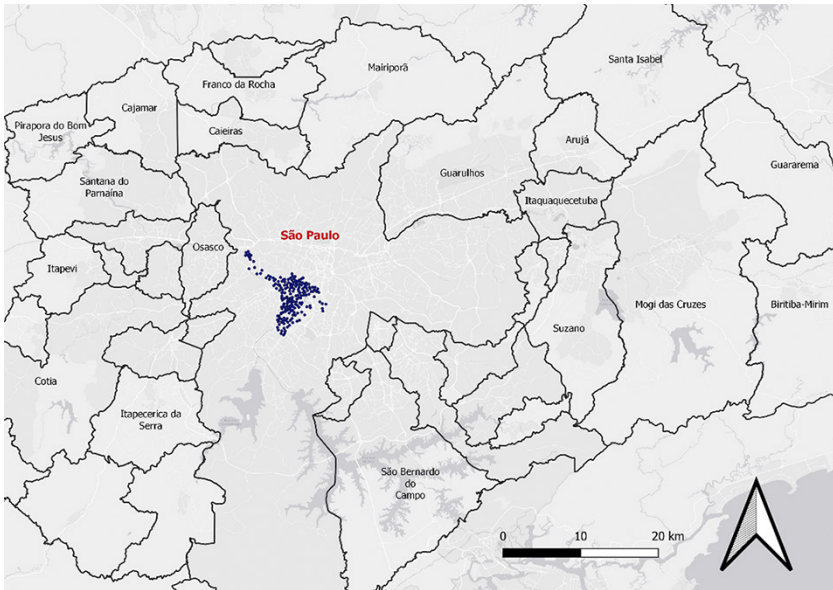
As income is closely related to the city's socio-spatial segregation, it is worth highlighting where the Bike Itaú's systems are located. According to data collected during the research, Rio de Janeiro has 304 stations with an average distance of 318 meters between them. In relation to São Paulo, the capital has 260 stations with an average distance of 302 meters between them. They are generally located in the central areas of the cities: in the case of São Paulo, on the southwest axis (Figure 1); in Rio de Janeiro, in turn, on the beachfront (Figure 2).

Graph 3 – Proportion of low-income people using the bike-sharing system – 2021



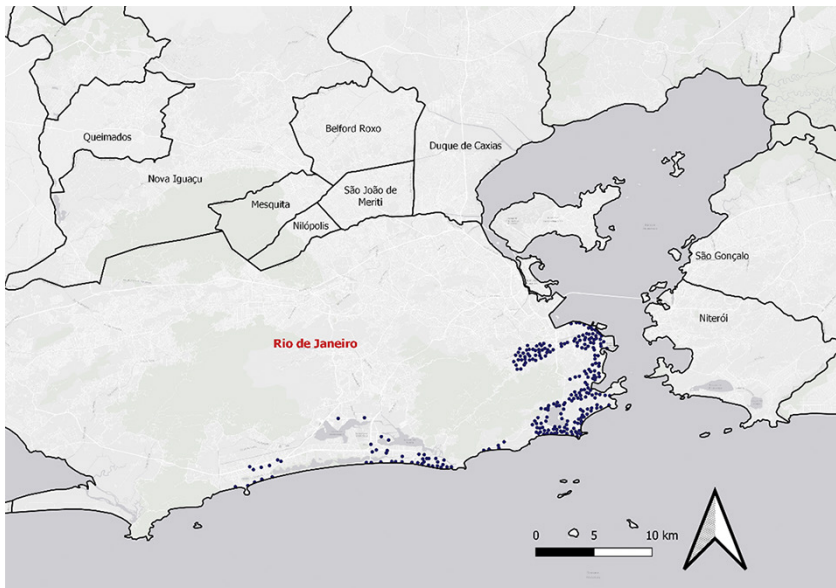
Source: own elaboration, in 2023.

Figure 1 – Bike Itaú Stations in the city of São Paulo – 2021



Source: own elaboration, in 2023.

Figure 2 – Bike Itaú Stations in the city of Rio de Janeiro – 2021



Source: own elaboration, in 2023.

