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## **Sexual Harassment, Public Transportation, and Labor Market Outcomes for Women: Case Study of Lahore, Pakistan**

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SEXUAL HARASSMENT, PUBLIC TRANSPORTATION, AND LABOR  
MARKET OUTCOMES FOR WOMEN:  
CASE STUDY OF LAHORE, PAKISTAN

by

RACHEL WILDER

A thesis submitted in partial fulfillment of the requirements  
for the Honors in the Major program in Economics  
in the College of Business Administration  
and in the Burnett Honors College  
at the University of Central Florida  
Orlando, Florida

Spring Term, 2018

Thesis Chair: Melanie Guldi, Ph. D.

## **Abstract**

This thesis investigates an understudied question in the economics literature: how does sexual harassment experienced in and around public transportation affect labor market outcomes for women? Previous research suggests that access to public transport can improve labor market outcomes and that women's use of public transportation is sometimes limited by their experience of sexual harassment. It follows that when harassment is particularly widespread or severe – as is the case in much of South Asia – it may lead women who depend on public transportation for travel to make different labor market choices or not to work at all. If this effect exists, then it holds important implications for policymakers who aim to boost economic development and social equality by increasing women's labor force participation.

I analyze the case of Lahore, Pakistan using data from the Lahore Urban Transport Master Plan Household Interview Survey. I present a descriptive analysis of women's transportation usage, safety onboard transport, and employment in Lahore. I then use ordinary least squares and logistic regression analysis to assess the relationship between proxy variables for harassment and women's odds of employment, use of public transportation, and price and time of day of commute. Results do not support the hypothesis that sexual harassment on transportation affects labor market outcomes for women. Important limitations and suggestions for further research are discussed.

## **Acknowledgements**

I extend my sincere gratitude to my thesis chair, Dr. Melanie Guldi. Your guidance and mentorship throughout this process pushed me to grow as a researcher and made this project the most rewarding experience possible. Thank you also to my summer internship supervisor Dr.

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## **Introduction**

This thesis attempts to address an understudied question in the economics literature: how does sexual harassment experienced in and around public transportation affect labor market outcomes for women? I examine the case study of Lahore, Pakistan.

Social science and criminology literature suggest that women's use of public transportation is sometimes limited by their experience of sexual harassment, while a separate body of work in economics and urban studies highlights the role of public transportation in improving labor market outcomes. It follows that when harassment is particularly widespread or severe – as is the case in much of South Asia – it may lead women who depend on public transportation for travel to make different labor market choices or not to work at all. If this effect exists, then it holds important implications for policymakers who aim to boost economic development and social equality by increasing women's labor force participation. However, no studies to date examine the labor market impact of sexual harassment that takes place on transportation.

In this thesis, I present a simple economic model to illustrate the hypothesized impact of harassment on labor market choice, review existing literature in economics and other disciplines, and analyze transportation survey data from Lahore. Results do not support the hypothesis that sexual harassment on transportation affects labor market outcomes for women. Important limitations and suggestions for further research are discussed.

## Theoretical Motivation

### Background

We would expect the impact of sexual harassment on public transportation on labor market outcomes to differ between women according to personal characteristics such as access to private transportation, sensitivity to sexual harassment, and labor market choice in the absence of harassment. Some women who otherwise wish to work may choose not to in order to avoid harassment, while others may not alter their decisions as a result. If sexual harassment on transportation is experienced only during certain times (e.g. at night or during crowded conditions) or in certain geographic areas, then we expect that only women who wish to travel in these conditions would be affected. Table 1 summarizes the hypothesized effects.

Table 1: Predicted Impacts of Harassment on Transportation on Labor Market Outcomes

No Impact	Some Impact	Large Impact
<ul style="list-style-type: none"><li>• Women who are insensitive to sexual harassment or do not feel unsafe</li><li>• Women who can afford private transportation and choose to use it for other reasons</li><li>• Women who receive private transport from work</li><li>• Women who do not work outside the home for other reasons, such as childcare responsibility</li></ul>	<ul style="list-style-type: none"><li>• Women who are sensitive to sexual harassment and can afford to travel a limited distance using private transportation<ul style="list-style-type: none"><li>○ Impact: labor choices limited to a smaller geographic area around home</li><li>○ Some women may not find work or work in a lower-paid or lower-skilled job than they would otherwise</li></ul></li></ul>	<ul style="list-style-type: none"><li>• Women who want to work outside the home but are sensitive to sexual harassment and cannot afford to replace public transportation with private transportation<ul style="list-style-type: none"><li>○ Impact: women do not participate in the labor market or work from home instead</li></ul></li></ul>

## Model

A simple labor-leisure choice model provides a theoretical foundation. In this model, a woman's utility  $U$  depends on her total income  $Y$  and her number of non-work hours  $N$ , which includes time spent on unpaid household tasks. Her utility function is therefore given by  $U = U(Y, N)$  where  $U$  is increasing in  $Y$  and  $N$  (see Perloff, 2011 for an example of this model).

A woman's income  $Y$  is comprised of her earned income – hourly wage  $w$  timed hours worked  $H$  – and her unearned income  $M$ , which may include financial support from her spouse or parents.  $N$  is equal to 24 minus number of hours worked  $H$ . Therefore

$$U = U(wH + M, 24 - H)$$

I assume that a woman faces the discrete choice of working for eight hours or not working at all. In this case, she will choose to work only when

$$U(8w + M, 16) > U(M, 24)$$

Sexual harassment during commute enters as a factor  $S$  that decreases the utility from working by acting as a tax on the wage. The magnitude of  $S$  varies based on the intensity and frequency of harassment experienced during the commute and the degree to which harassment causes a woman to feel uncomfortable or unsafe. The monetary cost of the daily commute is  $c$ . Therefore a woman's utility function can be written as

$$U = U(wH + M - H(S + c), 24 - H)$$

So she will choose to work when

$$U(8w + M - 8(S + c), 16) > U(M, 24)$$

It should be noted that in this discrete choice model, the cost of commute is included as a factor multiplied by working hours to indicate that only women who work outside the home incur this cost. Therefore, this model cannot be generalized to the continuous case.

In addition, women can avoid experiencing harassment if they choose private transportation, such as a taxi or personal vehicle, instead; however, private transportation is more expensive than public transportation. Given a public transportation cost of  $c_p$  and a private transportation cost of  $c_r$  where  $c_p < c_r$ , the condition for choosing to work becomes

$$\max(U(8w + M - 8(S + c_p), 16), U(8w + M - 8c_r, 16)) > U(M, 24)$$

Several implications can be drawn from this model. We can assume that women experience decreasing marginal utility from income, so that women with a lower  $M$  derive more utility from earning  $8w$ . A woman who has no resources other than what she earns will be more likely to work than one who can live comfortably on unearned income, holding harassment and commute cost constant. By the same logic, a woman whose total income when working is smaller will be more sensitive to the cost of private transportation and therefore more likely to choose public transportation absent harassment. Women will choose not to work under two conditions:

- $U(8w + M, 16) < U(M, 24)$ : These women value eight additional non-work hours at a rate greater than  $w$ .
- $U(8w + M, 16) > U(M, 24)$ ; however,  
 $\max(U(8w + M - 8(S + c_p), 16), U(8w + M - 8c_r, 16)) < U(M, 24)$ : These are women who do not work because to them the cost of taking public or private transportation to work is greater than the utility gained from earning  $8w$ . For them, private transportation is prohibitively

expensive, and they will not take public transportation because either the monetary or harassment cost is too high.

