

# Gendered Differences in Mobility and the Demand for Transport: Evidence from a Field Experiment in Urban Ethiopia

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## Background and Motivation

Improving mobility through the expansion of transport networks, the construction of roads, and other related investments has long been considered a major development priority in low- and middle-income countries, particularly in urban settings where the returns to agglomeration and the demand for efficient and effective transport, both as a means and as an end, are high (1–4). A well-organized transport system has the potential to minimize travel burden (in terms of costs, convenience, and travel time) and increase mobility to a range of desirable destinations (markets, places of production and employment, amenities, community centers, etc.). These improvements to access may, in turn, boost demand for and utilization of local services, encourage productivity, and, in the long run, foster growth and development (5,6).

In spite of rapid urbanization, however, many urban residents in low- and middle-income countries continue to be constrained by poor transport options and generally low mobility. Inadequate transportation in cities has a particularly disproportionate effect on women, who are likely to face additional social, economic, and structural barriers that prevent them from accessing services and engaging with markets (7,8). Women's travel patterns and means of mobility are notably different from men's, and these differences can be characterized by deep and persistent inequalities. Within a given urban setting, women typically have inferior access to both private and public means of transport while concurrently assuming a higher share of their household's travel burden (7,9). Poor access to safe and efficient transit limits a time- and resource-constrained woman's ability to choose whether and how to travel outside the home, particularly if she is also compelled to be more conscientious of her safety and well-being in public settings. A woman may therefore be compelled to modify her travel behavior (e.g. traveling during certain times of the day, taking multiple transport routes, trip chaining, avoiding travel during peak travel times, etc.) in order to minimize any risks that she may face in public spaces, especially when using multiple modes of transport (10–12). These mobility constraints, along with the costs that women have to bear to overcome them, have significant and adverse implications for women's productivity, engagement with markets and services, and overall well-being.

The introduction of effective transportation services for women, either through the provision of private transport options or through improvements to public modes of transport, has the potential to:

1. Meet women's demand for transport and access to destinations of interest
2. Promote women's access to services, including those that enhance their human capital, productivity, and well-being (health, education, etc.)
3. Improve women's access to economic, political and social opportunities (jobs, markets, social services, cultural and political spaces, etc.), which in turn, may positively affect their autonomy and well-being.

Recently, programs in South Asia and the Middle East have aimed to improve access to safe transport and expand mobility, particularly for women. For example, the Lahore “safe city” program in Pakistan recently introduced a range of services, including smart patrolling, the introduction of CCTV cameras

on public transport, and gendered transport options, as a means to positive impact public access, and specifically women's mobility. However, there is a need for more rigorous impact evaluation of the effect of improved transport on women's (as well as men's) travel demand and well-being, particularly in Sub-Saharan Africa where the evidence is scarce. To date, few evaluations have sought to identify the impact of improved services on women's travel demand, and apart from three ongoing studies by Field and Vyborny in Pakistan (13), Borker et al in India (14), and, most recently, Christensen and Osman in Egypt (15), no randomized control trial, to our knowledge, has attempted to causally identify the impact of improved mobility and transport on more expansive measures of women's empowerment and well-being in Sub-Saharan Africa.

### **Research Aims**

We document the extent to which mobility and travel demand vary by gender, and particularly for women, with the introduction of an improved private transport option. To this end, we will conduct a field experiment to evaluate the causal impact of introducing free and efficient transport on mobility, access to services and desired destinations, and measures of empowerment and well-being. Our key research aims are to: 1) examine gender differences in mobility patterns, travel demand, and transport preferences in urban settings; and 2) identify how the removal of key barriers to efficient and safe transport affects: a) travel demand and mobility; b) travel patterns and preferences; and c) autonomy and well-being, particularly for women.

### **Target Population**

Our target population is urban households in Addis Ababa, Ethiopia. We will select households that have at least one adult male and female member who are both permanent household residents (i.e. have resided for at least 6 months in the household). Selecting households that are comprised of both genders will allow us to observe potential bargaining behavior between men and women over transport access and use. We will also target and oversample poorer urban households that are likely to be mobility constrained and have a higher demand for high quality transport options.

