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Closing the Gap

Gender, Transport, and Employment in Mumbai

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Abstract

There is increasing recognition that women experience mobility differently from men. A growing body of literature documents the differences in men and women's mobility patterns. However, there is limited evidence on the evolution of these mobility patterns over time and the role that transportation networks play in women's access to economic opportunities. This study attempts to fill these gaps. It contributes to the literature in two ways. First, it documents the differences in men and women's mobility patterns in Mumbai, India, and the changes in these patterns over time, as the city has developed. Second, it explores whether the lack of access to mass transit limits women's labor force participation. The study analyzes two household surveys conducted in the Greater Mumbai Region in 2004 and 2019. It finds important differences in the mobility patterns of men and women that reflect differences in the division of labor within the household. These differences in mobility patterns, and their evolution over time, point to an implicit "pink tax" on female mobility. Transport appears to be only one of many barriers to women's labor force participation and not the most important one.

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Closing the Gap: Gender, Transport, and Employment in Mumbai[1]

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1. Introduction

South Asia's urban population grew by about 130 million people between 2001 and 2011—more than the entire population of Japan. It is projected to grow by another 250 million by 2030 (Ellis and Roberts 2016). Several factors—including inadequate provision of housing, infrastructure (including transport), and basic urban services—are constraining the potential of the region's cities to fully realize the benefits of urbanization.

An unintended consequence of rapid urbanization is the creation and exacerbation of unequal access to, and use of, opportunities for different segments of the population (the rich and poor, people living in city centers and people living on the periphery, men and women, and so on). Poor infrastructure and limited transport services constrain the mobility of both men and women, but women often face additional socio-cultural constraints that exacerbate these negative effects. A well-established body of literature on the travel behavior of women in both developed and developing countries finds that women are responsible for a disproportionate share of the household's transport burden (due to responsibilities within the household) but at the same time having more limited access to available means of transport (Peters 2002).

Several studies link access to transportation with access to jobs. A qualitative study of three Latin American cities provides evidence that transport deficiencies are a burden for low-income women (World Bank 2020). When combined with socio-cultural factors, this burden significantly constrains women's ability to make mobility and work choices. Quiros, Mehndiratta, and Ochoa (2014) study the travel behavior of men and women in Buenos Aires, Argentina. Consistent with the literature, they find that male commuters travel farther, and at faster speeds, than women, but that travel times of men and women are approximately equal. This finding implies that women are accessing fewer economic opportunities, even though they are commuting for the same amount of time as men. Quiros, Mehndiratta, and Ochoa also estimate the increase in the number of jobs that would be available to women living in different areas of the city were they to travel at speeds equal to men. They find that men with children have access to over 80% more jobs than their female counterparts.

Only a few studies quantitatively document the evolution of men and women's mobility patterns or explore the causal role that transportation networks play in women's access to economic opportunities. Martinez and others (2018) evaluate the labor market impacts of providing bus rapid transit (BRT) in two cities with limited public transit options (Lima, Peru and Lahore, Pakistan). In Lima, a BRT line and an elevated light rail (Metro Line 1) connecting peripheral areas of the city to major employment centers increased employment rates for women living near the new infrastructure. These investments provided faster and more secure transport in a city reliant on informal public transit. A metro bus system in Lahore with subsidized fares increased the percent of commuters taking public transit by 24 percent (Majid, Malik, and Vyborny 2018). There is also evidence that women are more likely than men to use the metro bus system, holding other factors constant (Zolnik, Malik, and Irvin-Erickson 2018).

It is difficult to generalize from the experiences in Lima and Lahore to Mumbai. Unlike Lima or Lahore, Mumbai has an extensive rail system, and female labor force participation in Lima is much higher (about 60 percent) than in Mumbai.

No studies appear to have examined the quantitative effect of transport options on the likelihood of female labor force participation in India. A few studies assess female travel behavior. They include a study of the transport patterns of women in the slums of Delhi (Anand and Tiwari 2006), a study linking the perceived risk of street harassment on women's human capital attainment in Delhi (Borker 2021), a qualitative study of women's mobility challenges in Mumbai (World Bank 2011), a study of the user experience of female railway users in Mumbai (Bhide, Kundu, and Tiwari 2016), and a study that examines the perspectives of women and girls on urban mobility in 11 Indian cities (Ola Mobility Institute 2019).

Women's labor force participation rates in urban India are among the lowest in the world (Chatterjee, Rama, and Murgai 2015). Poor transport infrastructure—in particular, lack of affordable, accessible, and safe public transit—may limit women's access to jobs. It may also reduce female labor force participation by making it difficult for women to combine work- and family-related travel.

This paper examines how the mobility patterns of men and women differ from each other, and how have they evolved over time in Mumbai and whether lack of access to mass transit limits women's access to jobs. It is based on a survey of 3,024 randomly sampled households in the Greater Mumbai Region (GMR) in January–March 2019. The survey asked a man and a woman in each household about their labor market experience, their commuting behavior, and their perceptions of the accessibility of public transit in Mumbai. Respondents who were not working were asked about barriers to employment. Each respondent also filled out a travel diary describing trips made during a 24-hour period.

This paper contributes to the literature in two ways. First, it documents the differences in men and women's mobility patterns and the evolution of these patterns over time (as a city develops). Second, the paper assesses whether transport options appear to play a role in female labor force participation in Mumbai. In 2004, Baker and others (2005) conducted a household mobility survey of a representative sample of households in the GMR. That study did not analyze gender differences in mobility patterns. This study administered a similar survey to a representative set of households in the GMR (thus developing a repeated cross-section). It analyzes gender differences in mobility patterns in Mumbai in 2019 and documents the changes in these differences since 2004.

Three broad results emerge from this study:

- The mobility patterns of men and women differ in several important respects that reflect differences in the division of labor within households.
- These differences and the evolution of these patterns point to an implicit "pink tax" on female mobility.
- Transport is only one of the barriers to women's labor force participation—and not the most important one.

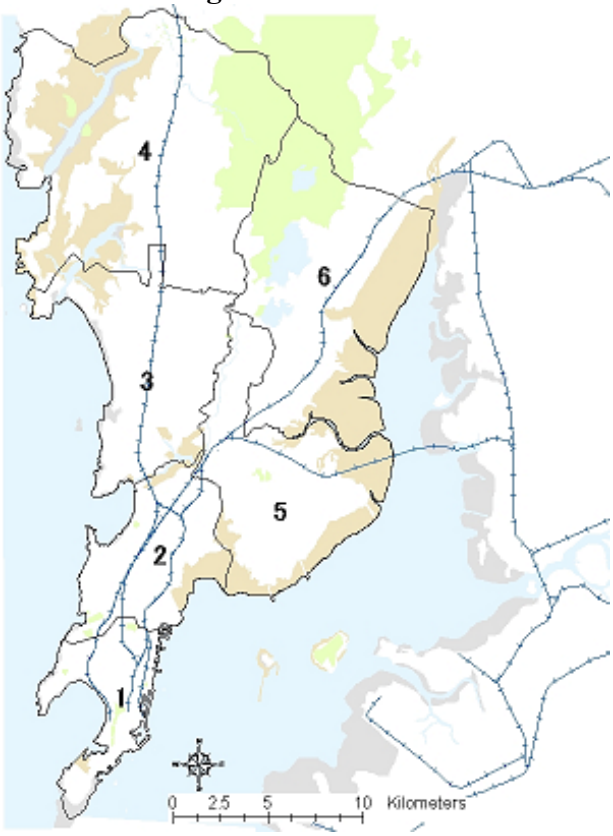
The paper is organized as follows. Section 2 discusses the data and methodology. Section 3 discusses the results. Section 4 summarizes the conclusions and identifies areas for future research.

2. Data and Methodology

The target population of the survey is households in the GMR, which constitutes the core of the Mumbai metropolitan area. With a population of about 12.5 million people in 2011 and an area of 468 square kilometers, the GMR is one of the most densely populated areas in the world. Between 2001 and 2011, the population of the GMR grew at a rate of about 0.4 percent a year—less than the national average. The lower rate reflects a declining rate of migration into the city and the more rapid growth of the larger Mumbai metropolitan area. The Mumbai metropolitan area is one of the world's largest, with a population in 2011 of 20.7 million.[6] The city faces enormous challenges, including shortages of land, housing, infrastructure, and social services, provision of which has not kept up with growing demands.

The Municipal Corporation of Greater Mumbai has divided the city into six zones, each with distinctive characteristics (figure 1). The southern tip of the city (zone 1) is the traditional city center. Zone 3 is a newer commercial and employment center. Zones 4, 5, and 6, each served by a different railway line, constitute the suburban area. Most jobs are concentrated in zones 1–3, although there has been increasing dispersion in the distribution of jobs to the suburbs.

Figure 1 Zones of Greater Mumbai Region



Urban development and urban transport are managed by the Mumbai Metropolitan Regional Development Authority (MMRDA), a regional planning agency under the Department of Urban

[6] http://pibmumbai.gov.in/scripts/detail.asp?releaseId=E2011IS3.

Development. The urban transport network is linear along the peninsula. Two national rail lines —the Western Railway (WR) and the Central Railway (CR)—serve Mumbai. They also provide suburban commuter rail services. Three urban arterial roads run through crowded urban areas, also running linearly. Cross-road links are less developed.

Design and Administration of the Household Questionnaire

In each household, the questionnaire was administered to a man and a woman between the ages of 18 and 45. The two respondents were chosen based on whether they were the primary or secondary earners in the household. Where no man or woman in the house was working, a member of the same gender who was looking for work was selected as a respondent. If no member of that gender was looking for work, a member of the same gender who was knowledgeable about the household and "involved in household decision making" was selected.

The following information was collected for the households: (a) demographic composition and educational achievement of all household members; (b) geographic location and characteristics of the household; (c) activities (employment, schooling) undertaken by each household member; (d) household assets and sources of income; (e) assessment of quality and availability of transport services and barriers to use of transport; (f) distances to educational and health facilities; (g) description of typical trips (work trips taken by each respondent and typical school trips taken by children in the household); and (h) willingness of the two main respondents to work if not currently employed. In addition, each of the main respondents kept a travel diary for 24 hours, in which they were supposed to record, for all trips taken on the chosen day, the destination, purpose, and time of day the trip originated; the distance traveled; the mode(s) chosen; the duration of the trip; and the out-of-pocket cost. Travel dairies were collected for all individuals who took at least one trip outside the home. Trip data were collected for 3,020 men and 2,717 women. The questionnaire was a modified version of the questionnaire administered during a 2004 household survey (Baker and others 2005), with additional questions added about female labor force participation. The survey was pre-tested and administered by Nielsen India, Pvt. Ltd.

