

# Replication Package for: [Safety First: Perceived Risk of Street Harassment and Educational Choices of Women](#)

This paper examines the long-term consequences of unsafe public spaces for women. It combines student-level survey data, a mapping of potential travel routes to all the colleges in the choice set, and crowdsourced mobile application safety data from Delhi. The findings show that women choose a college in the bottom half of the quality distribution over a college in the top quintile to feel safer while traveling, relative to men with comparable choice sets who choose a college in the top one-third of the distribution over a college in the top quintile. These findings have implications beyond women's human capital attainment, such as their participation in the labor force.

## Overview

The code in this replication package create the figures and tables in the paper using Stata and Matlab. Three main files run all of the code to generate the data for the outputs.

## Data Availability

### Summary of Availability

- All data are publicly available.
- Some data cannot be made publicly available.
- No data can be made publicly available.

### Details on each Data Source

The main data sources are:

- A 3,800 student-level survey conducted at The University of Delhi (DU) in 2016.
- A mapping of potential travel routes to all colleges in the choice set, build up with Google Maps and an algorithm developed by the author.
- Safety data from two crowdsourced mobile applications in Delhi, which allowed to assign a safety score to each travel route:
  - SafetiPin, which provides perceived spatial safety data in the form of safety audits conducted at various locations across the Delhi National Capital Region (NCR).
  - Safecity, which provides analytical data on harassment rates by travel mode recorded by users during their travel in the city.

## Dataset list

Available on Microdata Library as Licensed files. [Link](#)

Data file	Source	Notes	Provided
<a href="#">data/raw/*collegecode*_data.xlsx*</a>	Collected by author	Student-level survey data.	Yes
<a href="#">data/raw/alphaid.dta</a>	Created by author	This file contains alpha identifiers.	Yes
<a href="#">data/raw/car_price.xlsx*</a>	<a href="#">carwale website</a>	Data collected on June 25, 2017. These data are no longer available because the prices have been updated to today's rates.	Yes
<a href="#">data/raw/coll_withsafety.dta</a>	Created by author	College details.	Yes
<a href="#">data/raw/college_descriptives.dta</a>	Created by author		Yes
<a href="#">data/raw/college_fees.dta</a>	Created by author	This file contains the fees for each college and course. The original links to the information are no longer available, but the data were accessed in 2016. The process involved visiting each college's website and using the fee data published in the universities' fee structure reports.	Yes
<a href="#">data/raw/College_locations.dta</a>	Created by author	The dataset includes information from the <code>College_coordinate.dta</code> and <code>student_pop_bygender.csv</code> databases, supplemented with additional details about whether the college participated in the full or short survey conducted by the author, as well as whether the college is exclusively for women or coeducational.	Yes
<a href="#">data/raw/comparing_samples_updated.dta</a>	Collected by author	Clean database to create table A1.	Yes
<a href="#">data/raw/men_grid_popdensity.csv*</a>	Meta	Author used <code>population_ind_pak_men.zip</code> . Find more instructions below.	Yes

Data file	Source	Notes	Provided
<a href="#">data/raw/placement_data_tally_placed.dta</a>	Collected by authors		Yes
<a href="#">data/raw/randcoor_route_saf_bycollege.dta</a>	Created by authors		Yes
<a href="#">data/raw/RankofColl_col.xlsx*</a>	Created by authors		Yes
<a href="#">data/raw/SS_data.dta</a>	Collected by author	Short-survey.	Yes
<a href="#">data/raw/SS_online.xlsx*</a>	Collected by author	Short-survey.	Yes
<a href="#">data/raw/stud_coll_catchment.dta</a>	Created by author		Yes
<a href="#">data/raw/Survey of College Choice_v3003.csv*</a>	Collected by author		Yes
<a href="#">data/raw/women_grid_popdensity.csv*</a>	Meta	Author used population_ind_pak_women.zip. Find more instructions below.	Yes

Notes

(\*) The datasets available on the Microdata Library are provided in both XLSX/CSV and DTA formats; however, to run the code, the XLSX/CSV files should be used.

Women and Men population data

To process population density data for Delhi, start with the male and female population density rasters from the Meta dataset, specifically, download [population\\_ind\\_pak\\_men.zip](#) and [population\\_ind\\_pak\\_women.zip](#), and inside these files locate [population\\_20\\_lon\\_70\\_men.tif](#) and [population\\_20\\_lon\\_70\\_women-v1.5.tif](#). Open ArcMap and add both rasters together with the Delhi boundary shapefile [NCR\\_boundary\\_Project.shp](#). Because the original rasters contain decimal values, multiply each raster by 1000 and convert the results to integers before polygon conversion. To do this, open ArcToolbox → Spatial Analyst Tools → Map Algebra → Raster Calculator and run the expressions `Int("population_20_lon_70_men.tif" * 1000)` and `Int("population_20_lon_70_women-v1.5.tif" * 1000)`, saving the outputs as [men\\_popdensity\\_int.tif](#) and [women\\_popdensity\\_int.tif](#), respectively. Next, convert both integer rasters into polygons using ArcToolbox → Conversion Tools → From Raster → Raster to Polygon, selecting the VALUE field and leaving "Simplify polygons" unchecked. Save the outputs as [men\\_popdensity\\_polygon.shp](#) and [women\\_popdensity\\_polygon.shp](#). Clip these polygon layers to the Delhi boundary using ArcToolbox → Analysis Tools → Extract → Clip with [NCR\\_boundary\\_Project.shp](#) as the clipping feature, producing [delhi\\_men\\_popdensity.shp](#) and [delhi\\_women\\_popdensity.shp](#). Open the attribute tables of these shapefiles and add a new field called `gc_conv` with type Double. Using Field Calculator, calculate `gc_conv = [GRIDCODE] / 1000` in order to restore the original population density values.