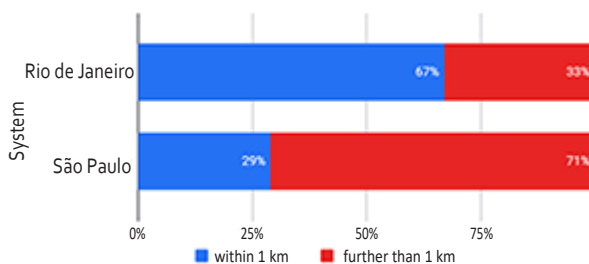
Concerning the system's location, the distance between the user's house and the bike station characterizes bike-sharing users in two ways. On the one hand, access to a station up to 1km from home facilitates access to the system, encouraging bicycle use for the first part of the journey or intra-neighborhood micro journeys. On the other hand, it is also convenient for those who live far from the system, whether to make the last part of their journey or to travel to more central locations in the city. Proximity to the system means greater usefulness for what the literature calls "first mile/last mile," that is, the initial or final stretches of urban journeys that can be easily completed through active modes – in particular, on foot or by bicycle (Shaheen and Chan, 2016).

According to our interviews, those who use shared bike systems and live within 1 kilometer of stations represent 67% of users

in Rio de Janeiro and 29% in São Paulo. On the other hand, users who live further than 1km from the station represent 33% in Rio de Janeiro and 71% in São Paulo (Graph 4). In addition to users' residence, use conditions also vary depending on the intermodality provided in their cities' mobility, that is, to what extent bike-sharing is integrated into the local transport system.

Bike-sharing systems potentially expand the range of trips through different modes by promoting intermodality, contingent upon their integration with the city's public transport system. In general, the intermodality percentage of bike-sharing users in Rio de Janeiro is 41%. Depending on the characteristics of Rio de Janeiro users, the data indicates that system integration is more significant with the train or subway network (34%), followed by buses (15%), and, finally, individual motorbikes (6%). In the city of São Paulo, intermodality

Graph 4 – Proportion of people using the bike-sharing system who live within 1 km and those living further than 1 km from the station – 2021



Source: own elaboration, in 2023.

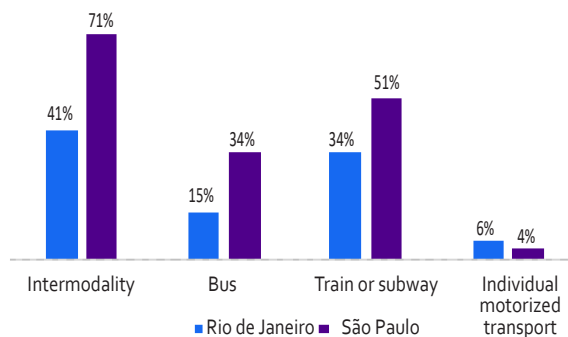
generally reaches 71 percentage points. Bike-sharing users in São Paulo combine their use mainly with the train or subway networks (51%) and busses (34%), in addition to a tiny percentage of those who combine bicycles with individual motorized transport (4%) (Graph 5). Intermodality provides circulation in the city and a more fluid and effective urban mobility system, especially for longer journeys.

We find it helpful to compare our data with the aforementioned research conducted by UFRJ and TA (2021). Despite very significant sampling methodological differences, the rate of combining cycling with other modes identified among cyclists in the city (regardless of whether they use bike-sharing systems or not) was similar for Rio de Janeiro (38%) and quite different for São Paulo (41%). Such contrasting differences between the capitals and within them (between the types of cyclists, that is, bike-sharing users or not) reflect the differences in urban mobility in each of the cities, the locations of shared bike

stations, and the historical and social formation of these cities, as we have discussed above, one more diffuse and the other more compact (Abramo, 2007).

The city of São Paulo displays a more evident center/periphery spatial segregation, with greater dispersion between different social classes and greater social homogeneity within neighborhoods. As the central regions concentrate not only the upper classes, but also bike-sharing stations, most of the city's population lives further away from the system. However, the long distance between stations and residences does not necessarily mean a negative aspect access-wise, as the city's transport configuration is the most integrated vis-à-vis other Brazilian capitals, providing high intermodality rates in urban mobility. Therefore, it is likely that the low-income population utilizing the system (24%) use it to make the last part of their journey or to transit in the city center.

Graph 5 – Proportion of intermodality with the bike-sharing system – 2021



Source: own elaboration, in 2023.

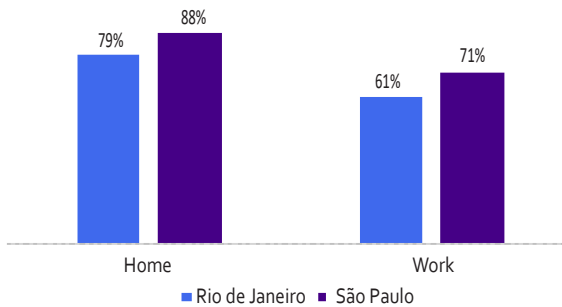
It is worth noticing that this data needs to be analyzed in light of each city's transport matrix. The capital of São Paulo has a more comprehensive mass transport network than Rio (71.4 km in length<sup>7</sup> compared to 54.4<sup>8</sup> km of subway lines), which significantly benefits intermodality. The same characteristic applies to metropolitan train systems. Thus, although the concentration of shared bike stations is similar in both cities, the public transport systems they connect are very different in scope and operation.