Sample Selection

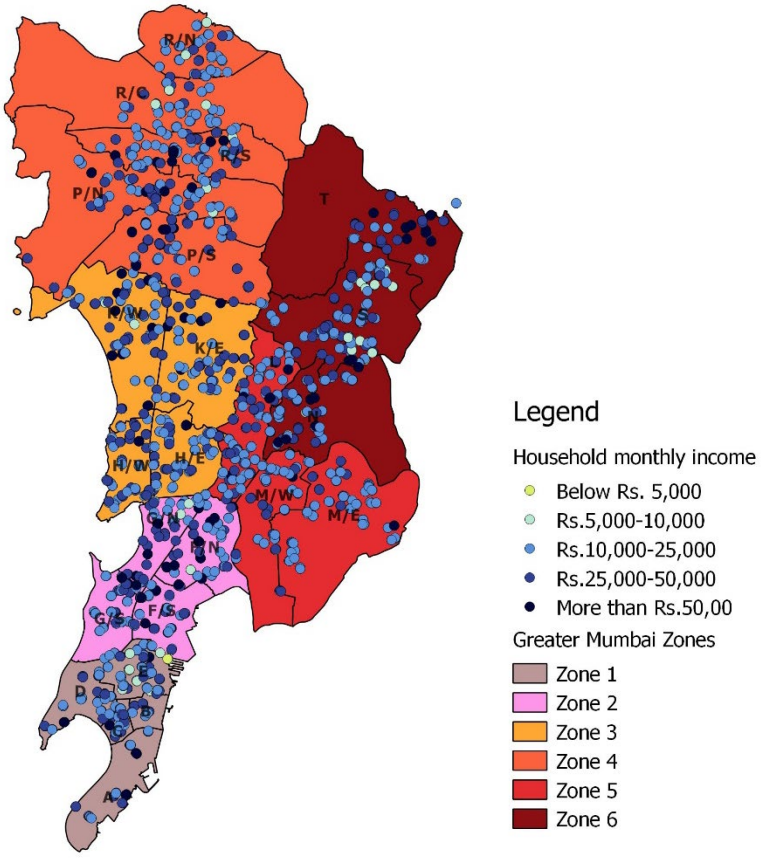
The Mumbai survey was designed to be representative of the GMR, hence the sampling universe did not cover the entire Mumbai metropolitan area, which is considerably larger than the GMR. All households in the city with at least one man and one woman 18–45 were part of the sampling universe except residents of military cantonments and institutions (such as prisons). Respondents this age were selected because the focus of the survey is on employment and commuting.[7]

Data on 3,024 households were collected. Seven hundred and fifty geographic points (latitude and longitude combinations) were sampled across the 24 wards of the GMR (figure 2). Sampling was done in proportion to the ward-level population, based on WorldPop data for 2018.[8] The survey team went to each location and surveyed four households, selected at random. At each location,

[7] Two of the 6,048 respondents were 55 years old.
[8] WorldPop (www.worldpop.org) School of Geography and Environmental Science, University of Southampton.

one direction (north, south, east, and west) was selected and four households in that direction were sampled (figure 2).

Figure 2 Map of sampled households, by ward, zone, and household income range



Description of Households Surveyed

The distribution of households by zone mirrors the population of the GMR. Sixty-three percent of households had lived in their current home for more than 10 years (41 percent had lived in the same home since birth) (table 1). Of households that moved to their current house since birth, 88 percent moved from either the same neighborhood (37 percent) or another neighborhood in Mumbai (51 percent). Median household size was four people, with only 8 percent of households having six or more members, and 40 percent of households had at least one child under the age of 10. Monthly household income categories were chosen to mirror those in the 2004 household survey. Forty-four percent of households have an average monthly income of at least Rs. 25,000.

Table 1 Characteristics of surveyed households

Characteristic	*Percent of households*
Zone	
1	9.8
2	14.8
3	19.4
4	25.3
5	16.6
6	14.1
Housing tenure at current residence	
Within last 12 months	1.8
1–2 years	5.7
3–5 years	11.9
6–10 years	17.4
More than 10 years	22.4
Since birth	40.8
Caste category	
Scheduled Tribe	4.7
Scheduled Caste	5.3
Other Backward Caste	28.7
General	61.3
Household size	
2	13.6
3	32.4
4	32.4
5	13.8
6	5.1
7 or more	2.6
Number of children in household under age 10	
0	60.2
1	27.2
2	10.7
3 or more	1.9
Average monthly household income	
Less than Rs. 5,000	0.1
Rs.5,000–10,000	3.3
Rs.10,000–25,000	52.5
Rs. 25,000–50,000	34.4
More than Rs. 50,000	9.7

Table 2 describes the characteristics of the respondents. In 82 percent of households, the main respondent was also the household head; 3 percent of households were headed by women. Most

respondents were married at the time of the survey. Ninety-eight percent of men and 21 percent of women worked for pay, but 25 percent of working women worked from home (only 11 percent of working men did so). Average years of education were higher for men than for women. Among respondents who were working, a larger percentage of men described themselves as skilled (versus unskilled) workers, although a larger percentage of women describe themselves as self-employed professionals.

Table 2 Characteristics of surveyed respondents (percent of total)

Category	*Men*	*Women*
Age group		
18–24	7.1	11.1
25–29	16.4	23.6
30–34	20.3	18.8
35–39	18.2	22.2
40-45	38	24.3
Observations	3,024	3,024
Marital status		
Never married	12.5	7.3
Currently married	87.0	89.7
Widowed	0.0	3.0
Divorced or separated	0.2	0.4
Observations	3,024	3,024
Education		
Less than primary school	3.2	7.0
Primary school	6.3	12.3
Middle school	12.5	19.1
High school	22.4	24.4
12th grade/technical training	26.3	19.5
Graduation	25.3	16.0
Postgraduate degree	4.1	1.7
Observations	3,024	3,024
Work status		
Outside home	87.9	15.6
From home	10.6	5.3
Not working	1.5	79.1
Observations	3,024	3,024
Occupation		
Unskilled worker	16.6	25.9
Skilled worker	40.2	31.9
Petty trader	3.6	0.6
Self-employed professional	4.1	9.2
Clerical/salesperson	4.2	8.4
Supervisor	15.3	11.9

Self-employed worker	16.1	12.2
Observations	2,978	633

Methodology

The first set of questions addressed was how men and women's mobility patterns differ and how they evolved over time. A descriptive approach was adopted that quantitatively compares changes in household travel patterns between 2004 and 2019 among men and women. This descriptive analysis was augmented with geospatial analysis that calculates the share of jobs accessible across zones by road and by rail.[9]

The second question motivating the study was what role transportation plays in the employment decisions of women in Mumbai. It was answered in two ways. First, the study examined the factors that explain whether a woman was working. A linear probability model was estimated to describe the correlation between factors the literature suggests affect women's decision to work—namely, age, education, number of children, husband's income, and household size (Klasen and Pieters 2015). Variables measuring zone of residence and proximity to public transit were added. Although residence zone and proximity to a rail stop may be endogenous to the employment decision, it is nevertheless interesting to determine whether there is any correlation between these variables and employment status, especially for women who commute. Identical models were also estimated using women who were living in the house where the main respondent of the survey was born, as it can be argued that the residential location of this sample is more likely to be exogenous to the employment decision than it is for all 3,024 women in the full sample.

Formally, the linear probability model[10] estimated is as follows:

$$L_{ij} = a_0 + \boldsymbol{a_T} T_j + \boldsymbol{a_1} X_{ij} + \boldsymbol{a_1} Y_j + e_{ij}.$$

L_{ij} is dummy variable that takes the value of 1 if woman i in household j is working and takes the value of 0 otherwise. T_j represents the time to reach the closest rail stop from household j. It takes on three values: 0 if the time is 10 minutes or less, 1 if the time is more than 10 minutes but less than or equal to 20 minutes, and 2 if the time is more than 20 minutes. X_{ij} represents person-specific characteristics of each women, such as educational attainment and age. Xij represents household characteristics, such as income and size, number of children, and zone of residence.

Second, the survey asked women who were not working whether they saw commuting as a barrier to doing so and why. The 2,388 women in the sample who were not working were asked whether they would be willing to accept employment and if so whether they would be willing to work part time or full time. These women were asked whether they considered commuting, as well as other factors, to be a barrier to working outside the home.

[9] Rail is used synonymously with train.

[10] As a robustness check a Probit model was estimated, the results are similar to the linear probability model.

3. Results

Household Travel Patterns

Gender differences in purpose of trips

Table 3 describes the purpose of trips taken, based on travel diaries. The distribution of trips by gender mirrors the employment patterns described in table 2 as well as the traditional division of duties within the home. Eighty percent of men's trips were work related, whereas only 17 percent of women's trips were. Forty-one percent of women's trips involved shopping, and another 9 percent involve taking children to or from school /tuition centers. In contrast, less than 7 percent of men's trips were for these purposes. Twenty-two percent of women's trips were for outings, socializing, or visiting relatives, whereas only 9 percent of men's trips were.

Table 3 Purpose of trips made on typical day, by gender (percent)

Purpose	*Men*	*Women*
Work (regular workplace)	77.0	16.7
Work (off-site meeting, conference, sales call)	2.8	0.3
Drop off/pick up children from school	0.2	8.2
Drop off/pick up children from tuition centers	0.1	0.8
Go to hospital, clinic, or doctor	2.6	5.4
Shop for groceries, clothes, or other household goods	6.1	40.9
Outing (movies, lunch, dinner, park, sports)	3.5	10.3
Socializing(visit friends/relatives)	5.4	11.4
Government office or religious place	0.6	2.1
Attend school/college as a student	0.2	0.3
Personal services (banking, dry cleaning, beauty parlor, mechanic)	1.1	2.7
Other	0.4	1.0
Observations	3,105	27,90
Individuals	3,020	2,717

Source: Travel diaries completed by survey respondents.
Note: As 99 percent of all trips were round trips, originating and ending at the respondent's home, trips are recorded as round trips.

Tables 4 and 5 describe the mode choices and travel times for men and women for select trip purpose. For commutes to work, which constituted about half of all trips, the results from the trip diary, which are based on a single commute trip, are consistent with the descriptions of the typical commute trip (see tables 6 and 7). The main mode chosen is the mode that takes the longest time, unless a motorized mode is chosen, in which case the choice selected is the motorized mode that takes the longest time.