In addition, there are women for whom

$$U(8w + M - 8c_p, 16) > U(8w + M - 8c_r, 16) > U(M, 24)$$

and

$$U(8w + M - 8c_r, 16) > U(8w + M - 8(S + c_p), 16) > U(M, 24),$$

meaning that they choose to work but pay for private transportation in order to avoid harassment.

It is possible that for some women in this category, the higher cost of private transportation means that they will be willing to working in a smaller radius around their home than if they were able to travel on public transportation without harassment.

## **Review of Academic Literature**

### **Transportation and the Labor Market**

An extensive body of economics and urban studies literature examines the relationship between transportation and labor market outcomes. Multiple studies using United States data have demonstrated that having access to a car increases the probability of employment (Baum, 2009; Raphael & Rice, 2002; Gurley & Bruce, 2005). Cervero et al. (2002) completed logistic regression analysis on the transport-employment relationship using panel data from welfare recipients in California. They found that car ownership had a stronger impact on odds of employment than did variables related to public transportation access and quality. However, the ability to walk to and ride public transportation did significantly impact employment outcomes after controlling for car ownership. Other papers identify a strong impact of public transportation on employment outcomes, including Sanchez's (1999) analysis of transport access and labor force participation levels in Atlanta, Georgia and Portland, Oregon; Kawabata's (2003) work on low-skilled autoless workers in San Francisco, Los Angeles and Boston; and Matas et al.'s (2010) investigation on transport access and employment for women in Barcelona and Madrid. Public transport may disproportionately increase access to low-wage jobs (Fan et al., 2010) and benefit individuals with lower levels of educational attainment (Matas et al., 2010).

Reducing the costs of accessing public transportation may also improve labor market outcomes. In one randomized control trial, individuals in Washington, D.C. who sought help from a job search program and were given public transportation subsidies completed 19% more job search actions than individuals without the subsidy, although the effects disappeared after two weeks (Phillips, 2014).

This body of transportation literature is limited by its geographic focus on the United States and Europe; studies from the developing country context are few. One such study is Franklin's (2016) randomized control trial on 551 young job seekers in Addis Ababa, Ethiopia, in which treated individuals were given twice-weekly public transportation subsidies to travel to the city center. Regression analysis showed that treated individuals had jobs of higher quality and in higher skilled sectors than their counterparts and were more likely to work in the city center, with effects beginning to dissipate after six months. This suggests that reducing cost of transportation may have a larger impact on the quality and location of employment than on employment itself.

### **Gendered Dimension of Transportation**

Since the ways in which women's commuting patterns differ from men's might provide insight into the effect of sexual harassment on their labor market choices, I reviewed work on women's commuting patterns more generally in order to identify the factors other than harassment that might impact women's choices.

A well-established phenomenon in transportation literature from developed countries is that women have shorter commutes, measured in both distance and time, than do men (Madden 1981, Randall 2007). Some evidence indicates that this difference is the result of the difference between men's and women's household roles, with women spending more time on household and caretaking tasks. Erickson (1997) found that women with more demanding roles in the home had shorter commutes than their counterparts, while Johnston-Anumonwo (1992) observed that among Baltimore workers, the work-trip length sex disparity is larger in two-worker households. In a study analyzing the elasticity of married women's labor supply with regard to the length and

cost of a commute, Andrews (1978) noted that husband's attitudes and wife's contribution to household income impacted elasticity. In a survey of female computer professionals in Tel Aviv, Pazy et al. found that women with a child under six years old and who were dependent on the bus for transportation were more sensitive to increases in commute time than were other groups of women.

Women's shorter commutes might also be explained by the relative location of their homes and employment; for example, Hanson and Johnston (1985) found that women in Baltimore were more likely to live in the city center and that "female-dominated" jobs were less likely to be concentrated in certain districts.

There is little evidence on the relationship between transport and employment from the developing country context. Developing countries are often distinguished by wider income and geographic disparities, religious beliefs and social norms that limit women's participation, higher dependence on public transportation, and "para-transit systems" including rickshaws and taxis (Uteng 2011). Women in poor areas may be forced to use slow modes of transportation to get to work, such as walking, in turn limiting their employment prospects (Anand and Tiwari 2006). In a study of Pune, India, Astrop (1996) found that women made a higher proportion of trips by walking and by bus than did men, as women were less likely to have access to family-owned vehicles.

### **Sexual Harassment and Transportation**

I did not find any work that analyzed the impact of sexual harassment that takes place on transportation on women's labor market outcomes in my review of the economics literature. However, a body of theoretical, survey, and case-study based literature in the fields of sociology



and criminology suggests that sexual harassment on public transportation limits women's mobility. I also discuss limited work in economics on sexual harassment and assault.

**Sexual Harassment and Fear of Sexual Assault.** I define sexual assault as non-consensual sexual activity that is criminalized under most legal systems, while sexual harassment includes all other unwelcome behavior of a sexual nature. The two are related, and it is not always possible to distinguish between them. Vera-Gray (2016) notes that conventional definitions of sexual harassment include behaviors such as staring, commenting on the woman's appearance, following, or groping, all of which can be characterized as intrusions by men on women in public space. Sexual harassment may impact mobility by increasing women's fear of sexual assault. Multiple studies have documented that women experience more fear of violent crime than do men, and that this fear primarily reflects a fear of sexual assault by men (Pain 1997, Stanko 1995, Madge 1995). Women's fear of sexual assault is much stronger in public spaces than private spaces - a fact that some scholars have deemed paradoxical, as women are much more likely to be assaulted in private and by someone that they know than by a stranger in public (Pain 1991). Pain theorizes that women's fear of assault in public is exacerbated by the sexual harassment they experience from strangers (1991). Valentine (1989) and Crouch (2009) argue that sexual harassment in public functions as a tool to keep women confined to certain spaces, a theory that has also been applied to harassment in the workplace.

**Situational and Individual Factors.** I reviewed work on how personal and environmental factors influence experience of and fear of harassment and assault in order to gain insight into which groups of women may be most affected by harassment on public transportation. Lahsaeizadeh and Yousefinejad's (2012) survey of female college students in Iran

found that dressing less conservatively and having less acceptance of gender norms were associated with a higher reported experience of sexual harassment. Valentine (1989) theorizes that women experience more fear of assault at night. Lindo et al.'s (2015) analysis of panel data on football games and sexual assault on college campuses showed that game days increased reported rapes by 28% - indicating that the presence of heavy alcohol consumption is associated with sexual assault. More generally, LaGrange et al.'s (1992) analysis of over 1,000 randomly surveyed adults in the U.S. showed that factors such as public drinking and poor lighting were associated with increased perceived risk of violent crime.