To construct the analysis grid, open ArcToolbox → Cartography Tools → Data Driven Pages → Grid Index Features and use [NCR\\_boundary\\_Project.shp](#) as the input feature. Define the grid using 10 rows and 10 columns and save the output as [gridfeature\\_1.shp](#). Clip this grid again with the Delhi boundary shapefile using ArcToolbox → Analysis Tools → Extract → Clip to create [delhi\\_withgrid.shp](#). Open the attribute table of [delhi\\_withgrid.shp](#) and add two new Double fields named `centroid_x` and `centroid_y`. Use the "Calculate Geometry" option to compute the X Coordinate of Centroid for `centroid_x` and the Y Coordinate of Centroid for `centroid_y`. These centroid coordinates serve as reference points for the spatial analysis. Next, intersect the clipped population density polygon layers with the grid using ArcToolbox → Analysis Tools → Overlay → Intersect. Intersect [delhi\\_men\\_popdensity.shp](#) with [gridfeature\\_1.shp](#) to create [men\\_grid\\_popdensity.shp](#), and intersect [delhi\\_women\\_popdensity.shp](#) with [gridfeature\\_1.shp](#) to create [women\\_grid\\_popdensity.shp](#). To calculate average population density within each grid cell, perform a Spatial Join using the grid as the target feature and the intersected population density layer as the join feature, specifying the aggregation rule for `gc_conv` as Mean. Finally, export the resulting attribute tables to CSV format using the table export option, producing [men\\_grid\\_popdensity.csv](#) and [women\\_grid\\_popdensity.csv](#) for subsequent statistical analysis.

Available on DDH as public files. [Link](#)

Data file	Source	Provided
<a href="#">data/raw/student_neighbors_forrf_1</a>	Created by author	Yes
<a href="#">data/raw/student_neighbors_forrf_1_5</a>	Created by author	Yes
<a href="#">data/raw/student_neighbors_forrf_2</a>	Created by author	Yes
<a href="#">data/raw/student_neighbors_forrf_2_5</a>	Created by author	Yes
<a href="#">data/raw/routes/all_app_arrival_rate</a>	Created by author	Yes
<a href="#">data/raw/routes/all_app_excl_feeling</a>	Created by author	Yes
<a href="#">data/raw/routes/all_app_excl_transport</a>	Created by author	Yes
<a href="#">data/raw/routes/all_app_gender_usa</a>	Created by author	Yes

Data file	Source	Provided
data/raw/routes/all_app_grid_500	Created by author	Yes
data/raw/routes/all_app_grid_1500	Created by author	Yes
data/raw/routes/all_app_light	Created by author	Yes
data/raw/routes/all_app_open	Created by author	Yes
data/raw/routes/all_app_path	Created by author	Yes
data/raw/routes/all_app_security	Created by author	Yes
data/raw/routes/all_app_visibility	Created by author	Yes
data/raw/routes/nondelhires_app	Created by author	Yes
data/raw/routes/mc_simulation_app	Created by author	Yes
data/raw/routes/overlap_driving	Created by author	Yes
data/raw/routes/overlap_transit	Created by author	Yes
data/raw/routes/overlap_walking	Created by author	Yes
data/raw/routes/route_time_correction_byhand	Created by author	Yes
data/raw/routes/routes_additional_major	Created by author	Yes
data/raw/routes/routes_delhi	Created by author	Yes
data/raw/routes/SS_app	Collected by author	Yes
data/raw/Safetipin/ArcGIS/c12.shp	Created by author	Yes
data/raw/Safetipin/ArcGIS/c14.shp	Created by author	Yes
data/raw/Safetipin/ArcGIS/c18.shp	Created by author	Yes
data/raw/Safetipin/ArcGIS/c39.shp	Created by author	Yes
data/raw/Safetipin/ArcGIS/c52.shp	Created by author	Yes
data/raw/Safetipin/ArcGIS/c60.shp	Created by author	Yes
data/raw/Safetipin/ArcGIS/c62.shp	Created by author	Yes
data/raw/Safetipin/ArcGIS/c63.shp	Created by author	Yes
data/raw/Safetipin/bootstrap_datasets/appended_bbs	Created by the author	Yes
data/raw/Safetipin/Safety data/clip_grid_500.shp	Created by author	Yes
data/raw/Safetipin/Safety data/clip_grid_1500.shp	Created by author	Yes
data/raw/Safetipin/MAPDATA/idw_polymer_clippedtoNCR.shp	Created by author	Yes
data/raw/Safetipin/MAPDATA/52_013.shp	Created by author	Yes
data/raw/Safetipin/MAPDATA/college.shp	Created by author	Yes
data/raw/Safetipin/MAPDATA/student.shp	Created by author	Yes

#### Additional files

Data file	Source	Notes	Provided
data/raw/audit_withdist.dta	SafetiPin	Safety audit data with associated postal district across Delhi. The dataset includes 26,560 audits conducted between November 2013 and January 2016. Each audit evaluates nine parameters that prior research has identified as relevant for perceptions of safety: lighting, openness, visibility, crowd, security, walk path, availability of public transport, gender usage, and feeling. Each parameter is scored on a scale from 0 (low safety) to 3 (high safety). The dataset includes the original audit scores, geographic coordinates for each audited location, and a composite safety measure (PCA_SAF) constructed using principal component analysis (PCA) on the nine safety parameters. The main variables used in the	No