Table 4 Mode choice by (select) trip purpose, by gender (percent)

Main mode of transport	*Work*		*Shopping for household-related items*		*Healthcare*		*Socializing*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*

Foot	32.6	41.5	68.6	87.7	71.6	80	63.7	79
Bicycle	0.9	0	0.5	0	0	0	0	0
Rail	13	18.3	2.1	0.5	0	0.7	2.4	1.9
Public bus	6.9	11	2.1	0.6	1.2	0.7	1.8	1.9
Private bus	0.2	0.7	0	0.1	0	0	0	0
Auto-rickshaw (shared)	4.1	8	3.7	2.5	2.5	2	2.4	1.9
Auto-rickshaw (private)	3.6	7.5	6.9	4.8	8.6	11.3	11.3	7.5
Taxi	1.2	0.7	1.1	1.1	6.2	2	0.6	2.2
Call cab	0	0.2	0	0	0	0	0	0
Uber/Ola	1.9	1.5	0	0.2	0	0.7	0	1.3
Own two-wheeler	30.4	8	12.2	2	7.4	1.3	14.9	3.1
Own car, jeep, or van	4.4	1.3	2.1	0.3	2.5	1.3	1.2	0.6
Someone else's car, jeep, or van	0.6	1.1	0.5	0.1	0	0	1.8	0.6
Metro	0.3	0.4	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100
Observations	2,392	465	188	1140	81	150	168	319

Table 5 One-way travel time by (select) trip purpose, by gender (percent)

Travel time (minutes)	*Work*		*Shopping for household-related items*		*Healthcare*		*Socializing*	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
1–10	31.4	29.7	60.4	80.1	69.1	76.0	55.4	73.4
11–20	30.5	28.0	27.3	14.9	13.6	19.3	26.2	16.0
21–30	16.4	15.5	10.2	3.4	12.4	4.7	11.3	7.5
31–40	7.5	8.8	1.1	0.8	2.5	0.0	4.8	2.2
41–50	5.9	7.1	0.5	0.2	2.5	0.0	0.6	0.0
51–60	3.8	4.1	0.5	0.4	0.0	0.0	0.6	0.0
61–90	3.6	5.8	0.0	0.3	0.0	0.0	0.0	0.3
91–120	0.7	0.2	0.0	0.0	0.0	0.0	1.2	0.6
Above 120	0.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Total	100	100	100	100	100	100	100	100
Observations	2,392	465	187	1,140	81	150	168	319

For non-work trips, three results stand out:

- For both men and women, walking is the predominant mode of travel.
- Rail and bus are seldom used for non-work trips.

- Women generally travel by slower modes than men.

More than two-thirds of all non-work trips were made on foot, and the percentage was higher for women (84 percent) than men (66 percent).[11] This finding is consistent with the fact that most non-work trips have one-way travel times of 20 minutes or less, including more than 80 percent of men's non-work trips and more than 95 percent of women's non-work trips. The fact that destinations are close to home partly explains the small modal shares of rail and bus for non-work trips. When motorized transport is used, it is likely to be a two-wheeler (especially for men) or an auto-rickshaw.

Gender differences in commuting to work

Table 6 reveals that women were 10 percentage points more likely than men to walk to work (38 percent versus 28 percent) and that they had larger modal shares than men for rail (20 percent versus 17 percent), bus (12 percent versus 8 percent), and auto rickshaw (14 percent versus 8 percent). Thirty-two percent of commute trips by men but just 9 percent of trips by women were by two-wheeler. The greater reliance of women commuters on walking and public transit mirrors patterns observed in other countries, as does the larger share for auto-rickshaws than two-wheelers (Ng and Acker 2018).

Table 6 Main transport mode for typical commute to work, by gender (percent)

Main mode	*Men*	*Women*
Foot	28.1	38.9
Bicycle	1.1	0.2
Rail	16.9	20.3
Public bus	7.1	10.8
Private bus	0.4	0.6
Auto-rickshaw (private)	4.8	9.1
Auto-rickshaw (shared)	3.0	5.3
Taxi	1.2	0.8
Uber/Ola	0.1	1.1
Two-wheeler (own vehicle)	31.5	8.9
Own car, jeep, or van	4.7	2.1
Someone else's car, jeep, or van	0.6	1.5
Other	0.4	0.4
Observations	2,658	473

Note: Table is based on responses by 2,658 men and 473 women who worked outside the home and for whom the main mode of transportation was known. The survey asked for up to three modes of transport. The main mode is defined as the motorized mode on which the respondent spends the most time during a typical commute to work and as the non-motorized mode (foot or bicycle) if it were the only mode of transport reported, with precedence given to bicycle if both foot and bicycle were reported.

Table 6 indicates that a larger percentage of men commuted by faster modes (37 percent of men commuted by car or two-wheeler, in contrast to 12 percent of women). Table 7 indicates that the

[11] Figures refer to all non-work trips, a subset of which are described in table 5.

distribution of commute times was almost identical for men and women: 60 percent of women and 61 percent of men had commute times of 20 minutes or less, and 85 percent of women and men had commutes of 40 minutes or less. The figures from the two tables indicate that on average, men traveled farther to work than women, a finding mirrored in studies of Argentina (Quiros, Mehndiratta, and Ochoa 2014) and elsewhere (Ng and Acker 2018).

Table 7 Travel time for typical commute to work, by gender (percent)

Length of commute (minutes)	*Men*	*Women*
1–10	32.1	28.8
11–20	29.1	31.1
21–30	16.0	15.6
31–40	8.1	9.1
41–50	6.3	7.4
51–60	3.7	3.2
61–90	3.7	3.0
91–120	0.8	1.3
More than 120	0.4	0.6
Observations	2,658	473

Note: The survey asked for up to three modes of transport for a typical commute and the time spent on each mode. Table is based on the sum of the durations reported.

Analysis of the data from the 2004 survey (tables 8 and 9) allows us to compare commute mode choice and commuting times by gender in 2004 and 2019. The stylized facts characterizing commuting patterns in 2019—that a higher percentage of women than men walked to work and that a smaller percentage of women traveled by two-wheeler or car than men—also characterize commuting patterns in 2004. The big difference between the two surveys is the reduction in the share of people walking to work, the reduction in the share of men and women taking public transit, and the huge increase in two-wheelers as a commute mode. The share of men using bus (rail) as their primary commute mode fell by 50 (28) percent between 2004 and 2019, and the modal share of two-wheelers increased by 350 percent. There was little change in the distribution of commute times: For both men and women, 55 percent of commutes in 2004 were 20 minutes or less, although the longer tail of the commute distribution observed in 2004 (10 percent of commutes of 60 minutes or more) was cut in half in 2019. The 2008 Comprehensive Transportation Study (CTS) report noted that informal employment was growing more rapidly than formal employment sectors in Mumbai. This increase in employment in informal sectors reduced the distance and consequently time taken to get to work.

Table 8 Main commute mode for typical commute to work, by gender, 2004 and 2019 (percent)

	Men		*Women*	
Main mode	*2004*	*2019*	*2004*	*2019*
Foot	40.5	28.1	52.2	38.9
Bicycle	3.4	1.1	0.0	0.2
Rail	24.0	16.9	24.3	20.3
Bus	16.5	7.5	15.5	11.4
Auto-rickshaw	1.8	7.8	3.0	14.4
Taxi	0.2	1.4	0.0	1.9
Own two-wheeler	9.4	31.5	1.1	8.9
Own car, jeep, or van	2.9	4.7	1.6	2.1
Someone else's car, jeep, or van	0.2	0.6	0.2	1.5
Other	1.1	0.4	2.2	0.4
Observations	5,171	2,658	629	473

Note: Reported figures are based on respondents who worked outside the home and for whom the main mode of transportation was known. For the 2019 survey, the table includes responses only by the main respondent of the survey. In 2004, commuting information was collected for people working in the household (whether the main respondent or not); responses by all respondents for whom this information was available are reported. The surveys asked for up to three modes of transport. The main mode is defined as the motorized mode on which the respondent spends most of his or her usual work commute and as the non-motorized mode (foot or bicycle) if that was the only mode of transport reported, with precedence given to bicycle if both foot and bicycle were reported. In the 2004 survey, where there was more than one potential main commute mode, precedence was given to choices that were less representative on the aggregate level. No such possibility arose in the 2019 round.

Table 9 One-way travel time for a typical work commute, gender, 2004 and 2019 (percent)

	Men		*Women*	
Travel time (minutes)	*2004*	*2019*	*2004*	*2019*
1–10	32.5	32.1	33.0	28.8
11–20	23.0	29.1	21.6	31.1
21–40	21.4	24.0	23.8	24.7
41–60	12.7	10.0	11.1	10.6
60–120	10.0	4.4	10.2	4.2
More than 120	0.5	0.4	0.3	0.6
Observations	5,068	2,658	588	473

Note: Survey asked for up to three modes of transport for a typical commute to work and the time spent on each mode. Figures are the sum of the durations reported.

Employment and commuting patterns of respondents by residential location

Table 10 indicates where survey respondents living in each of the six zones in the GMR work.[12]

[12] This table is based on employed people in each household, whether or not they are one of the main respondents.

Table 10 Employment of survey respondents, by zone of residence, workplace, and gender (percent)

	Zone of residence						
Gender/zone of workplace	*1*	*2*	*3*	*4*	*5*	*6*	*Average*
Women							
1	45.1	5.6	0.0	1.3	1.4	1.9	6.6
2	4.2	49.3	2.3	0.0	4.1	7.6	8.5
3	4.2	14.1	80.7	9.9	4.1	3.8	17.2
4	0.0	1.4	6.8	56.3	2.0	3.8	15.6
5	0.0	0.0	0.0	0.7	51.0	4.8	12.8
6	0.0	0.0	0.0	0.7	2.0	43.8	7.9
Home	46.5	29.6	10.2	30.5	12.2	31.4	25.3
Outside the Greater Mumbai Region	0.0	0.0	0.0	0.7	23.1	2.9	6.0
Average percent by zone of residence	11.2	11.2	13.9	23.9	23.2	16.6	
Men							
1	55.2	6.8	2.3	1.7	1.8	2.1	8.0
2	5.4	66.3	2.1	1.6	3.0	4.5	12.3
3	7.4	9.6	78.7	11.6	7.7	5.2	22.3
4	1.0	1.1	8.7	66.1	1.2	1.7	19.0
5	1.0	1.4	1.2	1.5	45.8	4.5	9.2
6	1.7	0.7	0.7	0.8	4.0	67.6	10.8
Home	27.3	11.2	4.7	14.8	4.0	7.9	10.8
Outside Greater Mumbai Region	1.0	3.0	1.7	1.9	32.5	6.4	7.7
Average percent by zone of residence	10.0	14.7	19.4	25.2	16.7	14.1	

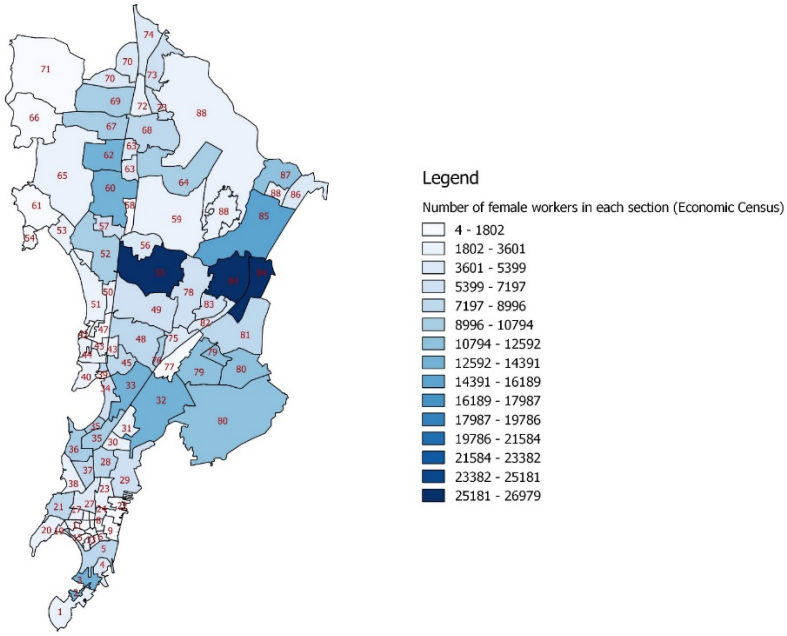
Source: Figures are based on responses of 633 female and 2,939 male survey main respondents who work.