Although Rio de Janeiro displays more remote and peripheral neighborhoods, the movement towards compacting spatial segregation stands out, with heterogeneous neighborhoods where the upper and lower classes coexist. In other words, the central region of the capital of Rio de Janeiro is also characterized by its subnormal agglomerations. It is likely for this reason that most of the city's population lives closer to bike-sharing

stations, and almost ¼ of users are low-income demographics. On the other hand, the intermodality rate is lower than that observed in São Paulo.

As the conditions for intermodality, the motivation for using shared bicycles helps to understand how much the system is integrated into the city, enabling users to carry out daily activities. Despite the differences concerning distance from residence and intermodality, home and work are the most common reasons for trips with Bike Itaú (like other modes) in these capitals, whether at origin or destination. In Rio de Janeiro, 79% of users name their home as motivation at the origin or destination, and 61% mention their work. In São Paulo, 88% of users have their origin or destination as home and 71% as work (Graph 6). These results demonstrate and reinforce the relevance of the shared bicycle system for access to workplaces, where opportunities for generating employment and income are concentrated.

Graph 6 – Origin and destination of the bike-sharing system users – 2021



Source: own elaboration, in 2023.



## Concluding remarks

The historical construction of the cities of Rio de Janeiro and São Paulo, especially since the end of the 19th century and throughout the 20th century, was marked by abolitionist, republican, and "pro-modernization" policies, establishing a more urban and industrial scenario. The consequences of these social and economic transformations, far from promoting equity among citizens, led to social segregation expressed and reflected in the city, further reinforcing social inequalities.

In this context, groups that were already subordinate to wealthy white men from Brazil's colonial and imperial period, such as women and the black population, remained excluded from public life and deprived of various rights under a false illusion of civic equality. As a public space, the city was built in a hostile fashion for women, who, according to patriarchal values, should be restricted to unpaid domestic activities. The recently freed enslaved people (as free and poor men) had to take up residence where, to this day, there is a lack of opportunities to access urban centers, or even, as is the case in Rio de Janeiro, began to dwell closer to their workplaces in "informal" arrangements.

If urban mobility in these cities is obstructed for these social groups, the right to the city and access to other social opportunities (such as income generation, jobs, and leisure) are consequently denied or limited. Ergo, accessible and inclusive mobility is vital to full citizenship, especially concerning public transport and active modes (cycling and walking). However, we observed that,

due to the historical constructions of Rio de Janeiro and São Paulo, transit is, to this day, characterized by inequalities.

With this in mind, we proposed to analyze the access to shared bicycle systems in these cities, using a methodology able to detect the representation of certain social groups in the Bike Itaú systems. With the LQ calculation, we could compare the proportion of women, black and indigenous populations, and low-income people in these cities, and the ratio of this population using bike-sharing systems – where 1 indicates full representation.

Compliance with the representation of these social groups in such shared bicycle systems is relevant from the point of view of urban mobility and the right to the city, but also from other social and individual spheres, such as health, environment, and economy. In other words, the use of bike-sharing for transportation by those who have historically been excluded is a way of being aligned with the values of citizenship, enabling a mode of transport that gives access to opportunities while providing clearer, cleaner, and free-of-polluting gases urban mobility. This more economical mode promotes activity and physical exercise, which, in turn, allows for fewer costs in the public health system.

The data demonstrated that the bike-sharing system can be a gateway to the use of bicycles by women. Even with an LQ of 0.39 in the capital of Rio de Janeiro and 0.29 in the capital of São Paulo, bike-sharing systems are more attractive to women than urban cycling in general. With 21% of women in Rio de Janeiro and 33% in São Paulo, its percentage points are higher than those found in general urban cycling surveys, which are below 13%.

These data may suggest that bike-sharing systems provide women with a greater sense of security, as this is one of their main barriers when using bicycles in urban settings (Sersli et al., 2021).

With an overrepresented LQ reaching 1.4 in São Paulo and 1.5 in Rio de Janeiro, it is possible to affirm that the bike-sharing system in both cities is inclusive from a racial point of view. Reinforcing the data on the representation of race and color, the survey data indicate that over half of the users (53% in the capital of São Paulo and 60% in the capital of Rio de Janeiro) are black and indigenous people.