Data file	Source	Notes	Provided
		<p>project analysis are PCA_SAFRES (a rescaled version of PCA_SAF ranging from 0 to 3) and the corresponding district name. SafetiPin data was requested in October 2015 and received in April 2016. The data was requested in person during a meeting since the firm was fairly new. At present, the data needs to be requested by emailing Rithvika Rajiv at Safetipin (Email: rithvika.rajiv@safetipin.com), along with a formal request for data. Following the request a Data user agreement is signed by the requestor and then data is shared. Additional information can be found in the Safetipin <a href="#">Terms and Conditions</a>.</p>	
data/raw/College_coordinates.dta	Google Maps	<p>Search for the college names in Google Maps, extract their latitude and longitude coordinates. Store the coordinates in the A1_co_name column, while the A1_co column should contain the corresponding college code. The colleges included in this database correspond to college codes ranging from 1 to 77. Please refer to the Survey Data Codebook file in the MDL repository for this project to identify the full names of the colleges. The database is not included due to the <a href="#">Terms and Conditions</a> of Google Maps.</p>	No
data/raw/college_enrollment.dta	University of Delhi Annual Report 2015–16	<p>Table in page 84, Under-Graduate columns. The file is not included due to the <a href="#">Term and Conditions</a> of the University of Delhi platforms.</p>	No
data/raw/ranking_india_today.xlsx	India Today annual rankings (2013–2015)	<p>In the Excel file, create the columns RANK, COLLEGE CODE, YEAR, and STREAM. Using the websites, look up each college included in the sample according to the College codes sheet in the Survey Data Codebook file included in the MDL repository. For the RANK column, record the rank reported on the website. For COLLEGE CODE, use the code corresponding to the college according to the codebook. For YEAR, record the year of the ranking, and for STREAM, record the academic field or discipline indicated on the website. These files are not included due to the <a href="#">Term and Conditions</a> of India Today website.</p>	No
data/raw/ranking_the_week.xlsx	The Week annual rankings (2013–2015)	<p>The links to the data are no longer available. However, at this link you can find an example of how The Week publishes its annual rankings: <a href="#">THE WEEK-Hansa Research Survey 2025: India's best colleges</a>. The file was created by first setting up an Excel spreadsheet and adding the columns RANK, COLLEGE CODE, YEAR, and STREAM. Information for each college in the sample was then collected using the corresponding websites. The RANK variable records the rank reported on the website, COLLEGE CODE corresponds to the code assigned in the codebook to the college, YEAR indicates the year of the ranking, and STREAM identifies the academic field or discipline reported on the website. These files are not included due to the <a href="#">Term and Conditions</a> of The Week website.</p>	No
data/raw/SafetiPin_NCR_audits.dta	Safetipin	<p>Scores by the nine safety parameters along with the time of submission and location, limited to the NCR of Delhi. The dataset includes 26,560 audits conducted between November 2013 and January</p>	No

Data file	Source	Notes	Provided
		<p>2016. Each audit evaluates nine parameters that prior research has identified as relevant for perceptions of safety: lighting, openness, visibility, crowd, security, walk path, availability of public transport, gender usage, and feeling. Each parameter is scored on a scale from 0 (low safety) to 3 (high safety). Those nine parameters are the key variables for the analysis. SafetiPin data was requested in October 2015 and received in April 2016. The data was requested in person during a meeting since the firm was fairly new. At present, the data needs to be requested by emailing Rithvika Rajiv at Safetipin (Email: rithvika.rajiv@safetipin.com), along with a formal request for data. Following the request a Data user agreement is signed by the requestor and then data is shared. Additional information can be found in the Safetipin <a href="#">Terms and Conditions</a>.</p>	
<p><a href="#">data/raw/du_course_enrollment.dta</a></p>	<p><a href="#">University of Delhi Annual Report 2013–14</a></p>	<p>Create a .dta file in which the first three variables are course_name, course_code, and univ_category, using the information from the Survey Data Codebook file included in the MDL repository. Then, add three additional variables named m, f, and t, which should contain the information from the University of Delhi report. For each course, locate the corresponding entry in the report and use the values from the Total row for the columns Total M, Total F, and Total T. If a course has multiple total rows, use the one labeled Regular, Day + Eve, or Grand Total, as applicable. The file is not included due to the <a href="#">Term and Conditions</a> of the University of Delhi platforms.</p>	<p>No</p>
<p><a href="#">data/raw/NCRB_rape_2013.xlsx</a></p>	<p><a href="#">NCRB Crime Against Women, NCRB Crime in India, Census of India</a></p>	<p>Find below the instructions to set up this file. The file is not included due to the <a href="#">Copyright statement</a> of the NCRB website.</p>	<p>No</p>
<p><a href="#">data/raw/cutoffs/</a></p>	<p><a href="#">University of Delhi</a></p>	<p>Cut-off lists for Arts &amp; Commerce , and Science bachelor from 2013 to 2015. You can find the links to the sources below. These files are not included due to the <a href="#">Term and Conditions</a> of the University of Delhi platforms.</p>	<p>No</p>
<p><a href="#">data/raw/Safetipin/Safety data/Audits_formap_2017-04-09.shp</a></p>	<p><a href="#">Safetipin</a></p>	<p>The shapefile contains geocoded safety audit data collected by SafetiPin across Delhi. The dataset includes 26,560 audits conducted between November 2013 and January 2016. Each audit evaluates nine parameters that prior research has identified as relevant for perceptions of safety: lighting, openness, visibility, crowd, security, walk path, availability of public transport, gender usage, and feeling. Each parameter is scored on a scale from 0 (low safety) to 3 (high safety). The dataset includes the original audit scores, geographic coordinates for each audited location, and a composite safety measure (PCA_SAF) constructed using principal component analysis (PCA) on the nine safety parameters. This composite index is the measure used in the figure presented in the project. SafetiPin data was requested in October 2015 and received in April 2016. The data was requested in person during a meeting since the firm was fairly new. At present,</p>	<p>No</p>