The employment patterns of men and women are similar. However, among respondents who work, the percentage who work from home was larger for women (25.3 percent) than for men (10.8 percent) (for the sample as a whole, 5.3 percent of women and 10.6 percent of men worked from home). Combining people who work from home with people who work outside the home but within their zone of residence, the percentage of people who work in the zone in which they live was largest in zones 1, 3, and 4. The percentage of people working outside the zone in which they live was largest in zone 5, where the percentage of people working outside the GMR was also largest.

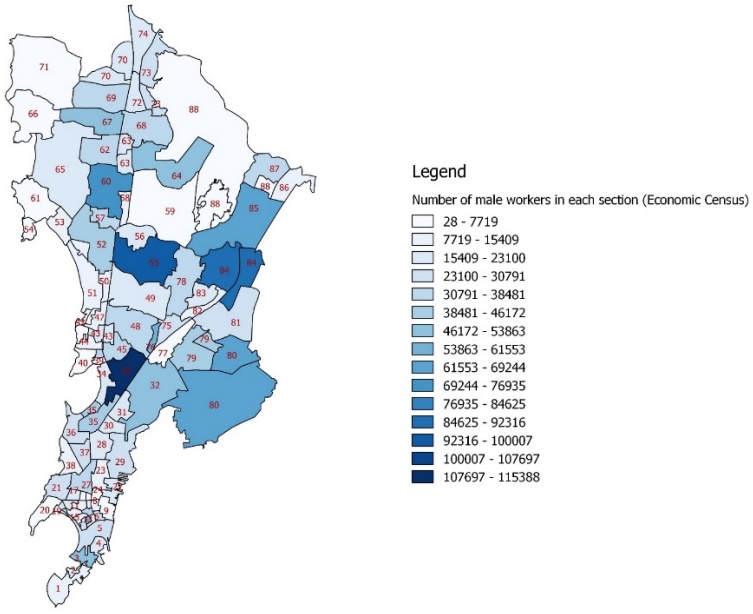
These patterns can be explained in part by the location of jobs (figure 3). The number of jobs was largest in zones 3, 4, and 1 for women and zones 1, 4, and 3 for men. Zone 5 had the fewest jobs, for both men and women.

Figure 3 Number of people working, by Economic Census of India section, 2013

a. Women



b. Men



The main mode of commuting for work varies significantly across the six zones. For both men and women, reliance on public transit was highest in zones 5 and 6 and lowest in zones 3 and 4 (table 11). In zone 6, 31 percent of women and 25 percent of men reported rail as their main commute mode; the figures were 26 percent (women) and 22 percent (men) in zone 5. Reliance on bus as a main commute mode was highest in zone 5, for both men and women. Zones 3 and 4 had the lowest modal shares for rail for both men and women.

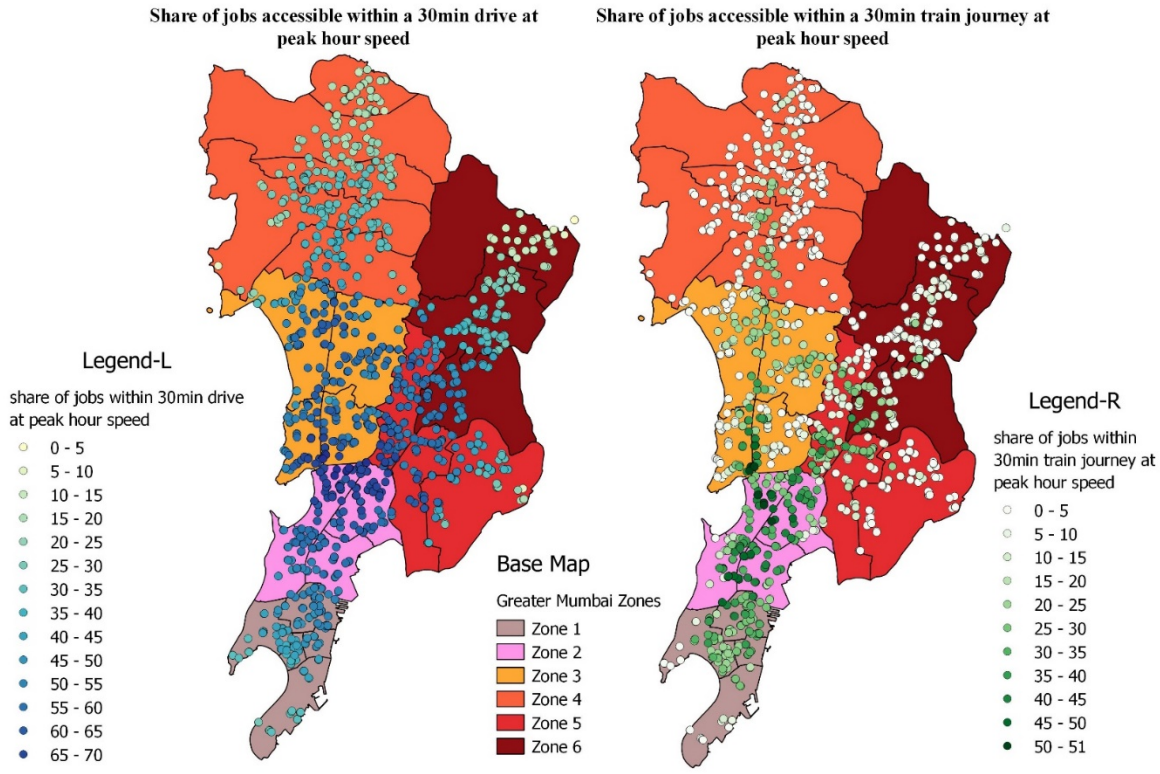
Table 11 Main commute mode for typical commute to work, by zone of residence and gender (percent)

	Zone of residence						
Gender/mode	*1*	*2*	*3*	*4*	*5*	*6*	*Average*
Women							
Foot	60.5	24.0	36.7	51.4	34.9	29.2	38.9
Bicycle	0.0	0.0	0.0	0.0	0.0	1.4	0.2
Rail	23.7	20.0	13.9	9.5	26.4	30.6	20.3
Bus	7.9	8.0	13.9	6.7	17.8	8.3	11.4
Auto-rickshaw	0.0	2.0	26.6	14.3	11.6	22.2	14.4
Taxi	0.0	8.0	3.8	1.0	0.8	0.0	1.9
Own two-wheeler	5.3	26.0	2.5	11.4	7.0	5.6	8.9
Own car, jeep, or van	0.0	8.0	1.3	2.9	0.8	1.4	2.1
Someone else's car, jeep, or van	2.6	4.0	0.0	1.9	0.8	1.4	1.5
Other	0.0	0.0	1.3	1.0	0.0	0.0	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Men							
Foot	37.5	24.9	25.1	26.0	37.0	23.0	28.1
Bicycle	0.5	1.3	0.6	2.0	1.5	0.0	1.1
Rail	14.8	16.2	12.6	12.7	22.3	25.3	16.9
Bus	3.2	6.4	6.6	6.7	12.6	7.5	7.5
Auto-rickshaw	0.5	0.8	9.6	8.1	6.1	18.1	7.8
Taxi	3.2	5.6	0.9	0.2	0.0	0.3	1.4
Own two-wheeler	34.3	39.7	37.1	38.8	15.3	21.5	31.5
Own car, jeep, or van	4.6	4.9	7.3	4.5	3.2	3.4	4.7
Someone else's car, jeep, or van	1.4	0.3	0.2	0.6	0.8	0.8	0.6
Other	0.0	0.0	0.2	0.3	1.3	0.3	0.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Table is based on responses of 473 women and 2,658 men who worked outside the home and for whom the main mode of transportation was known. The survey asked for up to three modes of transport. The main mode is defined as the motorized mode on which the respondent spends the most time during a typical commute to and as the non-motorized mode (foot or bicycle) if that was the only mode of transport reported, with precedence given to bicycle if both foot and bicycle were reported.