**Harassment on Public Transportation.** Sexual harassment on public transportation is prevalent. Geloski et al.'s (2017) review of studies on sexual harassment of women and girls on public transportation found global prevalence rates ranging from 15% to 95%, with women in developing countries more likely to have been harassed. In their study of sexual harassment in Nepal, Neupane and Chesney-Lind (2014) suggest that public transport "offers males both proximity and anonymity, which, in turn, results in high level abuse with very little risk of social or legal consequences." Women across cultures often report experiencing fear or discomfort on public transportation (Paul-Majumder et al., 1997; Astrop, 1996; Pain, 1997). An analysis of a survey of Canadian women by Scott (2003) found that 75% of women felt somewhat or very worried when using public transportation alone at night, with a younger age and higher education level increasing the likelihood of being afraid. In a household survey in Pune, India, 41% of women said that overcrowding on public transport vehicles was a problem, compared to only 28% of men – an indicator that they experienced sexual harassment more often in crowded conditions (Astrop 1996).

Literature on the direct effect of sexual harassment on public transportation on women's mobility is scarce, as noted by Gardner et al. (2017) in their literature review. A unique quantitative study by Borker (2017) analyzes survey data from 4,000 students at the University of Delhi and data from crowd-sourced mobile applications on perceived safety of locations in Delhi as well as level of sexual harassment experienced on different modes of transportation. Results indicate that women are willing to attend a college 25 percentage points lower in the quality distribution to have a commuting route that is one standard deviation safer.

In a study consisting of focus groups with 18 women from the United States and from Taiwan, Hsu (2011) observed that some women reported avoiding sexual harassment on public transportation by not traveling alone, after dark, or on bus or train lines through areas with a high-crime reputation. These strategies were echoed by Mexican women interviewed by Graglia (2016). Additionally, a survey of women in Karachi, Pakistan by the Asian Development Bank (2014) found that half of women did not make any changes to their use of public transportation because of sexual harassment, citing their inability to choose or afford other options. A third of students and a fifth of working women and homemakers surveyed had reduced their use of public transportation in favor of more expensive private options, such as taxis and rickshaws, and 40% of students said they avoided using public transportation at night as a result of harassment. Similarly, Paul-Majumder (1997) noted that insecurity and congestion on buses in Dhaka, Bangladesh forced women to take more expensive private forms of transport.

Together, these papers outline a relationship: sexual harassment, in conjunction with women's fear of crime, causes at least some women to change or limit their use of transportation.

By extension, they may face employment options that are limited to certain geographic areas or times of day.

The understudied relationship between sexual harassment on transportation and women's labor market outcomes has policy and economic implications. This thesis attempts to close a gap in the economics literature by examining that relationship.

## **Background on Pakistan and Lahore**

Pakistan was classified as “medium human development” country in the latest United Nations Development Program Human Development Report, ranked 147 out of 188 countries (2016). Its GNI per capita in 2016 was \$1,510, and in 2013 (the latest data available) almost 30% of its population lived under the national poverty line (The World Bank 2017). The World Economic Forum ranked Pakistan 143 out of 144 countries—the second-worst place—in its 2016 Global Gender Gap Report, which rates countries on the relative status of men and women in economics, politics, health and education. Pakistan’s female labor force participation rate has more than doubled from 1995 to 2017, but is still just under 25%, compared to a worldwide rate of 49.5% (The World Bank, 2017). Rigid gender roles continue to prescribe the ways that men and women participate in society and the workforce (Saeed et al., 2017). Ejaz’s (2007) probit regression analysis of women’s labor force participation in Pakistan based on the 2004-2005 Pakistan Social and Living Standards Measurement Survey found that having access to any type of personal vehicle (including a bicycle, motorcycle, or car) had a significant positive impact on probability of labor force participation. Other significant factors included education, age, and whether the woman was the head of household. Azid et al.’s (2009) similar analysis of married women in the province of Punjab province found that whether a woman is impoverished was the largest determinant of labor force participation.

Lahore is the second-largest city in Pakistan and the capital of the province of Punjab. Focus groups and pilot studies conducted by the Center of Economic Research in Pakistan, presented in a policy brief as part of ongoing research, provide great insight into the relationship between sexual harassment and transportation for women in the city (Sajjad et al., 2017). Their

survey of 1,000 households found that 70% of men discouraged or strongly discouraged female household members from using public buses, while 86% said that they would support women using female-only transportation. 30% of women reported that it was “very unsafe” to walk through their neighborhood in order to wait at a bus stop. In focus groups, women reported that men “stare, pass comments, and follow women to their destination, or physically touch women while passing by.” Some women said that they avoided using transportation if a male relative was unable to escort them.

Some alternative forms of transportation better facilitate women’s mobility. Three women-only “Pink Bus” routes are available to women in Lahore. Sajjad et al. (2017) found that while users depend on this transportation, its effectiveness is limited by its small geographic range and the fact that it makes a small and sometimes unpredictable number of trips each day. In addition, some companies provide private door-to-door transportation for female workers. 45% of women surveyed said that whether or not this kind of transport was provided would be a very important factor in considering whether or not to take a job.

Additional forthcoming research provides insight into women’s commute decisions and experience of sexual harassment on transportation in Lahore. In an analysis of two sources of data on commuters in the Lahore, Zolnik et al. (2018) find that female commuters are more likely to use bus or van services to get to work than their male counterparts. Irvin-Erickson et al. (2018) discuss the feasibility of using smartphone technology to gather data on women's fear of crime and public transit experience, presenting a pilot study from Lahore that includes data on mobile application users’ perceived likelihood and fear of sexual harassment.

## **Data**

The Lahore Urban Transport Master Plan (LUTMP) Household Interview Survey was administered by the Transport Department of the Government of Punjab and the Japan International Cooperation Agency to a representative sample of over 18,000 households in Lahore from 2010 to 2011.

Survey respondents include 13,127 men and 3,275 women. The survey includes household information, household member information, a daily travel log for household members over five years of age, and opinions on public and private transport from select household members. One question asks selected respondents to rate the safety on board public buses on a scale of 1 to 5. The data includes household address and geographic location, income level, number of vehicles owned by the household, and occupation and work address for all household members. The daily travel log includes departure and arrival address and time, trip purpose and cost, reason for choice of travel mode, and an overall assessment of the trip, including travel time, convenience, and safety.

## **Methods**

I first undertake an exploratory descriptive analysis of the data to understand women's transportation choices, labor market outcomes, and experience of harassment in Lahore. Maps present data for approximately 140 of 250 geographic zones included in the household survey dataset, including the majority of the central city region. Only zones that could be matched directly with official union councils are included.