Data file	Source	Notes	Provided
		the data needs to be requested by emailing Rithvika Rajiv at Safetipin (Email: rithvika.rajiv@safetipin.com), along with a formal request for data. Following the request a Data user agreement is signed by the requestor and then data is shared. Additional information can be found in the Safetipin <a href="#">Terms and Conditions</a> .	
<a href="#">data/raw/start.xlsx</a>	Empty excel file used to organize data	Create an empty Excel file and named it start.	No
<a href="#">data/raw/student_pop_bygender.csv</a>	<a href="#">University of Delhi Annual Report 2013–14</a>	Use table in page 444. The file is not included due to the <a href="#">Term and Conditions</a> of the University of Delhi platforms.	No
<a href="#">data/raw/Safetipin/ArcGIS/CollegeLocations_final_1.shp</a>	<a href="#">Google Maps and University of Delhi Annual Report 2013–14</a>	Location for all colleges in Delhi University and their size. The colleges' locations were geocoded using Google Maps, and their size was obtained from the report (page S-1, column 'Total Undergraduate Students'). The colleges included in this shapefile correspond to the following codes: 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 14, 17, 18, 19, 20, 21, 22, 24, 26, 27, 28, 29, 30, 31, 34, 35, 36, 38, 39, 41, 42, 43, 46, 47, 48, 50, 51, 52, 53, 54, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 75, 76 and 77. Please refer to the Survey Data Codebook file in the MDL repository for this project to identify the full names of the colleges. The shapefile is not included due to the <a href="#">Term and Conditions</a> of the University of Delhi platforms and the <a href="#">Terms and Conditions</a> of Google Maps.	No
<a href="#">data/raw/Safetipin/ArcGIS/coll_loc_insample_Withsize.shp</a>	<a href="#">Google Maps and University of Delhi Annual Report 2013–14</a>	Location of the eight colleges in the sample and their size. The colleges' locations were geocoded using Google Maps, and their size was obtained from the report (page S-1, column 'Total Undergraduate Students'). The colleges included in this shapefile correspond to the following codes: 12, 14, 18, 39, 52, 60, 62 and 63. Please refer to the Survey Data Codebook file in the MDL repository for this project to identify the full names of the colleges. The shapefile is not included due to the <a href="#">Term and Conditions</a> of the University of Delhi platforms and the <a href="#">Terms and Conditions</a> of Google Maps.	No
<a href="#">data/raw/Safetipin/ArcGIS/coll_loc_shortsurvey_withsize.shp</a>	<a href="#">Google Maps and University of Delhi Annual Report 2013–14</a>	Location of the colleges in the short survey and their size. The colleges' locations were geocoded using Google Maps, and their size was obtained from the report (page S-1, column 'Total Undergraduate Students'). The colleges included in this shapefile correspond to the following codes: 4, 11, 13, 20, 21, 22, 24, 26, 27, 28, 29, 31, 34, 35, 38, 41, 42, 46, 47, 48, 50, 53, 56, 61, 64, 67, 69, 70, 71, 75, and 76. Please refer to the Survey Data Codebook file in the MDL repository for this project to identify the full names of the colleges. The shapefile is not included due to the <a href="#">Term and Conditions</a> of the University of Delhi platforms and the <a href="#">Terms and Conditions</a> of Google Maps.	No
<a href="#">data/raw/Safetipin/ArcGIS/NCR_boundary_Project.shp</a>	ML Infomap	This boundaries shapefile for NCR was purchased from ML Infomap in April 2026. At present, the data needs to be requested using their Contact page:	No

Data file	Source	Notes	Provided
		<a href="https://www.mlinfomap.com/contact.php">https://www.mlinfomap.com/contact.php</a> and request the boundary file for Delhi NCR.	
<a href="#">data/raw/Safetipin/ArcGIS/NCR_PINCODE_Project.shp</a>	ML Infomap	This pincode boundaries shapefile for NCR was purchased from ML Infomap in April 2026. At present, the data needs to be requested using their Contact page: <a href="https://www.mlinfomap.com/contact.php">https://www.mlinfomap.com/contact.php</a> and request the boundary file for Delhi NCR postal pincodes.	No
<a href="#">data/raw/Safetipin/ArcGIS/Delhi_NCT_pincodes.shp</a>	ML Infomap	This pincode boundaries shapefile for NCR of Delhi was purchased from ML Infomap in April 2026. At present, the data needs to be requested using their Contact page: <a href="https://www.mlinfomap.com/contact.php">https://www.mlinfomap.com/contact.php</a> and request the boundary file for Delhi NCT postal pincodes.	No

Notes

- The geocoding process using Google Maps was conducted manually. Each location was individually searched in Google Maps, and the corresponding geographic coordinates were obtained by right-clicking on the selected location within the platform interface. These coordinates were then recorded and incorporated into the dataset.

Instructions to set up Excel file: NCRB\_rape\_2013.xlsx

- Create a new Excel workbook with two sheets: Sheet1 and dist\_population.
- To complete the dist\_population sheet, follow these steps: a. Open the file census\_2011.xls included in the MDL repository. b. Copy the following columns: Area, Age-group and the three Total columns: Persons, Males and Females. c. Paste the copied information into the dist\_population sheet.
- To complete the Sheet1 sheet, follow these steps: a. Open the NCRB Crime Against Women report. b. Go to page 539 and copy the following columns: District, Rape, Kidnapping & Abduction, Assault on Women with intent to outrage her modesty, Insult to modesty of Women, and paste this information into Sheet1. c. Open the NCRB Crime in India report. d. Go to pages 49–51 and copy the information for the Delhi UT districts (the same districts copied in step b) for the following columns: Dacoity, Robbery, Burglary and Theft-Total. e. Paste this information into Sheet1, next to the data pasted in step b. f. Create the following new columns in Sheet1: male\_pop\_15\_34, pop\_15\_34, male\_pop\_15\_49, pop\_15\_49. Complete these columns for the following districts: Central, East, New, Noth, North east, North west, South, South east, South west and west. Use the information from the dist\_population sheet as follows: i. male\_pop\_15\_34: for each district, calculate the sum of the Males population for ages 15–34. ii. pop\_15\_34: for each district, calculate the sum of the Female population for ages 15–34. iii. male\_pop\_15\_49: for each district, calculate the sum of the Males population for ages 15–49. iv. pop\_15\_49: for each district, calculate the sum of the Female population for ages 15–49.
- Save the completed workbook as NCRB\_rape\_2013.xlsx.

Data citation

Data.Name	Citation
"Cars prices"	carwale (2017)
"Census of India"	Office of the Registrar General & Census Commissioner (2011)
"Cut-off list Arts & Commerce First"	University of Delhi (2013)
"Cut-off list Arts & Commerce Second"	University of Delhi (2013a)
"Cut-off list Arts & Commerce Third"	University of Delhi (2013b)
"Cut-off list Arts & Commerce Fourth"	University of Delhi (2013c)
"Cut-off list Arts & Commerce Fifth"	University of Delhi (2013d)
"Cut-off list Arts & Commerce Sixth"	University of Delhi (2013e)
"Cut-off list Arts & Commerce Seventh"	University of Delhi (2013f)
"Cut-off list Arts & Commerce Eighth"	University of Delhi (2013g)
"Cut-off list Arts & Commerce Ninth"	University of Delhi (2013h)
"Cut-off list Arts & Commerce Tenth"	University of Delhi (2013i)
"Cut-off list Arts & Commerce First"	University of Delhi (2014a)
"Cut-off list Arts & Commerce Second"	University of Delhi (2014b)
"Cut-off list Arts & Commerce Third"	University of Delhi (2014c)