### **The Experiment and Setting**

This study is a three-armed randomized controlled trial that consists of a baseline survey followed by implementation of our transport intervention over a two month period. A follow-up survey will be conducted with all participants after completion of the intervention.

We will conduct this field experiment with an estimated 1,000 households in Addis Ababa, Ethiopia. Following a baseline survey, each household will be randomly assigned to one of three treatment arms: 1) a "woman transport" arm (N = 400 households); 2) a "man transport" arm (N = 300 households); or 3) a "couples transport" arm (N = 300 households). Each household will then be provided with the name and contact information of a private taxi service in Addis Ababa. For households that are randomly assigned to the woman transport arm, the taxi service will be offered to women in the household for their private use. For households that are randomly assigned to the men transport arm, the service will be offered to men in the household. Finally, for households that are randomly assigned to the couples transport arm, the service will be offered to both men and women in the household. Eligible client(s) in each household will receive a photo ID card that will allow them to set up appointments with the taxi. As part of the service, eligible client(s) will be informed that they will receive one of four randomized amounts (\$20, \$40, \$60, or \$80 to 250 clients each) in credit to cover

taxi fares for the duration of the intervention, a two-month period. The taxi service will be available to clients by appointment and at any time of day to transport clients to any destination (or destinations) of their choice within Addis. Eligible clients will be informed that the service they receive is intended for their personal use only, and only children or dependents under the age of 15 will be permitted to accompany them on any trip (i.e. rideshares are not permitted). As a part of the process evaluation, short passenger surveys will be conducted in real-time with clients when appointments are made, when clients enter the taxi from their point of origin, and when clients are dropped off at their desired destination.

All participating households and clients will be re-interviewed after two months of exposure to the intervention. Outcomes of interest include: 1) uptake of the taxi service; 2) attitudes and perceptions around access, and satisfaction with transport; 3) measures of access and travel to key destinations (markets, points of interest, etc.); 4) time use and changes in travel demand and preferences; 5) access to and utilization of public services (healthcare, public goods, etc.); 6) changes to labor market activity and productivity; and 7) broader measures of autonomy, empowerment, and economic well-being. As part of our primary analyses, we will estimate the extent to which gender gaps in travel, including travel distance, mobility (number of trips taken per participant per week), and spatial access (number of new destinations travelled), are reduced over the study period.

Our study seeks to achieve the following:

1. By providing private, free transport that is available on demand and at any time, we reduce a wide range of constraints that typically exist in cases where some determinants of travel burden are relaxed (e.g. through the subsidization of fares, improved safety of vehicles, increased geographic coverage, etc.). In doing so, we seek to more effectively estimate the true latent demand for travel by observing how mobility patterns, travel frequency, and measures of travel behavior change in a simulated, less constrained environment.
2. Through our study design, we document travel preferences, demand, and other measures of well-being by gender. Our experimental approach will allow us to rigorously assess the extent to which gender-specific barriers to mobility and effective transport account for any relative differences between women's and men's observed (realized) travel behavior and outcomes.

### **Power Calculations**

Our target baseline sample will consist of 1,000 households who will have met the eligible criteria and who will have consented to participate in the study. Estimates from the Ethiopia Demographic and Health Surveys have found that 23.1 percent of initially screened households would not meet the eligibility criteria of having at least one adult male and female household resident (16). Therefore, in order to meet our target sample size of 1,000, we will need to survey 1,500 households if we assume an ineligibility rate of 23.1 percent and a refusal rate of 10 percent from the preliminary recruitment process. In order to minimize spillover effects between households, we will recruit participants who live at least 5 households apart from each other. This recruitment process implies that we will need to choose enough enumeration areas in Addis to have at least 8,000 households in total ( $1,500 \times 5 = 7,500$  households that make up our sample and who are at least 5 households apart, plus an additional 500 households that are screened but where participants either do not meet the eligibility criteria or refuse to participate). Of the 1,000 households that will be recruited into the study at baseline following the initial screening process, 400 households will be assigned to the woman transport arm, 300

households will be assigned to the man transport arm, and 300 households will be assigned to the couples transport arm.