The study also estimated the proportion of all jobs in the GMR that a household could reach within 30 minutes by rail and 30 minutes by road (figure 4); figure 5 maps the corresponding proportions for 60-minute commutes.[13]

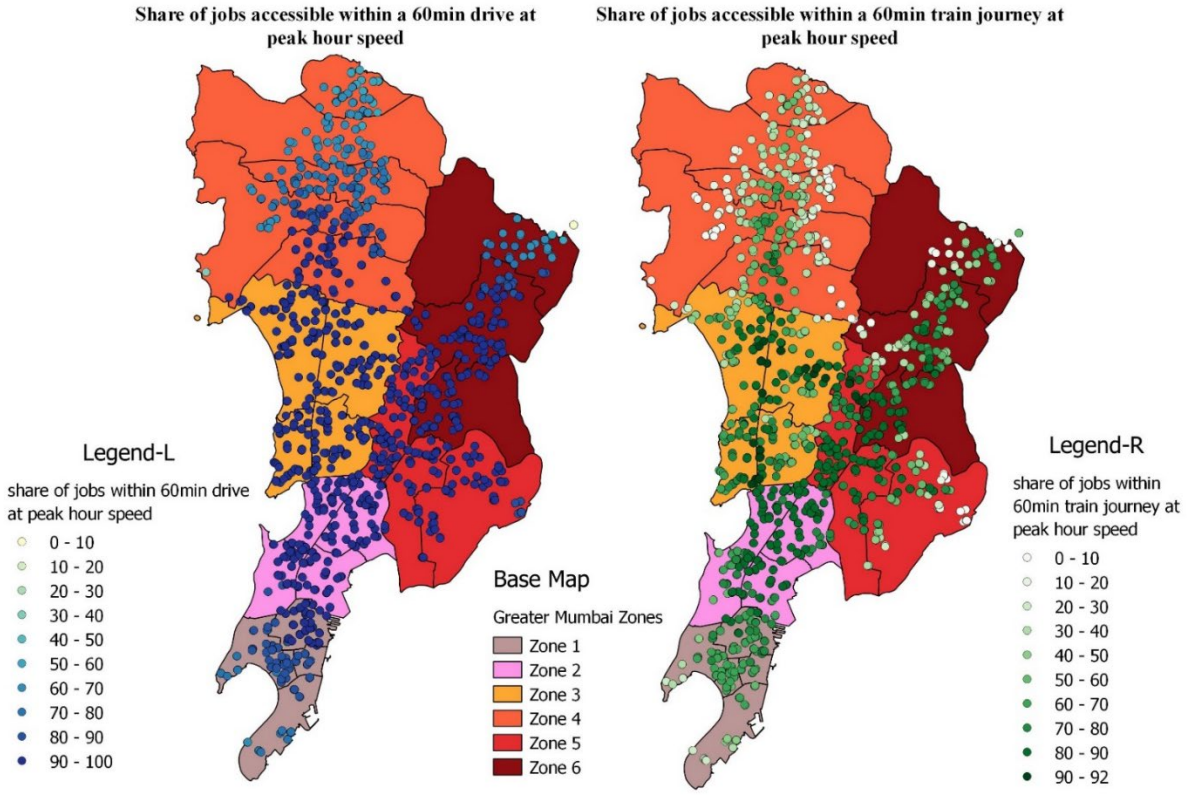
Figure 4 Share of jobs accessible within a 30-minute drive or rail journey during rush hour, 2019



Note: Jobs data from 2013 Economic Census of India is used.

[13] The percentage of jobs that can be accessed is based on travel time by rail or car only; it does not include walking time.

Figure 5 Share of jobs accessible within a 60-minute drive or rail journey during rush hour, 2019



Note: Jobs data from 2013 Economic Census of India is used.

Table 12 summarizes the job accessibility results averaged across all households living in each zone. It implies that workers living in zone 4 can access just 6.2 percent of jobs by rail within a 30-minute commute and just 36.3 percent of jobs within a one-hour rail commute. Workers living in zone 3 can access only 15.7 percent of all jobs within a 30-minute commute. This helps to explain the low share of commuters by rail in zones 3 and 4. The low reliance on rail in zones 3 and 4 can also be explained by the time required to walk to the nearest rail station (see table 13), which is not included in the 30-minute commute time in figure 5. In zones 3 and 4, only about one-fifth of households are within a 10-minute walk of a rail station. In contrast, over half of households in zone 1 are within a 10-minute walk of a rail station, a fact that may explain why the share of women taking rail to work (24 percent) is high in zone 1. Table 12 does not explain the high reliance on rail in zones 5 and 6. Although the percentage of jobs in the GMR that can be reached by rail within 30 minutes in these zones is low, the table does not indicate how many jobs can be accessed by rail in the Mumbai metropolitan area, e.g., in Navi Mumbai and Thane.

Table 12 Share of jobs accessible by households by car and rail, by zone (percent)

	Zone of residence					
Item	*1*	*2*	*3*	*4*	*5*	*6*
By car						
Share of jobs within 30-minute ride	44.7	60.7	55.1	28	50.9	34.6

Share of jobs within 60-minute ride	85.4	97.2	98.8	77.2	97	92.4
Share of jobs within 90-minute ride	100	100	100	99.7	99.3	100
By rail						
Share of jobs within 30-minute ride	24.4	32.4	15.7	6.2	13.6	8.7
Share of jobs within 60-minute ride	62.6	80.8	71	36.3	68.3	59
Share of jobs within 90-minute ride	88.6	93.5	94.3	80.6	90.2	89.7

Note: Figures are based on speeds at rush hour.

Accessibility and quality of public transit

The decline in the use of public transit by commuters in Mumbai between 2004 and 2019 (see table 8) raises questions about the accessibility and quality of public transit. Figures 5 and 6 suggest that part of the shift to private motorized transport may reflect the fact that more jobs are accessible within a given commuting time by driving than by rail. Allowing for the time required to walk from home to the nearest rail station and from the rail station to the workplace location would increase the advantage of driving over rail as a commute mode.

Table 13 shows the walking time from a respondent's home to the nearest rail station. Walking times are shortest for households in zones 1 and 2, where more than half of households have a walk of 10 minutes or less; they are longest in zones 3 and 4, where only about 20 percent of households have a walk of 10 minutes or less. In zones 3 and 5, half of households in the sample report a walking time of 20 minutes or more to the nearest rail station. In contrast, most households live within a 10-minute walk of the nearest bus stop, regardless of zone (table 14).

Table 13 Time to walk to nearest rail station, by zone of residence (percent)

	Zone of residence							
Time (minutes)	*1*	*2*	*3*	*4*	*5*	*6*	*Average*	*Observations*
Less than 5	11.0	10.4	5.0	5.2	6.4	11.1	7.5	451
5–10	42.1	41.0	17.1	14.0	19.3	29.3	24.4	1,462
10–20	34.3	39.4	28.2	41.1	19.9	33.1	33.0	1,977
20–30	8.2	5.7	28.4	21.1	19.8	19.4	18.5	1,106
More than 30	4.4	3.5	21.4	18.7	34.7	7.1	16.5	989

Note: Times reported are as perceived by main respondents. Table is based on 5,985 responses (63 participants responded "don't know").

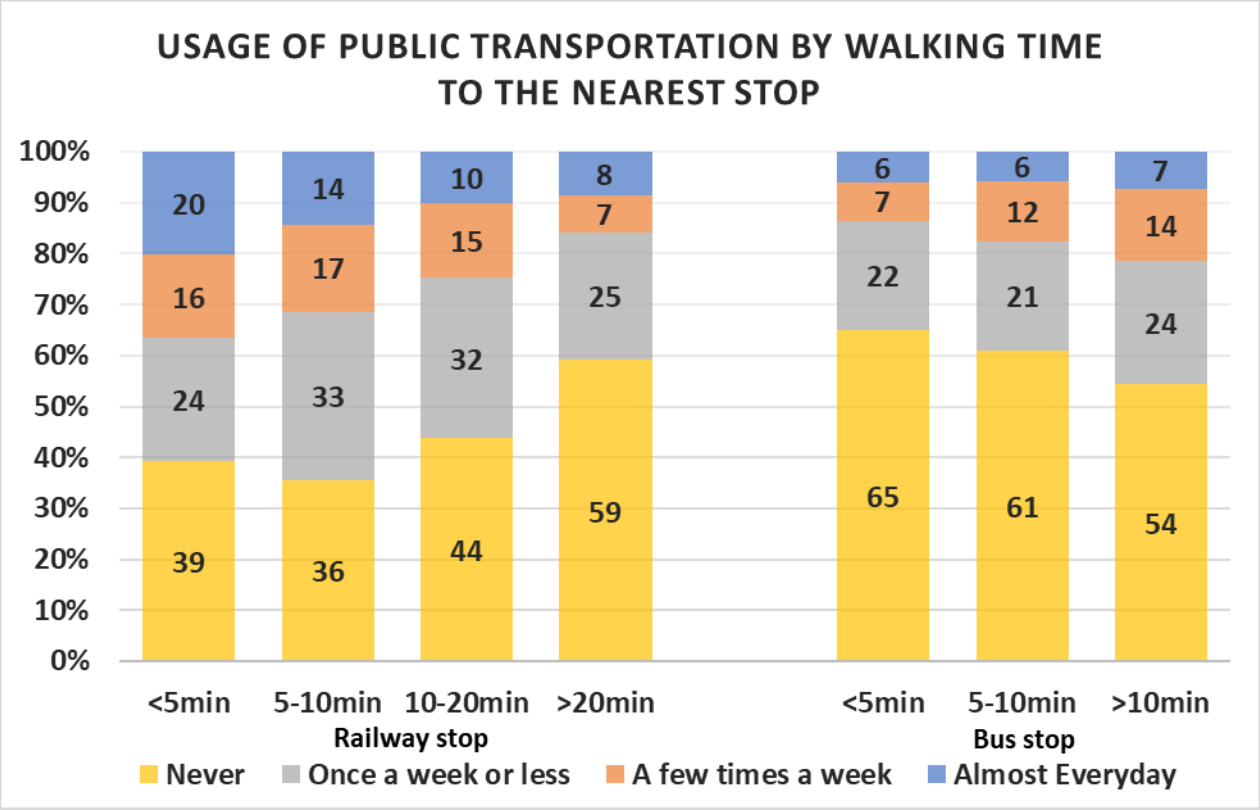
Table 14 Time to walk to the nearest bus stop, by zone of residence (percent)

	Zone of residence							
Time (minutes)	*1*	*2*	*3*	*4*	*5*	*6*	*Average*	*Observations*
Less than 5	65.0	53.1	54.2	40.6	23.0	40.5	44.5	2,652
5–10	31.8	38.2	37.7	51.4	65.9	47.1	46.7	2,786
10–20	3.0	7.4	6.1	6.5	9.7	11.9	7.5	449
20–30	0.2	1.2	0.8	0.8	0.8	0.4	0.7	44
More than 30	0	0.11	1.14	0.7	0.6	0.1	0.5	31

Note: Times reported are as perceived by main respondents. Table is based on 5,962 responses (86 participants responded "don't know").

Figure 6 shows the percentage of respondents using rail and bus services at various distances from the nearest rail station and bus stop. The share of respondents that use rail frequently declines with walking time to the nearest rail stop; the opposite pattern holds for walking time to the nearest bus stop.