I next use ordinary least squares regression analysis to investigate the relationship between proxies for level of sexual harassment and women's public transportation usage, monthly transportation expense, and time of day of commute. I use logistic regression analysis (suitable in the case of a binary dependent variable) to assess the relationship between proxies for level harassment and women's likelihood to work outside the home. Control variables include household income, age, education level, and number of children under the age of five, as appropriate.

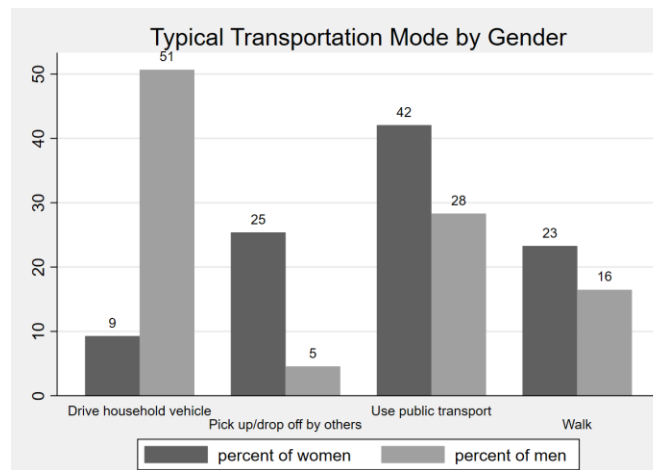


## Descriptive Analysis

### Transportation Mode Choice

As indicated in the literature, men and women have different primary mode choices. Figure 1 shows that men travel by driving a household vehicle much more than women, who are more often picked up or dropped off by others. Women also use public transportation and walk at higher rates.

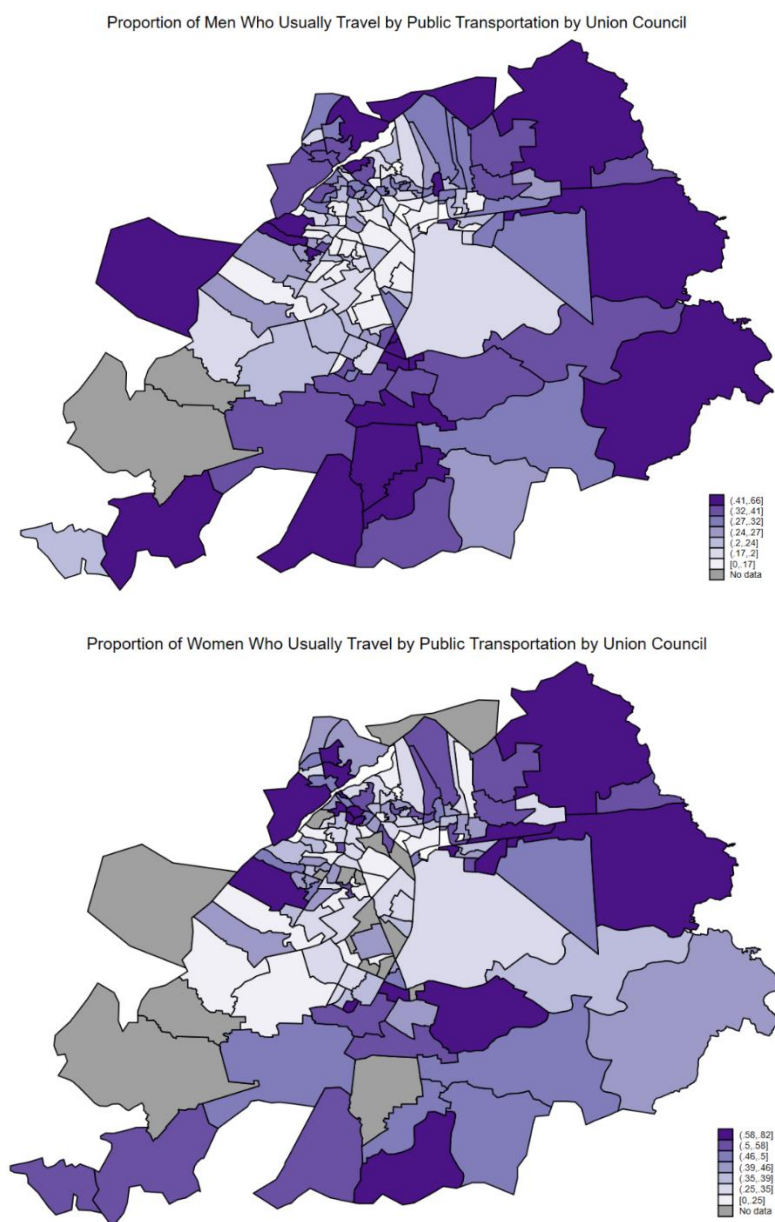
Figure 1: Typical transportation mode choice by gender



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011  
Notes: Bars represent the percentage of women and percentage of men who primarily travel by each mode of transportation. Respondents answered the question “How do you normally travel?”

Figure 2 illustrates the proportion of women and the proportion of men in selected union councils in the Lahore metro area that say they usually travel by public transportation. Only union councils with at least 10 respondents are included. With some exceptions, zones further from the city center tend to have a higher proportion of individuals who depend on public transportation.

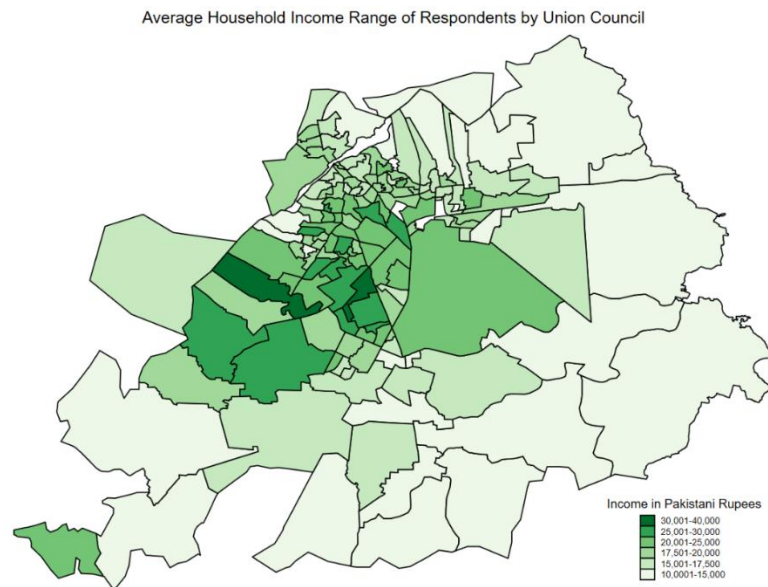
Figure 2: Proportion of women and men who usually travel by public transportation by union council



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011  
 Notes: Maps show proportion of men and women in each union council who report normally traveling on public transportation. Respondents answered question “How do you normally travel?” Only union councils with at least 10 respondents are included.

Average household income by union council is given in Figure 3. Areas of lower income generally correspond to areas of higher public transportation usage.