<b>Data.Name</b>	<b>Citation</b>
"Cut-off list Arts & Commerce Fourth"	University of Delhi (2014d)
"Cut-off list Arts & Commerce Fifth"	University of Delhi (2014e)
"Cut-off list Arts & Commerce Sixth"	University of Delhi (2014f)
"Cut-off list Arts & Commerce Seventh"	University of Delhi (2014g)
"Cut-off list Arts & Commerce Eighth"	University of Delhi (2014h)
"Cut-off list Arts & Commerce Ninth"	University of Delhi (2014i)
"Cut-off list Arts & Commerce Tenth"	University of Delhi (2014j)
"Cut-off list Arts & Commerce First"	University of Delhi (2015)
"Cut-off list Arts & Commerce Second"	University of Delhi (2015a)
"Cut-off list Arts & Commerce Third"	University of Delhi (2015b)
"Cut-off list Arts & Commerce Fourth"	University of Delhi (2015c)
"Cut-off list Arts & Commerce Fifth"	University of Delhi (2015d)
"Cut-off list Arts & Commerce Sixth"	University of Delhi (2015e)
"Cut-off list Arts & Commerce Seventh"	University of Delhi (2015f)
"Cut-off list Arts & Commerce Eighth"	University of Delhi (2015g)
"Cut-off list Arts & Commerce Ninth"	University of Delhi (2015h)
"Cut-off list Arts & Commerce Tenth"	University of Delhi (2015i)
"Cut-off list Arts & Commerce Eleventh"	University of Delhi (2015j)
"Cut-off list Arts & Commerce Twelfth"	University of Delhi (2015k)
"Cut-off list Science First"	University of Delhi (2013j)
"Cut-off list Science Second"	University of Delhi (2013k)
"Cut-off list Science Third"	University of Delhi (2013l)
"Cut-off list Science Fourth"	University of Delhi (2013m)
"Cut-off list Science Fifth"	University of Delhi (2013n)
"Cut-off list Science Sixth"	University of Delhi (2013o)
"Cut-off list Science Seventh"	University of Delhi (2013p)
"Cut-off list Science Eighth"	University of Delhi (2013q)
"Cut-off list Science Ninth"	University of Delhi (2013r)
"Cut-off list Science Tenth"	University of Delhi (2013s)
"Cut-off list Science First"	University of Delhi (2014k)
"Cut-off list Science Second"	University of Delhi (2014l)
"Cut-off list Science Third"	University of Delhi (2014m)
"Cut-off list Science Fourth"	University of Delhi (2014n)
"Cut-off list Science Fifth"	University of Delhi (2014o)
"Cut-off list Science Sixth"	University of Delhi (2014p)
"Cut-off list Science Seventh"	University of Delhi (2014q)
"Cut-off list Science Eighth"	University of Delhi (2014r)
"Cut-off list Science Ninth"	University of Delhi (2014s)
"Cut-off list Science Tenth"	University of Delhi (2014t)
"Cut-off list Science First"	University of Delhi (2015l)
"Cut-off list Science Second"	University of Delhi (2015m)
"Cut-off list Science Third"	University of Delhi (2015n)
"Cut-off list Science Fourth"	University of Delhi (2015o)

Data.Name	Citation
"Cut-off list Science Fifth"	University of Delhi (2015p)
"Cut-off list Science Sixth"	University of Delhi (2015q)
"Cut-off list Science Seventh"	University of Delhi (2015r)
"Cut-off list Science Eighth"	University of Delhi (2015s)
"Cut-off list Science Ninth"	University of Delhi (2015t)
"Cut-off list Science Tenth"	University of Delhi (2015u)
"Cut-off list Science Eleventh"	University of Delhi (2015v)
"Cut-off list Science Twelfth"	University of Delhi (2015w)
"India Today Annual Ranking 2013"	India Today (2013)
"India Today Annual Ranking 2014"	India Today (2014)
"India Today Annual Ranking 2015"	India Today (2015)
"NCRB Crime Against Women"	National Crime Records Bureau (2013a)
"NCRB Crime in India"	National Crime Records Bureau (2013b)
"Pakistan & India: High Resolution Population Density Maps"	Facebook and Columbia University - CIESIN (2016)
"Safecity"	Asok (2016)
"The Week annual rankings 2013"	The Week
"The Week annual rankings 2014"	The Week
"The Week annual rankings 2015"	The Week
"University of Delhi Annual Report 2013-14"	University of Delhi (2014)
"University of Delhi Annual Report 2015-16"	University of Delhi (2016)

### Statement about Rights

- I certify that the author of the manuscript have legitimate access to and permission to use the data used in this manuscript.

### Instructions for Replicators

It is possible to reproduce all the analysis using only the codes available in GitHub.

- Download the `\safety-first` .zip folder from from [World Bank Reproducibility Research Repository](#) and unzip it.
- Inside the `\safety-first` folder, create a new folder called "output". Inside this new "output" folder, create two new folders with the names "figures" and "tables."
- Following the Dataset list notes download the `\data` and save it inside the `\safety-first` folder. This way, the `\safety-first` folder must contain the folders `\code`, `\output` and `\data`, the 3 master code files and the `README.md`.
- Inside de `\data` folder create two new folders with the names "coded" and "mixed\_logit [dataset]." Inside the new "coded" folder, create a new folder called "routes."
- In the master code files, update the directory paths to the path on your computer that leads to the `\safety-first` folder.
- Run the master code files in the following order: `master_1.do`, `master_2.m` and `master_3.do`.

Everything should run smoothly. If any inconvenience is encountered, please don't hesitate on reaching out to the authors.

### Details

- Figures 4, 5, 6, A1 and A14 can be reproduced using the data provided in the folder "data/raw/", and ArcGIS Desktop (Version 10.8.2) by following these (manual) instructions:
- Figure 4:
  - Create a new map document in ArcGIS ArcMap, browse to the folder "data/raw/Safetipin/ArcGIS" in the "Catalog", with files "coll\_loc\_insample\_Withsize.shp", "NCR\_PINCODE\_Project" "c12.shp", "c14.shp", "c18.shp", "c39.shp", "c52.shp", "c60.shp", "c62.shp" and "c63.shp".
  - Drop the files listed above onto the new map, creating ten separate layers. Then arrange them from top to bottom in the following order: coll\_loc\_insample\_Withsize, c52, c14, c18, c60, c12, c62, c39, and c63.
  - Double-click the c12 and c39 layer symbols and change them to red circles.
  - For the c14, c18, c52, c60, c62, and c63 layers, right-click each layer and select Properties, then go to the Symbology tab, expand Categories, and choose Unique values. In the Value field, select data\_d\_fem and click Add All Values. For category 1, double-click the symbol and set it to red circles; for category 0, double-click the symbol and set it to blue triangles; and for category NULL, uncheck it so it is not displayed.
  - Finally, change the coll\_loc\_insample\_Withsize icon to black stars.
- Figure 5a:

- Create a new map document in ArcGIS ArcMap, browse to the folder "data/raw/Safetipin/Safety data" in the "Catalog", with file "Audits\_formap\_2017-04-09.shp" and "data/raw/Safetipin/ArcGIS" with file "NCR\_PINCODE\_Project".
- Drop the files listed above onto the new map, creating two separate layers. Order them with "Audits\_formap\_2017-04-09" in the top layer and "NCR\_PINCODE\_Project" in the bottom layer.
- Right-click on the layer on the Audits\_formap\_2017-04-09 icon and select Properties. Then, go to the Symbology tab. Expand the Quantities option and select Graduated Colors. In the Fields section, set the Value field to PCA\_SAF, select 5 classes in Natural Breaks, choose Red-Yellow-Green ramp color and click OK.
- Figure 5b:
  - Create a new map document in ArcGIS ArcMap, browse to the folder "data/raw/Safetipin/MAPDATA" in the "Catalog", with file "idw\_polymer\_clippedtoNCR.shp" and "data/raw/Safetipin/ArcGIS" with file "NCR\_PINCODE\_Project".
  - Drop the files listed above onto the new map, creating two separate layers. Order them with "idw\_polymer\_clippedtoNCR" in the top layer and "NCR\_PINCODE\_Project" in the bottom layer.
  - Right-click on the layer on the idw\_polymer\_clippedtoNCR icon and select Properties. Then, go to the Symbology tab. Expand the Quantities option and select Graduated Colors. In the Fields section, set the Value field to GRIDCODE, select 5 classes in Natural Breaks, choose Red-Yellow-Green ramp color and click OK.
  - Select the five categories shown in the window, right-click, choose Properties for Selected Symbols, set the Outline Color to No Color, and then click OK.
- Figure 6a:
  - Create a new map document in ArcGIS ArcMap, browse to the folder "data/raw/Safetipin/MAPDATA" in the "Catalog", with file "52\_013.shp", "college.shp" and "student.shp".
  - Drop the files listed above onto the new map, creating three separate layers. Arrange the layers so that "student" and "college" are on top, and "52\_013" is the bottom layer.
  - Right-click on the 52\_013 layer and select Properties. Go to the Symbology tab, expand the Categories, and choose Unique values. In the Value Field, select mode and click Add All Values. For each category, double-click the symbol, change the color, and set the line width to 2. Use green for Rickshaw, blue for Metro, orange for Walk, and purple for Bus. Next to mode, delete the text so the heading is left blank. Click OK.
  - Next, double-click the symbol for the student layer and change it to a blue triangle. Do the same for the college layer, changing its symbol to a black star.
  - Rename the layers by right-clicking on each one, selecting Properties, going to the General tab, and updating the Layer Name. Rename 52\_013 to Travel mode, college to Chosen college, and student to Student.
  - Switch from Data View to Layout View in order to add the map elements. To add the legend, click Insert and then Legend, select only the Travel mode layer, click Next, type Travel mode as the legend title, and continue clicking Next until finishing. Repeat this process for the Chosen college and Student layers, but remove the legend title.
  - To add a north arrow, click Insert, select North Arrow, choose ESRI North 3, and click OK. Finally, to add a scale bar, click Insert, select Scale Bar, choose Alternating Scale Bar 2, and click Properties. In the Scale and Units tab, set the Division Units to Kilometers. Then go to the Format tab, change the text size to 5, click OK, and accept the changes. Change the scale bar size manually so that the minimum value is 0 and the maximum value is 4.
- Figure 6b:
  - Add figure 6a to figure A14b and zoom in.
- Figure A1:
  - Create a new map document in ArcGIS ArcMap, browse to the folder "data/raw/Safetipin/ArcGIS" in the "Catalog", with files "coll\_loc\_insample\_Withsize.shp", "coll\_loc\_shortsurvey\_withsize.shp", "CollegeLocations\_final\_1.shp", and "Delhi\_NCT\_pincodes.shp".
  - Drop the files listed above onto the new map, creating four separate layers. Order them with "coll\_loc\_insample\_Withsize" in the top layer and "Delhi\_NCT\_pincodes" in the bottom layer.
  - For all layers except Delhi\_NCT\_pincodes, right-click on the layer and select Properties. Then, go to the Symbology tab. Expand the Quantities option and select Graduated Symbols. In the Fields section, set the Value field to size. Adjust the ranges as needed and click OK.
- Figure A14a:
  - Create a new map document in ArcGIS ArcMap, browse to the folder "data/raw/Safetipin/Safety data" in the "Catalog", with file "clip\_grid\_500.shp" and "data/raw/Safetipin/ArcGIS" with file "NCR\_boundary\_Project".
  - Drop the files listed above onto the new map, creating two separate layers. Order them with "clip\_grid\_500" in the top layer and "NCR\_boundary\_Project" in the bottom layer.
  - Right-click on the layer on the clip\_grid\_500 icon and select Properties. Then, go to the Symbology tab. Expand the Quantities option and select Graduated Colors. In the Fields section, set the Value field to GRIDCODE, select 5 classes in Natural Breaks, choose Red-Yellow-Green ramp color and click OK.
- Figure A14b:
  - Create a new map document in ArcGIS ArcMap, browse to the folder "data/raw/Safetipin/Safety data" in the "Catalog", with file "clip\_grid\_1500.shp" and "data/raw/Safetipin/ArcGIS" with file "NCR\_boundary\_Project".
  - Drop the files listed above onto the new map, creating two separate layers. Order them with "clip\_grid\_1500" in the top layer and "NCR\_boundary\_Project" in the bottom layer.
  - Right-click on the layer on the clip\_grid\_1500 icon and select Properties. Then, go to the Symbology tab. Expand the Quantities option and select Graduated Colors. In the Fields section, set the Value field to GRIDCODE, select 5 classes in Natural Breaks, choose Red-Yellow-Green ramp color and click OK.
  - Select the five categories shown in the window, right-click, choose Properties for Selected Symbols, set the Outline Color to No Color, and then click OK.