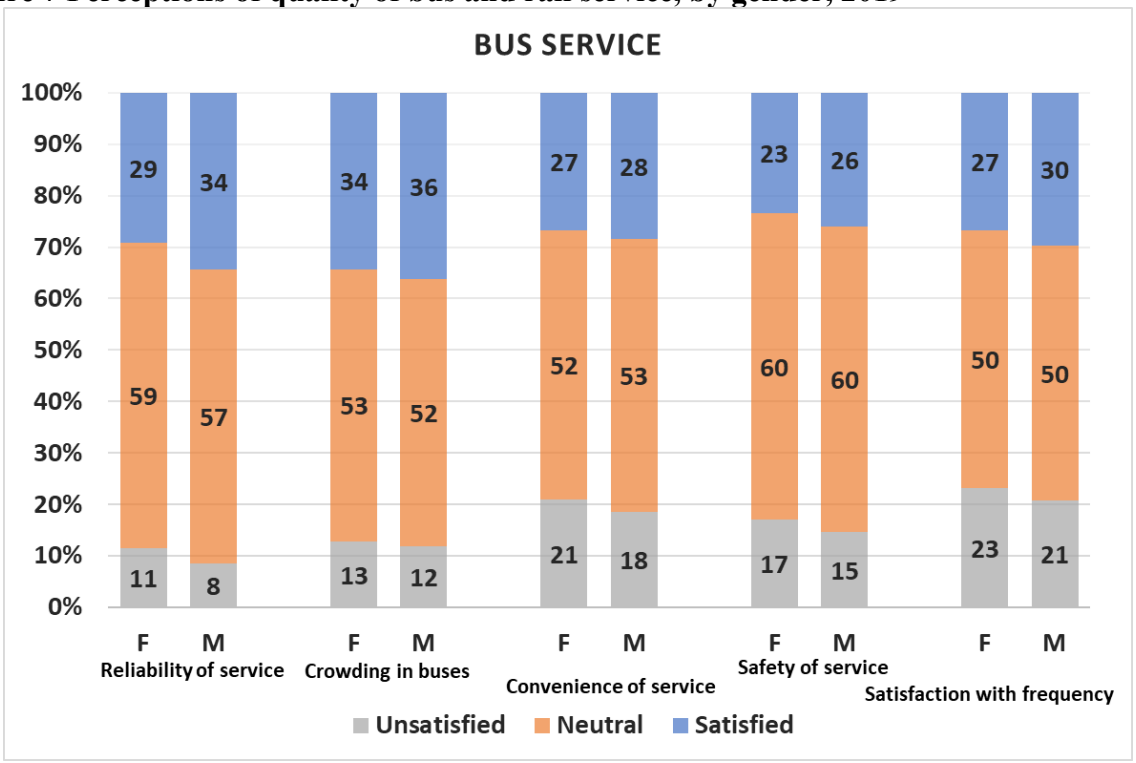
Figure 6 Use of rail and buses, based on walking time to nearest station or stop

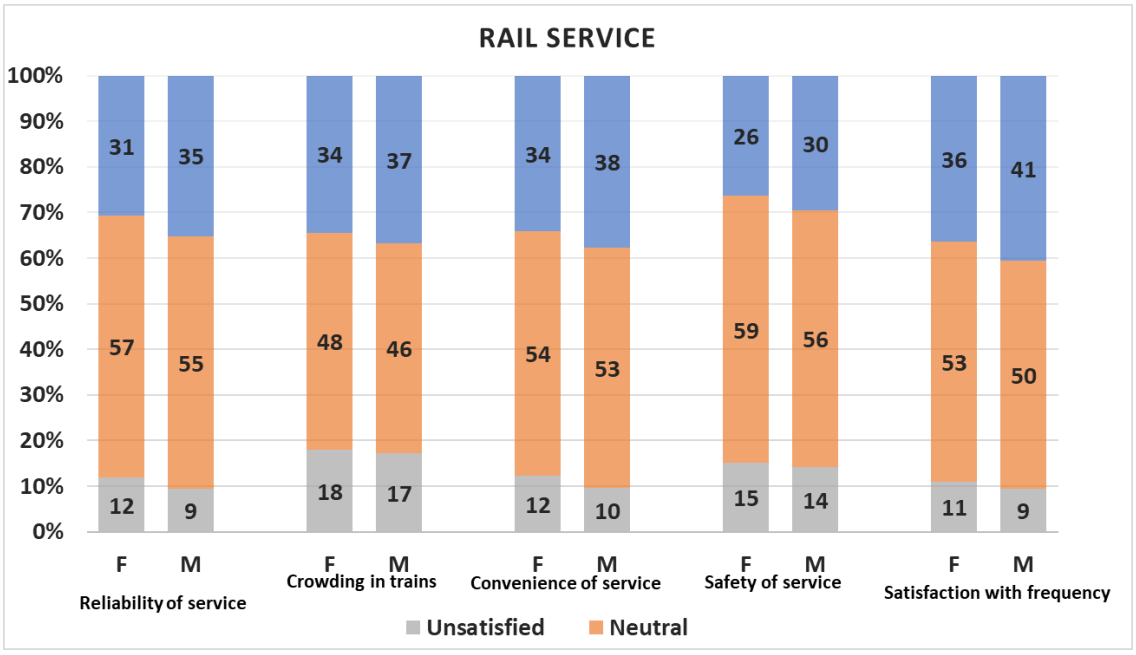


Note: Results are based on responses by both primary and secondary respondents.

Respondents were also asked their perceptions of the quality of rail and bus service. Figure 7 summarizes the responses.

Figure 7 Perceptions of quality of bus and rail service, by gender, 2019

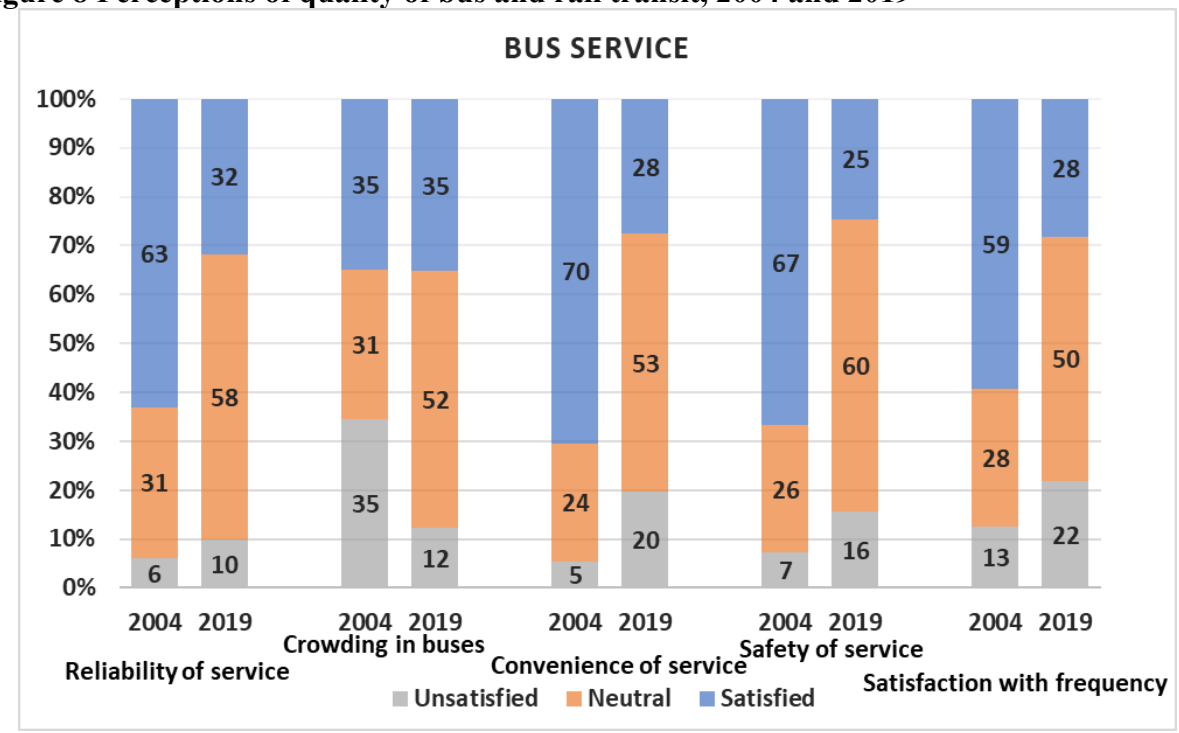


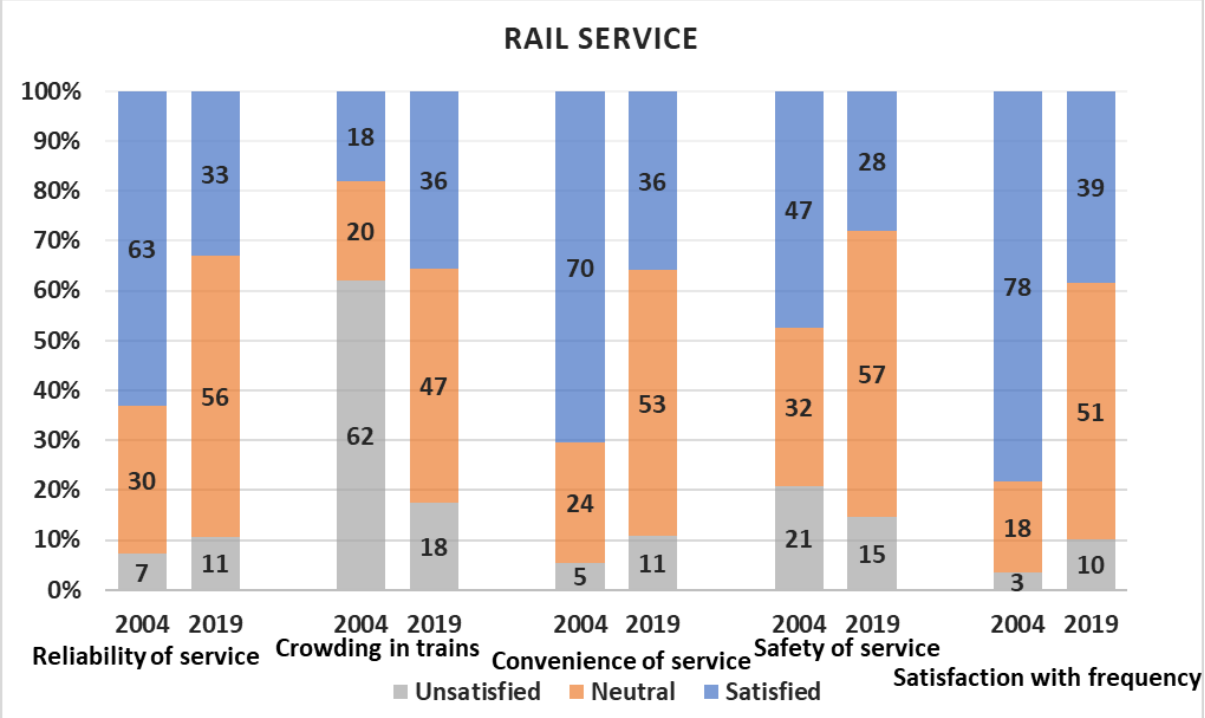


Perceptions of service quality are similar for men and women, although the percentage of respondents rating bus and rail quality as satisfactory was higher among men than women (about 2 percentage points higher for bus and 4 percentage points higher for rail) (figure 8). Women are

1–3 percentage points more likely than men to rate bus and rail quality as unsatisfactory. These findings are similar to the finding in Ola Mobility Institute (2019).