Figure 3: Average household income range by union council



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011

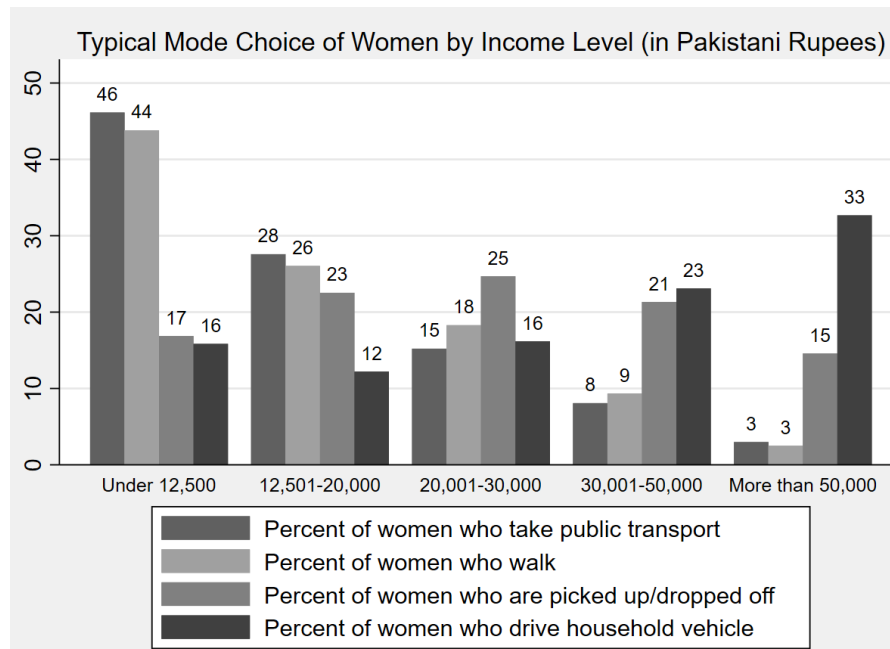
Notes: Map shows average reported household income range in Pakistani Rupees per month by union council. Respondents answered prompt “Total monthly household income, Rs/month.” Only union councils with at least 10 respondents are included.

Women’s reported typical mode choice varies by income level. 46% of women who say they usually use public transport fall into the bottom quartile for household income in the survey. In contrast, a third of women who usually drive a household vehicle are in the 95<sup>th</sup> percentile for income (Figure 4).

Figure 5 gives the frequency with which men and women report using public buses. Although a higher proportion of women report using public transport as their normal mode of travel, a lower proportion say that they use public buses at least once a week. This indicates that

women may be including other forms of transportation, such as rickshaw or taxi use, in the category of public transport.

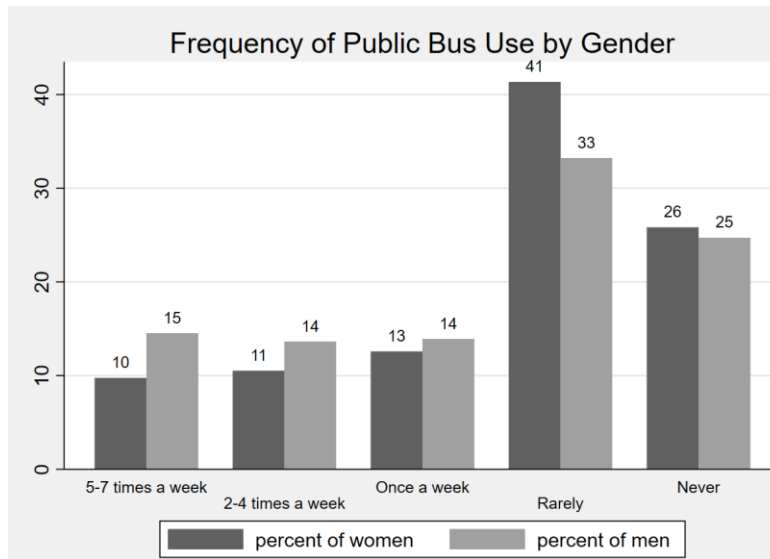
Figure 4: Typical transportation mode choice of women by income level



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011

Notes: Bars represent the percentage of women who primarily travel by each mode of transportation by income category. Respondents answered the question “How do you normally travel?” Income level is based on respondents’ reported total monthly household income in Pakistan Rupees per month.

Figure 5: Frequency of public bus use by gender



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011

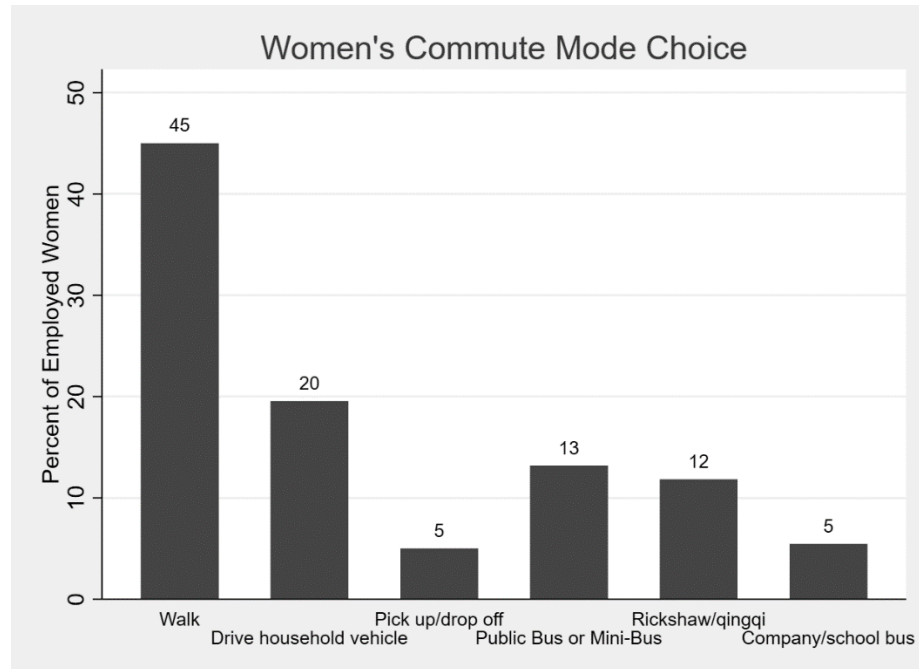
Notes: Bars represent the percentage of women and percentage of men who use the bus at each level of frequency. Respondents answered the question “How often do you use bus services?”

## Transportation on Commute

Although 42% of men and 32% of women report using public buses at least once a week, only 13% of working women respondents and 8% of men report taking the bus on their commute. 45% of women who work outside the home commute on foot and 20% take a personal vehicle or bicycle.

52% of women who work outside the home commute to a different geographic zone from their home. Among this group, 27% commute by driving a personal vehicle, 19% commute by bus, and 22% on foot. 70% of those who work in the same zone as their home walk to work.