## List of Exhibits

The provides code reproduces selected tables and figures in the paper, as explained and justified below.

Figure/Table #	Program	Line number	Output file	Note
Figure 1	11_figure_1_cdf.do	37	figure1_cdf_abs_rank.pdf, figure1_cdf_rank_1co.pdf	Found in output/figures
Figure 2	n.a. (no data)		stylized.pdf	Diagram
Figure 3	12_quality_dist.do	16	figure_3a.pdf, figure_3b.pdf	Found in output/figures
Figure 4	ArcGis		Students_allcoll_FS_withcoll.pdf	Find instructions above
Figure 5	ArcGis		SafetyAudits_pca_safres.pdf, IDW_pcasafres.pdf	Find instructions above
Figure 6	ArcGis		data_eg3_nb1.pdf, data_eg7.pdf	Find instructions above
Figure 7	33_descriptive_analysis_resid_ses_quant2.do	539	safety_diff_r_1_5_main.pdf, qual_diff_r_1_5_main.pdf, time_diff_r_1_5_main.pdf, cost_diff_r_1_5_main.pdf	Found in output/figures
Figure 8	13_balanced_spread.do	79	figure_8_a.pdf, figure_8_b.pdf, figure_8_c.pdf, figure_8_d.pdf, figure_8_e.pdf	Found in output/figures
Figure 9	15_mc_simulation_output_test.do	129	mc_simulation.pdf	Found in output/figures
Table 1	16_table_1_summary_stats_updated.do	129	table_1_updated_v2.tex	Found in output/tables
Table 2	17_table_2_gmap_routes_updated.do	149	gmaps_summary_updated.tex	Found in output/tables
Table 3	18_table_3_travel_behavior_updated.do	111	table_3_updated.tex	Found in output/tables. The values in the harassment column were hardcoded in the Stata do-file; the source of these values is Safecity (Asok, 2016).
Table 4	19_individual_table_benchmark_noc_sf.do	326	IndividualTablebenchmark_noc_sf.tex	Found in output/tables. The table in the paper shows bootstrapped standard errors in brackets. These are obtained at the end of the code and displayed in a matrix. The bootstrapped errors are then added manually.
Table 5	20_individual_table_robustness_noc_sf.do	320	IndividualTableRobust_major_noc_sf.tex	Found in output/tables
Table 6	21_table_asc.do	163	individual_table_asc.tex	Found in output/tables
Figure A1	ArcGis		AllDU_colleges_withsize_forpaper.pdf	Find instructions above
Figure A2	22_figure_A1_pdf_examscore.do	35	figure_A1_pdf_examscore.pdf	Found in output/figures
Figure A3	23_figure_A_numnics.do	65	numnics_C5.pdf	Found in output/figures
Figure A4	n.a. (no data)		data_eg1_nb.pdf, data_eg2_nb.pdf, data_eg4_nb.pdf, data_eg6_nb1.pdf	Found in output/figures
Figure A5	34_crime_safety.do	107	crime_safety.pdf	Found in output/figures
Figure A6	33_descriptive_analysis_resid_ses_quant2.do	671	figure_resid_radii_combined_25.pdf	Found in output/figures
Figure A7	n.a. (no data)		triangular_dist.pdf	Triangular distribution image
Figure A8	23_figure_A_numnics.do	115	value_of_college_first_co_bygender.pdf	Found in output/figures
Figure A9	25_external_rankings_v1.do	95	extrank_cutoff_polsc_indiatoday.pdf, extrank_cutoff_bcom_indiatoday.pdf, extrank_cutoff_physics_indiatoday.pdf, extrank_cutoff_polsc_week.pdf, extrank_cutoff_bcom_week.pdf, extrank_cutoff_physics_week.pdf	Found in output/figures
Figure A10	26_placement_analysis.do	167,180	placement_cutoff_avg_polsc_pres.pdf, placement_cutoff_high_polsc_pres.pdf	Found in output/figures

Figure/Table #	Program	Line number	Output file	Note
Figure A11	27_balanced_spread_coed.do	126	figure_LQ_coed.pdf	Found in output/figures
Figure A12	28_mrs_dist.do	119	mrs.pdf	Found in output/figures
Figure A13	14_MRS_bars.do	66	mrs_sq_bars.pdf, mrs_st_bars.pdf, mrs_sc_bars.pdf	Found in output/figures
Figure A14	ArcGis		extrapolation_500_edit.pdf, extrapolation_1500_edit.pdf	Found in output/figures
Table B1	29_table_B1_comparing_samples.do	168	table_B1_updated.tex	Found in output/tables
Table B2	30_table_nondelhi_updated.do	86	table_x_nondelhi_updated.tex	Found in output/tables
Table B3	n.a. (no data)		Rajdhani_cutoff_2015_eg.png	It is a scanned copy of a sample cutoff list from a college at DU for 2015-16.
Table B4	5_college_choice.do	223	college_choice.tex	Found in output/tables
Table B5	n.a. (no data)		table_sp_rubric.tex	It is a SafetiPin safety audit rubric
Table B6	33_table_descriptive_analysis_resid_ses_quant2.do	619	table_descriptive_analysis_25.tex	Found in output/tables
Table B7	31_advantage_girl.do	48	predict_adv_women.tex	Found in output/tables
Table B8	35_individual_table_total.do	309	IndividualTable_total.tex	Found in output/tables
Table B9	38_w_se.do	159, 167	w_regressions_v1.tex, w_regressions_v2.tex	Found in output/tables
Table B10	36_individual_table_noc_sf.do	156	IndividualTablebenchmark_noc_sf.tex, IndividualTable_conditional_logit_noc_sf.tex, IndividualTable_triangular_noc_sf.tex, IndividualTable_rest_triangular_noc_sf.tex, IndividualTable_normal_noc_sf.tex, IndividualTable_lognormal_noc_sf.tex	Found in output/tables. These tables contain the MRS results, which were manually combined into a single table, as shown in the paper.
Table B11	34_individual_table_benchmark_coed_only.do	175	IndividualTablebenchmark_coed_only.tex	Found in output/tables
Table B12	32_num_maj_descriptives.do	29	num_majors.tex	Found in output/tables
Table B13	37_individual_table_noc_safetyrobust.do	14	table_robustness_grid_edit_noci.tex	Found in output/tables
Table C1	n.a. (no data)		metro_fares.tex	Source: Delhi Metro Rail Corporation. <a href="http://www.delhimetrorail.com/">http://www.delhimetrorail.com/</a> (last accessed: May 28, 2020)
Table C2	n.a. (no data)		train_fares.tex	Source: <a href="https://nfr.indianrailways.gov.in">https://nfr.indianrailways.gov.in</a> , (last accessed: May 28, 2020)

## Requirements

### Computational Requirements

Portions of the code were reproduced on a Windows Server 2019 Standard machine with an Intel Xeon E7-4850 v4 CPU @ 2.10GHz (16 processors), 64 GB of RAM, running Stata 18.0 MP.