Figure 8 Perceptions of quality of bus and rail transit, 2004 and 2019





The more striking result is how perceptions of the quality of bus and rail services have changed over time. For bus service, with the exception of crowding, ratings of the other four dimensions of

service quality were rated satisfactory twice as often in 2004 as they were in 2019. On average, 59 percent of respondents rated quality as satisfactory in 2004; only 30 percent rated quality as satisfactory in 2019. The ratings for rail tell a similar story. With the exception of crowding, 65 percent of respondents, on average, rated quality as satisfactory in 2004; while only 34 percent rated quality as satisfactory in 2019. For rail, however, ratings of crowding improved over the period, with 36 percent of respondents rating crowding as satisfactory in 2019 compared to 18 percent in 2004.

Role of Transportation in Women's Employment Decisions

Transportation and current employment

Table 15 estimates the probability that a woman works (columns 1 and 2) and whether she works outside the home (columns 3 and 4) as a function of her age, education, number of children, husband's income, household size, and zone of residence. The models in columns (2) and (4) include walking time to the nearest rail stop.

The results show that women are more likely to work the higher their level of education and the larger their household size. The impact of a woman's age on the probability of working is *U*-shaped, decreasing until age 36 and rising thereafter. Having children reduced the probability of working, as does a husband having a monthly income of more than Rs. 25,000.

Table 15 Linear probability models of employment by all women

	Any work		*Work outside the home*	
Item	*(1)*	*(2)*	*(3)*	*(4)*
Education				
Primary school	–0.002	–0.001	–0.025	–0.024
	(0.039)	(0.040)	(0.032)	(0.032)
Middle school	0.002	0.005	0.030	0.035
	(0.039)	(0.039)	(0.035)	(0.036)
High school	–0.004	–0.005	0.004	0.007
	(0.040)	(0.040)	(0.030)	(0.031)
12th grade/technical training	0.101**	0.102**	0.102***	0.105***
	(0.044)	(0.045)	(0.036)	(0.037)
Graduate	0.295***	0.296***	0.276***	0.282***
	(0.040)	(0.040)	(0.037)	(0.037)
Postgraduate	0.580***	0.580***	0.456***	0.457***
	(0.075)	(0.074)	(0.076)	(0.076)
Age and household size				
Age	–0.023**	–0.024**	–0.021**	–0.022**
	(0.010)	(0.010)	(0.009)	(0.009)
Age squared	0.0003*	0.0003**	0.0003*	0.0003**
	(0.0002)	(0.0002)	(0.0001)	(0.0001)
Household size	0.030***	0.030***	0.024***	0.024***
	(0.009)	(0.009)	(0.007)	(0.007)
Number of children below 10				
One	–0.108***	–0.104***	–0.088***	–0.085***
	(0.017)	(0.016)	(0.014)	(0.013)
two	–0.188***	–0.185***	–0.174***	–0.172***
	(0.022)	(0.023)	(0.020)	(0.021)
Three or more	–0.165***	–0.156***	–0.122**	–0.115*
	(0.045)	(0.048)	(0.053)	(0.056)

Income				
Male primary earner earns more than Rs. 25,000 a month	–0.159***	–0.159***	–0.114***	–0.114***
	(0.019)	(0.019)	(0.018)	(0.018)
Time to rail stop (minutes)				
10–20		–0.017		–0.010
		(0.018)		(0.015)
More than 20		–0.027		–0.019
		(0.024)		(0.021)
Zone of residence				
2	–0.093***	–0.090***	–0.028	–0.025
	(0.022)	(0.022)	(0.024)	(0.024)
3	–0.065**	–0.056*	0.028	0.036
	(0.030)	(0.031)	(0.031)	(0.032)
4	–0.016	–0.003	0.035	0.045*
	(0.038)	(0.042)	(0.024)	(0.025)
5	0.023	0.037	0.110***	0.125***
	(0.034)	(0.032)	(0.038)	(0.035)
6	–0.011	–0.008	0.026	0.033
	(0.022)	(0.021)	(0.024)	(0.022)
Adjusted *R*-squared	0.147	0.148	0.138	0.140
Observations	3,024	2,981	3,024	2,981

Note: Columns 1 and 2: Dependent variable is an indicator taking the value 1 if the woman does any kind of work. Columns 3 and 4: Dependent variable is an indicator taking the value 1 if the woman works outside the home. Omitted category is less than primary for education, 0 for children under 10, 1 for zone of residence, and less than 10 minutes for time to rail stop. Standard errors (shown in parentheses) are clustered at the ward level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Zone of residence and access to rail play a minor role in explaining whether a woman works. Women in zones 2 and 3 were less likely to work (at all) than women living in zone 1, half of whom worked at home. In equations that estimate the probability of working outside the home, however, these results changed, with women in zone 5 significantly more likely to work outside the home than women living in other zones. Although an increase in walking time to the nearest rail stop reduced the probability of working, the effect was not statistically significant.

Table 16 presents the same models, estimated using only women who live in the house in which their husband was born. These models were tested because it can be argued that the residential location of these women is more exogenous to the decision to work than the residential location of all women. The impacts of education, household size, children, and husband's income on the probability of working are qualitatively similar to those in table 15, although the (absolute) effects of children and husband's income are larger. Age is no longer statistically significant. The impacts of zone of residence are qualitatively similar to the results in table 15. What is different is the impact of access to a rail stop. Having to walk 20 minutes or more to the nearest rail stop reduced the probability that a woman worked outside the home by 4.5 percentage points, suggesting that access to public transit may play a role, albeit a small one, in explaining whether a woman accepts employment outside the home.

Table 16 Linear probability models of employment by women living in house in which their husband was born

	Any work		*Work outside the home*	
Item	*(1)*	*(2)*	*(3)*	*(4)*
Education				
Primary school	0.015	0.007	–0.044	–0.053
	(0.051)	(0.051)	(0.040)	(0.039)
Middle school	0.020	0.018	0.049	0.046
	(0.038)	(0.037)	(0.037)	(0.037)
High school	0.012	0.004	0.028	0.023
	(0.030)	(0.029)	(0.029)	(0.028)
12th grade/technical training	0.132***	0.129***	0.131***	0.127***
	(0.041)	(0.041)	(0.042)	(0.041)
Graduate	0.362***	0.359***	0.327***	0.325***
	(0.039)	(0.040)	(0.041)	(0.041)
Post-graduate	0.623***	0.620***	0.622***	0.618***
	(0.081)	(0.081)	(0.067)	(0.067)
Age and household size				
Age	0.010	0.012	–0.005	–0.004
	(0.013)	(0.013)	(0.012)	(0.012)
Age squared	–0.0001	–0.0002	0.00004	0.00002
	(0.0001)	(0.0002)	(0.0002)	(0.0001)
Household size	0.031**	0.032**	0.024**	0.025**
	(0.014)	(0.014)	(0.010)	(0.010)
Number of children below 10				
One	–0.127***	–0.125***	–0.088***	–0.089***
	(0.024)	(0.023)	(0.021)	(0.020)
Two	–0.224***	–0.217***	–0.217***	–0.213***
	(0.036)	(0.039)	(0.033)	(0.034)
Three or more	–0.273***	–0.281***	–0.258***	–0.274***
	(0.083)	(0.088)	(0.066)	(0.068)
Monthly income				
Male primary earner earns more	–0.225***	–0.229***	–0.154***	–0.156***
than Rs. 25,000	(0.029)	(0.029)	(0.029)	(0.029)
Time to rail stop (minute)				
10–20		–0.031		–0.032
		(0.021)		(0.020)
More than 20		–0.040		–0.045**
		(0.029)		(0.021)
Zone of residence				
2	–0.111**	–0.113**	–0.036	–0.037
	(0.053)	(0.053)	(0.047)	(0.047)
3	–0.119**	–0.120*	–0.006	–0.005
	(0.057)	(0.058)	(0.047)	(0.048)
4	–0.034	–0.023	0.012	0.026
	(0.063)	(0.066)	(0.051)	(0.052)
5	–0.015	–0.003	0.110	0.126*
	(0.061)	(0.060)	(0.066)	(0.063)
6	–0.045	–0.053	0.034	0.037
	(0.052)	(0.054)	(0.048)	(0.048)
Adjusted *R*-squared	0.181	0.182	0.195	0.198
Observations	1,235	1,221	1,235	1,221

Note: Columns 1 and 2: Dependent variable is an indicator taking the value 1 if the woman does any kind of work. Columns 3 and 4: Dependent variable is an indicator taking the value 1 if the woman works outside the home. Omitted category is less than primary for education, 0 for children under 10, 1 for zone of residence, and less than 10 minutes for time to rail stop. Standard errors (shown

in parentheses) are clustered at the ward level
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 17 suggests that, conditional on working, the decision to work at home is influenced by proximity to rail. The linear probability models in table 17 use the same variables as in tables 15 and 16 to explain whether a woman works from home, given that she has decided to work. The models in columns (1) and (2) are estimated using all working women; the models in columns (3) and (4) are estimated using working women who live in the house in which their husband was born. For the latter group, living more than a 20-minute walk from a rail station increased the probability that the woman worked from home (rather than commuting) by 8.3 percentage points.