Figure 6: Women's commute mode choice



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011

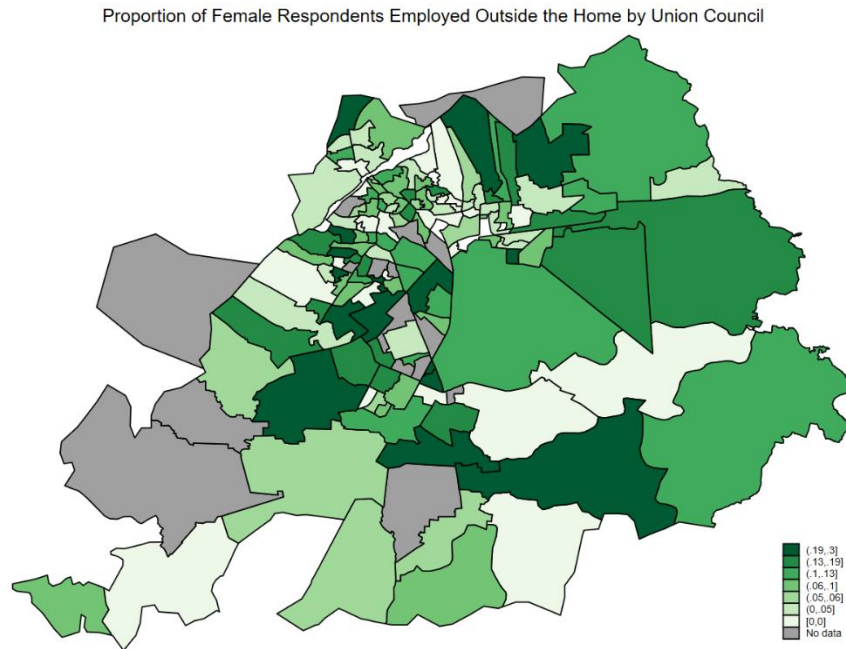
Notes: Bars represent the percentage of women employed outside the home who report taking a given mode of transportation on the way home from work. Employment outside the home was defined to include women who identified an employment sector other than “Home-based” or “Not in employment.” Commute mode was identified using travel diaries for women employed outside the home who reported at least one trip from work to home.

## Women's Employment

Only 9.5% of women surveyed in the dataset indicate that they are employed outside the home. Of this group, 41% work in the government sector (Figure 7). 28% of women employed outside the home fall into the lowest quartile of household income, while 13% are in the top 5% of household income. Of the 312 women who report working outside the home, only 221 completed travel diaries logging their commutes.

Figure 7 shows the proportion of female respondents in select union councils who are employed outside the home. Only union councils with 10 or more women are considered.

Figure 7: Proportion of female respondents employed outside the home by union council

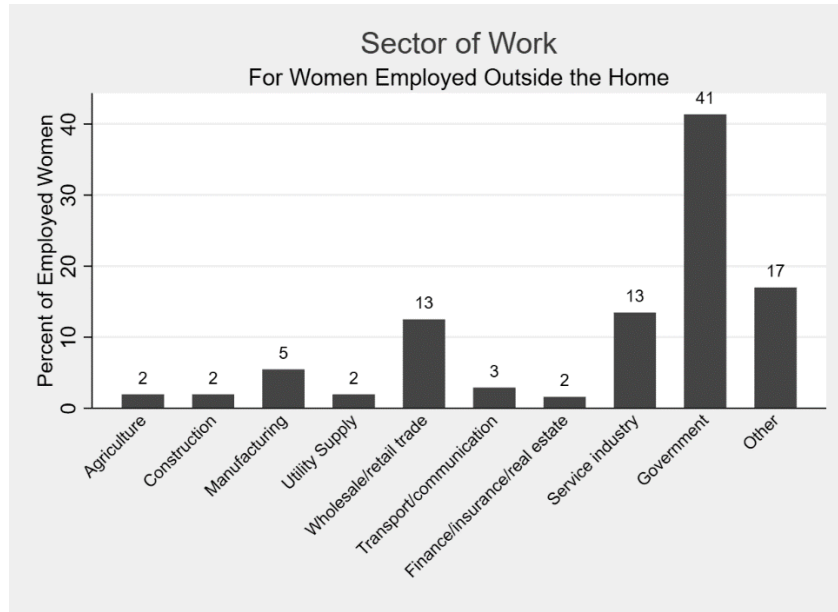


Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011

Notes: Map shows proportion of women employed outside the home by union council.

Employment outside the home was defined to include women who identified an employment sector other than “Home-based” or “Not in employment.” Only union councils with at least 10 respondents are included.

Figure 8: Sector of work for women employed outside the home



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011

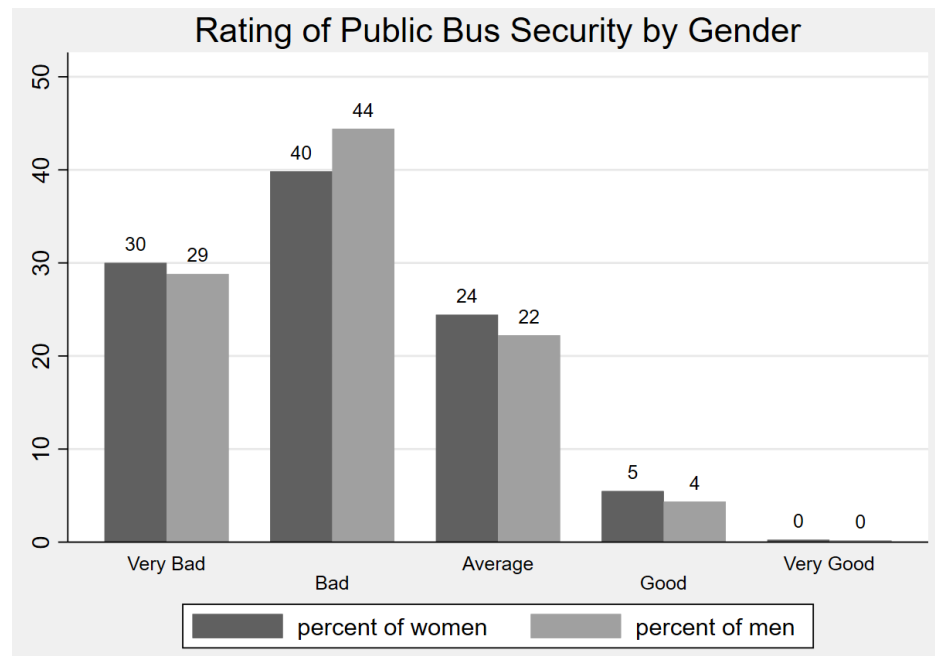
Notes: Bars represent the percentage of women employed outside the home that report working in each sector. Employment outside the home was defined to include women who identified an employment sector other than “Home-based” or “Not in employment.”