Portions of the code were reproduced on a Windows 10 Enterprise machine with an Intel Xeon Gold 6132 CPU @ 2.60GHz (16 cores, 16 logical processors), 128 GB of RAM, running Matlab 2024b.

### Software Requirements

- Stata (code was last run with version 14)
- Matlab (code was last run with Matlab R2023a)

### Memory and Runtime and Storage Requirements

Approximate time needed to reproduce the analyses on a standard desktop machine:

- <10 minutes
- 10-60 minutes

- 1-2 hours
- 2-8 hours
- 8-24 hours
- 1-3 days
- 3-14 days
- > 14 days

Approximate storage space needed:

- < 25 MBytes
- 25 MB - 250 MB
- 250 MB - 2 GB
- 2 GB - 25 GB
- 25 GB - 250 GB
- > 250 GB

## Code Description

There are three main code files:

- master\_1.do**: Main do file that runs all STATA code until do file **8\_mc\_simulation.do**. This section cleans survey data and organizes databases for analysis. (Takes 14 hours to run)
- master\_2.m**: Main script that runs all Matlab code. (Takes 463 hours to run)
- master\_3.do**: Main do file that runs all STATA code from do file **9\_conditional\_logit\_to\_csv\_v1.do**. (Takes 5 minutes to run)

The body of the code is organized into the `\code` folder as follows:

### STATA

All STATA code is stored in the `/stata` subfolder, and the cleaned files created by them are stored in the `/coded` subfolder in the `/data` folder.

### Matlab

All Matlab code is stored in the `/matlab` subfolder.

#### Inputs for Matlab

- data\_fem.csv
- data\_fem\_ses.csv
- data\_male.csv
- data\_male\_ses.csv
- data\_fem\_b`i`.csv
- data\_male\_b`i`.csv

where  $i = 1, \dots, 100$

- data\_fem\_robust\_major.csv
- data\_fem\_robust\_major\_ses.csv
- data\_male\_robust\_major.csv
- data\_male\_robust\_major\_ses.csv
- data\_fem\_asc.csv
- data\_male\_asc.csv
- sample\_`numcoll`/sample0\_`j`\_`i`.csv
- sample\_`numcoll`/sample1\_`j`\_`i`.csv

where numcoll in {2,5,8}, j in {100,500,900,1300,1700,2100},  $i = 1, \dots, 100$

- data\_fem\_robust\_safety.csv
- data\_male\_robust\_safety.csv
- data\_fem\_lognormal.csv
- data\_male\_lognormal.csv
- data\_fem\_robust\_safety\_grid.csv
- data\_male\_robust\_safety\_grid.csv

#### Outputs from Matlab

- mixed\_logit/prefix\_`reg`.txt
- mixed\_logit/prefix\_`reg`.sq.txt
- mixed\_logit/prefix\_`reg`.st.txt
- mixed\_logit/prefix\_`reg`.sc.txt
- mixed\_logit/coefficients/estimates\_`prefix`\_`reg`.csv

prefix = female, then reg

- benchmark
- benchmark\_ses\_fixed
- robust\_major
- robust\_major\_ses\_fixed
- asc
- robust\_arr\_rate3
- robust\_usage6
- robust\_psm\_min
- robust\_psm\_modal
- robust\_light
- robust\_open
- robust\_visibility
- robust\_crowd
- robust\_security
- robust\_path
- robust\_excl\_transport
- robust\_gender\_usa
- robust\_excl\_feeling
- triangular
- rest\_triangular
- normal
- lognormal
- robust\_coed\_only
- robust\_grid500
- robust\_grid1500

prefix = male, then reg

- benchmark
- benchmark\_ses\_fixed
- robust\_major
- robust\_major\_ses\_fixed
- asc
- robust\_arr\_rate3
- robust\_usage6
- robust\_psm\_min
- robust\_psm\_modal
- robust\_light
- robust\_open
- robust\_visibility
- robust\_crowd
- robust\_security
- robust\_path
- robust\_excl\_transport
- robust\_gender\_usa
- robust\_excl\_feeling
- triangular
- rest\_triangular
- normal
- lognormal
- robust\_coed\_only
- robust\_grid500
- robust\_grid1500

prefix = all, then reg

- benchmark
- benchmark\_ses\_fixed
- robust\_major
- robust\_major\_ses\_fixed
- robust\_coed\_only

Bootstrap

- bootstrap/female\_`numsim`.txt
- bootstrap/female\_sq\_`i`.txt
- bootstrap/female\_st\_`i`.txt

- bootstrap/female\_sc\_`i`.txt
- bootstrap/estimates\_female\_`i`.csv
- bootstrap/male\_`i`.txt
- bootstrap/male\_sq\_`i`.txt
- bootstrap/male\_st\_`i`.txt
- bootstrap/male\_sc\_`i`.txt
- bootstrap/estimates\_male\_`i`.csv

#### Monte Carlo

- sample\_`numcoll`/female\_`j`\_`i`.txt
- sample\_`numcoll`/female\_sq\_`j`\_`i`.txt
- sample\_`numcoll`/female\_st\_`j`\_`i`.txt
- sample\_`numcoll`/female\_sc\_`j`\_`i`.txt
- sample\_`numcoll`/estimates\_female\_`j`\_`i`.csv
- sample\_`numcoll`/male\_`j`\_`i`.txt
- sample\_`numcoll`/male\_sq\_`j`\_`i`.txt
- sample\_`numcoll`/male\_st\_`j`\_`i`.txt
- sample\_`numcoll`/male\_sc\_`j`\_`i`.txt
- sample\_`numcoll`/estimates\_male\_`j`\_`i`.csv

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