Table 17 Linear probability models of female home-based employment conditional on any employment

Item	*(1)* *Full sample*	*(2)* *Full sample*	*(3)* *Lives in spouse's birth home*	*(4)* *Lives in spouse's birth home*
Education				
Primary school	0.151	0.141	0.266**	0.273**
	(0.101)	(0.106)	(0.126)	(0.124)
Middle school	–0.162*	–0.177*	–0.194	–0.193
	(0.087)	(0.094)	(0.154)	(0.153)
High school	0.035	0.002	–0.047	–0.054
	(0.075)	(0.076)	(0.130)	(0.132)
12th grade/technical training	–0.120	–0.136*	–0.176	–0.176
	(0.071)	(0.077)	(0.139)	(0.140)
Graduate	–0.167**	–0.186**	–0.193	–0.186
	(0.078)	(0.084)	(0.115)	(0.117)
Postgraduate	–0.089	–0.104	–0.278**	–0.269**
	(0.093)	(0.097)	(0.127)	(0.122)
Age and household size				
Age	0.001	0.005	0.011	0.011
	(0.019)	(0.020)	(0.026)	(0.029)
Age squared	–0.000	–0.000	–0.000	–0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Household size	–0.012	–0.010	–0.015	–0.011
	(0.012)	(0.012)	(0.016)	(0.016)
Number of children below 10				
One	0.058	0.060	0.036	0.044
	(0.048)	(0.047)	(0.059)	(0.059)
Two	0.232***	0.229***	0.295**	0.312**
	(0.058)	(0.060)	(0.124)	(0.128)
Three or more	–0.057	–0.063	0.426	0.405
	(0.173)	(0.174)	(0.295)	(0.307)
Household income				
Male primary earner earns more	–0.026	–0.034	–0.057	–0.071
than Rs. 25,000 a month	(0.066)	(0.065)	(0.084)	(0.080)
Time to rail stop (minutes)				
10–20		0.019		0.045
		(0.034)		(0.049)
More than 20		0.027		0.083*
		(0.043)		(0.047)
Zone of residence				
2	–0.136	–0.140	–0.120	–0.107

	(0.084)	(0.086)	(0.120)	(0.125)
3	–0.356***	–0.368***	–0.313**	–0.327**
	(0.077)	(0.081)	(0.125)	(0.125)
4	–0.176	–0.190*	–0.106	–0.131
	(0.105)	(0.103)	(0.170)	(0.167)
5	–0.350***	–0.375***	–0.370***	–0.402***
	(0.075)	(0.076)	(0.120)	(0.120)
6	–0.153*	–0.179**	–0.245**	–0.281**
	(0.081)	(0.080)	(0.109)	(0.111)
Adjusted *R*-squared	0.121	0.123	0.201	0.210
Observations	633	626	295	292

Note: Dependent variable is an indicator of whether a woman is working from home conditional on working at all. Columns 1 and 2 include all women; Columns 3 and 4 include women living in the house in which their husband was born. Omitted category is less than primary for education, 0 for children under 10, zone 1 for zone of residence, and less than 10 minutes for time to rail stop. Standard errors (shown in parentheses) are clustered at the ward level.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Transportation and willingness to work

Women and men who were not working at the time of the survey were asked a series of questions about their occupational aspirations. Only 2.4 percent of these women reported having previously worked outside the home, although 26 percent had worked from home at some time in the past (table 18). The main reason given for not working outside the home was "domestic duties" (cited by 74 percent of respondents) and "own preferences" (cited by 20 percent of respondents). Only 3.4 percent of respondents cited jobs being too far from home.

Table 18 Nonworking women's attitudes toward employment and barriers to employment

Item	*Percent*
*Previous work experience (*n *= 2,388)*	
Worked outside the home	2.4
Worked from home	26.1
None	71.5
*Reasons for not working outside the home (*n *= 2,331)*	
Have been studying	4.3
Domestic duties	73.6
Family's preferences	7.7
Lack of qualifications	7.5
Preferred jobs are too far from home	3.4
Own preferences	20.3
*Willing to accept work outside the home (*n *= 2,388)*	
Yes	11.4
No	88.7
*Types of acceptable work (*n *= 271)*	
Outside home, regular full time	17.3
Outside home, regular part-time	50.6
Outside home, occasional full time	2.2

Outside home, occasional part time	2.2
From home, full time	6.6
From home, part time	21.0
*Skill level of acceptable jobs (*n = *257)*	
Unskilled	9.3
Skilled	90.7
*Commuting as a barrier to working (*n = *2,388)*	
Commuting is not a barrier to working	69.4
Commuting is a barrier to working	30.6
*Reason commuting is a barrier (*n = *2,388)*	
Public transit stop is far	3.7
Trips are long	3.9
Commuting is expensive	1.1
Commuting is unsafe	1.6
Childcare duties	12.7
Domestic duties	19.0
Family preference	2.5

When asked about barriers to working outside the home, 69 percent of women said that commuting was not a barrier. A small percentage of women said "public transit stops are far" (3.7 percent); that "trips are long" (3.9 percent); that "commuting is expensive" (1.1 percent); or that "commuting is unsafe" (1.6 percent). In contrast, 20 percent of women said that "childcare responsibilities" were a barrier to working outside the home.

When women not currently working were asked if they would accept work, 11.4 percent said that they would. Twenty-eight percent of these women would like to work from home, while the remainder were willing to commute. Seventy-four percent of women would prefer part-time, rather than full-time work (see table 18). Only 2 percent of the 2,388 respondents were willing to accept regular, full-time work outside the home. These responses reinforce the notion that demand-side factors may be preventing some women from working (Klasen and Pieters 2015).

Table 19 presents correlations between factors cited by respondents as barriers to working and answers to the question "Would you be willing to accept work?" The results indicate that respondents who mentioned that commuting trips were long, expensive, and unsafe were more likely than other respondents to say that they would accept work. This implies that lack of suitable transport options is preventing some respondents from joining the labor force. Women who reported that would need to find childcare if they worked were less likely than other women to say that they would accept work. Women whose husband's monthly income exceeded Rs. 25,000 were also less likely to say that they would accept work. These findings suggest that factors other than transport determine women's stated desire to work.

Table 19 Correlation between women's willingness to work and stated barriers to work

Item	*Correlation coefficient*	*p-value*
Far from public transit = 1	–0.0007	0.9728

Commuting trips long = 1	0.0973***	0
Commuting expensive = 1	0.041**	0.045
Commuting unsafe = 1	0.0685***	0.0008
Domestic duties = 1	0.0151	0.4618
Provide childcare = 1	–0.0726***	0.0004
Family restrictions = 1	–0.0237	0.2471
Child under 10 (truncated at 3)	–0.0208	0.3095
Household size	–0.0056	0.7857
Spouse's monthly income above Rs. 25,000	0.0669***	0.0011

Note: Table is based on responses by women who were not employed at the time of the survey.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4. Conclusions and Suggestions for Future Research

Three broad results emerge from this study:

- The mobility patterns of men and women differ in several important aspects that reflect differences in the division of labor within households.
- These differences and the evolution of these patterns point to a "pink tax" on female mobility.
- Transport is only one of the barriers to women's labor force participation—and not the most important.

Most men's trips are work-related, while half of women's trips are for shopping or transporting children to and from school or tuition centers. Women in Mumbai who work were also more likely than men to work from home. Women who commute to work were more likely than men to walk or travel by public transit. Women were also more likely than men to commute by auto-rickshaw than by two-wheeler or car. These patterns, together with the fact that the average commute time is approximately the same for men and women, suggest that on average men, commute farther than women.

The evolution of mobility patterns of men and women points to a "pink tax" (implicit surcharge) on women's mobility. Mumbai's transportation infrastructure and services (especially public transit options) have failed to keep pace with its growing population. For both bus and rail services, there was a substantial reduction in the level of user satisfaction between 2004 and 2019 across several measures, including reliability of service, convenience of service, and frequency of service. This decline undoubtedly contributed to the shift from public to private transportation (especially two-wheelers and auto-rickshaws) between 2004 and 2019.[14]

Most people in Mumbai work close to where they live, and a large share walk to work. One important difference between 2004 and 2019 is that the share of people commuting 60 minutes or more (10 percent of men and women in 2004) declined by half. The share of people walking to

[14] There was also a shift from walking and cycling toward private/semi-public modes of transport. Such a shift is typically expected as incomes rise.

work and taking public transit also declined. Despite the decline in walking, 30 percent of working women and 28 percent of working men walked to work in 2019. Integration of land use and transport networks at a granular level is critical for improving intracity connectivity in Mumbai.

There are important differences in the ways men and women changed their mobility patterns between 2004 and 2019. Although men and women expressed similar levels of dissatisfaction with bus and rail transit in 2019, a larger share of women who worked take the bus or rail. The share of commuters that walked was also higher among women. Women continued to use slower and lower-quality modes of transport than men and/or pay a higher price than men to reach similar destinations. Men increased their use of two-wheelers, and women increased their use of auto-rickshaws and taxis, which are more expensive.

These trends suggest that the presence of a pink tax on women's mobility. Although modal integration of rail, bus, road, and nonmotorized transport in Mumbai (including integrated fares) would benefit both men and women, the pink tax implies that such integration is likely to benefit women more. Providing affordable micro-mobility solutions in Mumbai (such as scooters and bicycles) could also differentially benefit women, given their greater reliance on walking. Previous studies of the bus and rail system of Mumbai identified specific aspects in the design of these services that could be improved to enhance the user experience of women. A 2011 World Bank study identified the need for an off-peak women's daily pass, women-only bus doors, women's toilets, gender training of bus conductors, and women conductors and drivers to improve the user experience of women with the bus system. Bhide, Kundu, and Tiwari (2016) identified specific design measures (such as improving the evenness of platforms, better locating hand poles at the doors, providing hand straps, and improving lighting at stations) that can improve women's user experience with the rail system.

The analysis suggests that transport is only one of the barriers to women's likelihood of participating in the work force—and not the most important one. About a third (31 percent) of the women surveyed cited commuting as a barrier to working. But less than 4 percent indicated that transport was a barrier. Much larger shares cited domestic duties (19 percent) and childcare responsibilities (13 percent) as barriers to commuting to work. Given the multitude of barriers that women face in commuting, providing safe and affordable childcare services at suitable locations in Mumbai (possibly at or close to rail stations) could enhance women's labor force participation.

Several additional questions could be investigated using the survey data. A first step could link data on the time and cost of different modes to each commuter in the survey and to estimate models of vehicle ownership and mode choice (see, for example, Takeuchi, Cropper, and Bento and others 2007). Doing so would help assess the impact of policies that shift commuters from private to public transit modes.[15] It would also help estimate the impact of congestion taxes, which are gaining traction.[16]

[15] See, for example, the reduction in bus fares in June of 2019 (https://www.indiatoday.in/india/story/mumbai-best-buses-new-fares-slashed-slab-rates-transport-bmc-1556631-2019-06-26).

[16] See https://www.itdp.org/2019/04/01/public-stakeholder-discussion-congestion-pricing-mumbai/.

The survey data could also be used to estimate models of residential location choice, which could be used to value access to jobs, via rail and via private motorized transport (see, for example, Takeuchi, Cropper, and Bento 2008). They could also be used to estimate the importance of access to jobs by men versus women in a household. Estimating such models would require data on employment by industry (available from the Sixth Economic Census) and occupation. The data could also be used to explore changes in mobility patterns based on changes in the transport landscape of Mumbai between 2004 and 2019.

To improve women's agency, it is also important to understand travel behavior for non-work-related trips. Models of mode choice quantify the trade-offs that women make between travel time, the monetary cost of travel, and mode characteristics (perceived safety, crowding, reliability). They yield information on the price elasticity of demand for various modes and quantify the importance of qualitative characteristics on travel choices. Estimates of accessibility from mode choice models serve as inputs into models that describe the number of trips taken. These models could be used to predict the impact of reduced bus fares for women, as suggested by the World Bank's *Gender Assessment of Mumbai's Public Transport* (2011).

Many of the results of this study point to inefficiencies in use of land in Mumbai. The data could be used, in conjunction with secondary data sources, to develop spatial equilibrium models that first quantify the level of land misallocation in Mumbai and then estimate the economic benefit of implementing counterfactual policies focused on improving land use in Mumbai.

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