## Safety and Travel

I identified two variables in the survey dataset as candidates for proxies for women’s experience of sexual harassment on transportation. The first, represented in Figure 9, asks respondents to rate the onboard security of public buses. The second, in Figure 10, averages a respondent’s rating of the safety of trips taken and recorded in the travel log. As the bar graphs illustrate, the response distributions for men and women are very similar. This indicates that these variables might not fully capture women’s experience of sexual harassment as a security or safety factor.

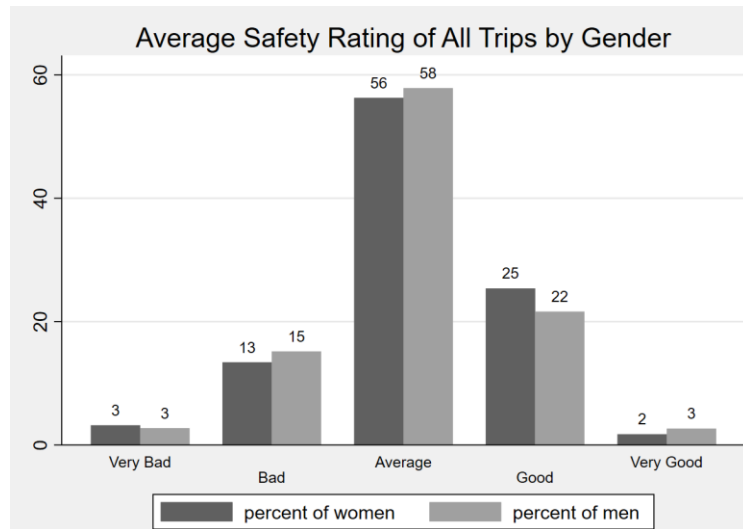


Figure 9: Rating of public bus security by gender



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011  
Notes: Bars represent the percentage of women and percentage of men that chose each bus security rating level. Respondents answered the prompt “Please assess the bus/wagon service on each of the following aspects,” with the aspect being “On-board security.”

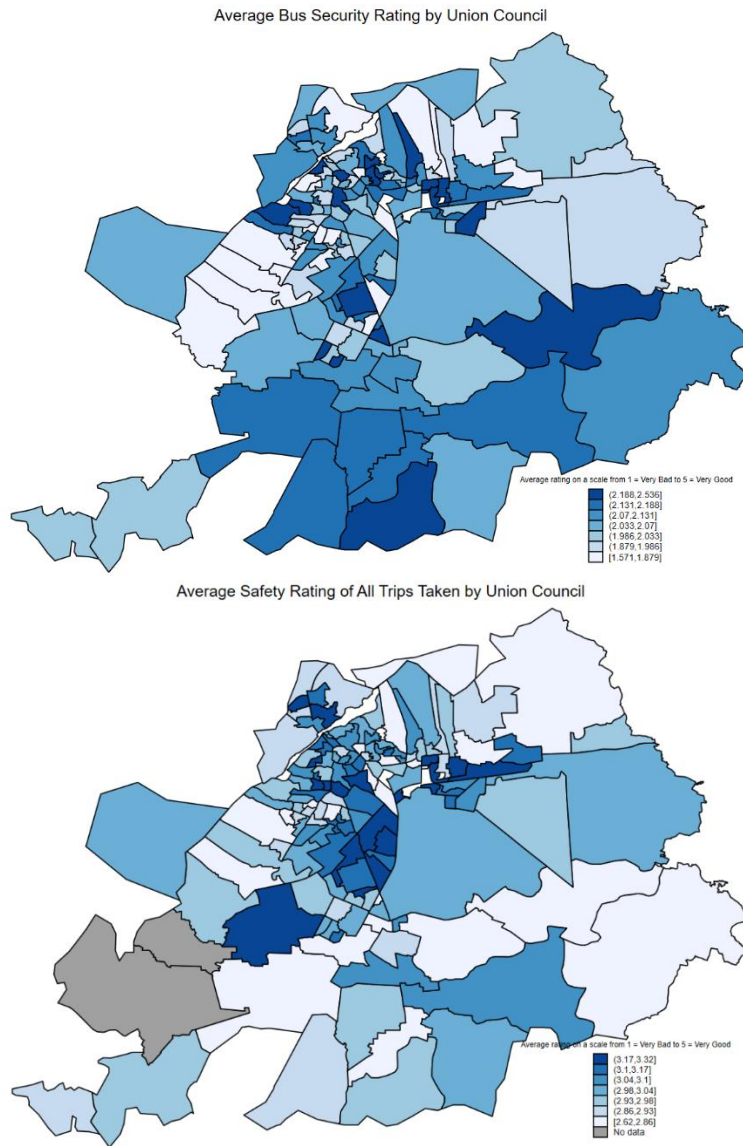
Figure 10: Average safety rating of all trips taken by gender



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011  
 Notes: Bars represent the percentage of women and percentage of men that chose each safety rating level on average across all trips recorded in a trip diary. Average ratings were rounded to the nearest integer level (from 1 for “Very Bad” to 5 for “Very Good”).

There is little variation in average security and safety rating by geographic zone. Out of 251 geographic zones in the study area, only 35 had bus security ratings significantly different from that of zone 1 at the 10% significance level. Similarly, 37 zones differed significantly from the first in average safety rating of all trips. There is a modest 0.2 correlation between average bus security rating and average safety rating by zone. Figure 11 shows the average measures of these variables for select union councils.

Figure 11: Average bus security and safety ratings by union council



Data source: Lahore Urban Transport Master Plan Household Interview Survey, 2010-2011

Notes: Maps show average of safety indicator scores for all respondents in a union council. Only union councils with 10 or more respondents are included. For bus security ratings, respondents answered the prompt “Please assess the bus/wagon service on each of the following aspects,” with the aspect being “On-board security.” Average safety ratings were drawn from respondents’ trip diaries, which asked them to rate the safety of each trip from “Very Bad” to “Very Good”.

## Results

### Security-Mobility Relationship

I hypothesize that a lower opinion of onboard bus security will be associated with lower bus use, after controlling for income.

To test the hypothesis, I regress the frequency with which individuals say they use the bus (measured from 1 = never to 5 = 5-7 times a week) on their rating of bus onboard security, controlling for income. Results show that an increased bus security rating is actually associated with a very slight decrease in bus use frequency (significant at the 5% level). The effect is small, and these two variables explain less than 0.3% of the variation in frequency of bus use. When the analysis is restricted to women, the effect disappears (Table 3). The hypothesis is not supported.