Concerning the low-income population (i.e., the population with a family income of up to 2 minimum wages), the index is underrepresented: 0.7 and 0.8 for Rio de Janeiro and São Paulo, respectively. However, unlike the gender LQ, this is closer to 1, which designates the ideal representation compared to the cities' low-income population. This is emphasized when one looks at the percentage points of system use by this social group, which reaches 23% in Rio de Janeiro and 24% in São Paulo.

Furthermore, shared bicycle stations are concentrated in the urban centers of each capital, where employment and leisure equipment and opportunities are also located. However, this configuration does not necessarily point to the exclusion of certain social groups. Although the system design is relevant to serve different regions of the city for an operation that considers different urban and social contexts, thus contributing to the urban mobility system as a whole, the distance

between stations and users' residences expresses different forms of use and a specific configuration of spatial and social segregation in each city.

The city of São Paulo, on the one hand, was built more diffusely, with neighborhoods that were increasingly homogeneous in terms of social classes, making it clear that higher classes live in the central regions, whereas lower classes reside in the urban peripheries. This has led to a scenario in which, today, most of the population lives further away from shared bicycle stations (71%) but with a high rate of intermodality (71%), indicating that they use these bicycles for the last part of their journey or for traveling within the city center, where the system is concentrated.

The city of Rio de Janeiro, on the other hand, despite displaying peripheral neighborhoods far from urban centers, was marked by a compact spatial segregation design, which led the poorest population to live in subnormal agglomerations in the most central regions, coexisting with the wealthiest classes. Contrary to what is observed in São Paulo, this may help explain the large proportion of users who live close to shared bicycle stations (67%), with less intermodality (41%). The interest in brand exposure related to service sponsorship could be raised as a hypothesis to explain the more central positioning of the stations; however, it seems unlikely, given that the systems are closely monitored by organized civil society in both cities and comply with guidelines related to service provision agreements with public authorities.

Despite these differences, the primary motivations for using the bike-sharing systems are the same in both capitals: home and work. These motivations are also the same ones that prompt trips by other modes, whether at destination or origin. Based on what we have explained, we conclude that the bike-sharing system serves women, racial diversity, and the low-income population, providing slightly more inclusive urban mobility. It is, therefore, a mode of transport that allows access to places with opportunities for generating income, employment, and leisure, in addition to providing individual and social benefits. Given

this inclusive potential and positive impact, we find it essential to fill the gaps and address the opportunities to expand the bike-sharing system, not only with new stations in hitherto non-assisted locations, but also to optimize use by diverse social groups historically excluded from urban mobility and the right to the city.

From the perspective of academic knowledge, it would be interesting to promote further research to understand the class, gender, and racial barriers that remain in bicycle usage, as well as the reasons why different groups use (or do not use) both bike-sharing systems and their own bicycle in the city.

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## Notes

- (1) For some time, Brazil also had a dockless model (i.e., without stations), but it has no longer been in operation in the country since May 2023.
- (2) This is defined as a trip motivated by someone else's needs or will, such as taking children to school or an elderly person to the doctor, for example.
- (3) For the most thorough historical construction of this process, see Moura (1988), Schwarcz (1993), and Monteiro (2022).
- (4) The universe of users and trips used for calculating the sample was kindly provided by the company that operates shared bicycle systems in both cities. For São Paulo, a population of just over 11 thousand cyclists and, for Rio de Janeiro, just over 59 thousand. The sample calculation formula is the following:  $n = Z^2 * p * (1-p) / e^2$ .
- (5) The *Pesquisa Nacional por Amostra de Domicílios* (National Household Sample Survey) is carried out quarterly by IBGE to monitor information relating to socioeconomic data and the labor market of the Brazilian population. It allows disaggregation by Federation Unit, Metropolitan Regions, and Capital Municipalities.
- (6) To obtain this estimate, we searched the most recent studies and counts carried out by the institutions *Ciclocidade* (São Paulo), *Transporte Ativo* and *Labmob* (Rio de Janeiro), *Ameciclo* (Recife) and the research *Perfil do Ciclista Brasileiro* (Transporte Ativo e Labmob-UFRJ, 2021), which has a nationwide coverage.
- (7) See the report with information on the system in: [https://transparencia.metrosp.com.br/sites/default/files/Infraestrutura%20-%202023\\_6.pdf](https://transparencia.metrosp.com.br/sites/default/files/Infraestrutura%20-%202023_6.pdf). Accessed on: June 25, 2023.
- (8) This information is available on the company's website: <https://www.metrorio.com.br/>. Accessed on: June 25, 2023.

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