Table 2: OLS results for regression of bus use on bus security rating

Bus Use Frequency	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Bus Security Rating	-0.03219	0.012555	-2.56	0.010	-0.0568	-0.00758
Household Income	-0.01976	0.003302	-5.98	0.000	-0.02623	-0.01328
Intercept	3.306553	0.038922	84.95	0.000	3.230259	3.382847
Prob > F = 0.000 R-squared = 0.0035 Adj. R-Squared = 0.0033						

Table 3: OLS results for regression of bus use on bus security rating, women only

Bus Use Frequency	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Bus Security Rating	-0.01473	0.025533	-0.58	0.564	-0.0648	0.035336
Household Income	0.018097	0.00724	2.5	0.013	0.0039	0.032295
Intercept	2.740151	0.082169	33.35	0.000	2.579019	2.901282
Prob > F = 0.0348 R-Squared = 0.0028 Adj. R-Squared = 0.0020						

## Women's Employment-Transportation Security Relationship

I hypothesize that a lower opinion of trip safety or bus security in the zone in which a woman lives will be associated with a lower likelihood that she is employed.

I complete logistic regression analysis with women's employment as the dependent variable and her rating of bus security in the zone as the independent variable of interest. I then repeat the analysis with average safety rating of all trips taken in zone as the independent variable of interest. Results show that neither bus security rating nor average safety rating of zone has a significant impact on odds of employment.

Table 4: Results for logistic regression of women's employment on bus security rating, with controls

Employed Outside Home	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Bus Security Rating	-0.0836	0.081629	-1.02	0.306	-0.24359	0.076393
Education Level	-0.66728	0.076891	-8.68	0.000	-0.81799	-0.51658
Household Income	-0.02618	0.025156	-1.04	0.298	-0.07549	0.023122
Age	0.007901	0.006291	1.26	0.209	-0.00443	0.020231
Number of Children Under 5 in Household	-0.17977	0.080091	-2.24	0.025	-0.33675	-0.02279
Intercept	0.272282	0.438043	0.62	0.534	-0.58627	1.13083

Prob > chi2 = 0.000 Pseudo R-Squared = 0.0622

Table 5: Results for logistic regression of women's employment on average safety rating in zone, with controls

Employed Outside Home	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Average Safety Rating in Zone	-0.45708	0.391648	-1.17	0.243	-1.2247	0.310535
Education Level	-0.71319	0.065667	-10.86	0.000	-0.8419	-0.58449
Household_Income	-0.06185	0.021538	-2.87	0.004	-0.10406	-0.01964
Age	0.008927	0.005283	1.69	0.091	-0.00143	0.019282
Number of Children Under 5 in Household	-0.15237	0.068823	-2.21	0.027	-0.28727	-0.01748
Intercept	1.751627	1.225271	1.43	0.153	-0.64986	4.153114

Prob> chi2 = 0.000 Pseudo R-Squared = 0.0684

Further, I hypothesize that among women who work outside the home, those who live in zones with lower transportation security measures will spend more on transportation. This follows from the prediction that some women will work but substitute more expensive private transportation for public transportation in an area with high harassment levels. Results are given in Table 6. Although an increase in an individual's rating of security onboard the bus is associated with a decrease in monthly spending on average, the result is not statistically significant.

Table 6: OLS results for regression of bus security rating on monthly transportation expense for employed women

Monthly Transportation Expense (Rs)	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Bus Security Rating	-358.253	234.0499	-1.53	0.127	-819.42	102.9135
Household Income	409.7134	65.36571	6.27	0.000	280.9183	538.5085
Intercept	166.5737	764.3721	0.22	0.828	-1339.53	1672.675
Prob > F = 0.000 R-Squared = 0.1383 Adj. R-Squared = 0.1382						

I estimate the model once more with average safety rating in the zone in which a woman lives as the independent variable of interest. In this case the coefficient on safety rating is positive although it is still not statistically significant.

Table 7: OLS results for regression of average safety rating of zone on monthly transportation expense for employed women

Monthly Transportation Expense (Rs)	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Average Safety Rating in Zone	2421.101	1527.705	1.58	0.114	-584.92	5427.122
Household Income	525.3101	70.79285	7.42	0.000	386.0131	664.6072
Intercept	-8584.27	4529.109	-1.9	0.059	-17496.1	327.5279
Prob > F = 0.000 R-Squared = 0.1721 Adj. R-Squared = 0.1668						

### Time of Day and Commute Decisions

In the survey dataset, women return home from work earlier than do men, on average. This result is significant at the 1% level after controlling for education level, income, and job sector. Women who work outside the home and commute on public transport return home later than do women who walk (significant at the 5% level after controlling for education, income, and job sector).

I hypothesize that women who live in zones with lower measures of transportation security will return home from work earlier. I run OLS regression with time at which a woman returns home from work (measured on a 24 hour clock from 1200 to 2400) as determined by the average safety rating of trips in the zone in which the woman lives, with controls. The analysis does not support the hypothesis (Table 8).

Table 8: OLS results for regression of zone safety on time at which women return home from work, with controls

Time home from work	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Average Safety Rating in Zone	-171.639	117.4218	-1.46	0.145	-403.155	59.87736
Household Income	11.03861	6.793786	1.62	0.106	-2.35644	24.43365
Education Level	87.14472	18.96373	4.6	0.000	49.75466	124.5348
Age	3.512635	1.733008	2.03	0.044	0.095731	6.92954
Number of Children Under 5 in Household	23.53573	19.70157	1.19	0.234	-15.3091	62.38054
Intercept	1631.885	357.3236	4.57	0.000	927.3643	2336.406

Prob > F = 0.000 R-Squared = 0.1703 Adj. R-Squared = 0.1499



## Discussion

This examination of transport survey data does not provide support for the prediction that women's employment depends on the level of harassment experienced on public transportation. However, important limitations of this analysis should be noted.

The first limitation is the difficulty of measuring the severity of sexual harassment on public transportation. The survey variables I used as proxies for harassment – rating of security onboard public buses and rating of safety of all trips – may simply be too broad in scope to approximate women's experience of sexual harassment. In addition, the limited statistically significant variation by geographic region makes geography-based analysis difficult.

A second limitation is the small size of the sample of working women in the survey dataset. Only 20% of the dataset is comprised of women, meaning that while the sample is representative at the household level, it is not representative at the individual level. Commute information was only available for 221 women who work outside the home across the Lahore metro area; with more than that number of geographic zones in the dataset, estimating distinguishing characteristics of working women by zone-level factors becomes difficult.

Finally, the predictions of the theoretical model are nuanced and depend on some factors outside the scope of this analysis; for example, an individual woman's sensitivity to sexual harassment and preference for private transportation over public in the absence of harassment.

Therefore, the contribution of this thesis is primarily to provide an expository exploration of the harassment-mobility-employment relationship for women. Further research should advance this analysis using more detailed data on working women and sexual harassment.

## **Conclusion**

Although sexual harassment on public transportation is highly prevalent, particularly in developing countries, very little is known about how harassment on transportation influences women's mobility and labor market choices. This thesis attempts to provide some insight by analyzing transportation survey data from Lahore, Pakistan. Pakistan exhibits a women's labor force participation rate well below the worldwide average, and understanding the link between safe transportation and work for women could allow policymakers and development workers to design more effective interventions. This thesis did not find evidence for a relationship between proxy variables for harassment and women's labor market outcomes. However, there is a need for further research on the harassment-mobility-work relationship.

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