Our unit of analysis is a household. Our power calculations for our main outcomes of interest that are related to the closure of gender gaps in distance travelled, mobility (number of trips taken per participant), and spatial access (number of new destinations travelled). Baseline estimates of our key outcomes are based on recent findings from an ongoing transport field experiment in Egypt and from secondary data analysis of transport performance in Addis Ababa (15,17). To guarantee enough power to detect a relative increase in women's travel behavior and mobility, we will assign more households to the woman transport arm relative to the other two intervention arms. To maximize power, we will also stratify our sample of households by baseline travel frequency, baseline availability of motorized transport (e.g. car ownership), and baseline household composition characteristics in order to be able to more easily detect treatment effects. Given our hypotheses around the impact of our intervention on our key outcomes, one-sided hypotheses tests will be conducted for all of our main analyses.

We have powered our study to detect closures of gender gaps in the following outcomes: 1) distance travelled per week; 2) the number of trips taken per participant per week; and 3) the number of new destinations traveled by women relative to men.

### **Study Timeline**

The study will span a total of 10 months, from October 2021 to July 2022. Months 1 to 3 (October 2021 to December 2021) will consist of conducting a site visit with local research and implementing partners in Ethiopia, finalizing IRB approvals, finalizing the electronic version of the baseline and follow-up survey instruments and interview guides, and completing preparations of the transport intervention (establishing contracts with local taxi drivers, finalizing participant photo ID cards and other intervention materials). The first half of month 4 (January 2022) will consist of hiring surveyors and other field management staff (field managers) and working with local partners on the study launch. Training of intervention staff, field staff, and surveyor will be administered in the third week of month 4 (January 2022) and will last less than 5 workdays. During the first week of month 5 (February 2022), eligible households that participate in the study will receive a baseline survey. Rollout of the baseline survey to 1,000 households will take up to 2 months to complete, from month 5 (February 2022) to month 6 (March 2022). Immediately following completion of the baseline survey, households will be randomized on site to one of the three intervention arms. We will randomize households to intervention arms such that intervention assignment is balanced according to the following baseline characteristics: average travel frequency, household wealth, employment and work status, and access to transport modes (car, motorbike, bicycle, etc.). Following randomization, eligible clients in the households will be re-visited by the field team and will be introduced to the transport intervention. Clients will be able to access the taxi service for a period of two months, from month 6 (March 2022) to month 8 (May 2022). Follow-up activities and data collection with households will commence in month 8 (May 2022) and will be completed by month 9 (June 2022). Analysis of the study data and dissemination of preliminary study findings to local partners and communities will begin in month 9 and will continue through month 10 (July 2022). The study will conclude in July 2022.

### **Project Contribution and Policy Relevance**

The results of this research will inform policy on how improved transport can best be designed, adapted, and expanded to improve mobility, meet travel demand, and contribute to overall well-being, particularly for women. We aim to contribute to the policy debate and academic literature on urban transport investments both in Ethiopia as well as globally. Evidence from this study will inform the

design and implementation of a larger-scale, gender-based transport intervention. The study findings will be effectively disseminated to practitioners through local partnerships with the World Bank and other key stakeholders in Ethiopia. The research team will work with these organizations to ensure the intervention is appropriate for the country setting. We will also share our research findings with members of the community in Addis.

### **Potential for Scale-Up**

The primary aim of our study is to demonstrate the impact of safe and efficient transport. To this end, the provision of private, on-demand taxi service seeks to remove a number of key barriers to accessing high quality transport, such as cost, convenience, availability, etc. While our intervention allows us to effectively estimate latent travel demand, it is not scaleable as it is currently designed. With this said, findings from our impact evaluation have the potential to inform the design and development of more scaleable transport interventions, e.g. vouchers or targeted subsidies for private transport, gendered public transport options, etc. Moreover, the process evaluation and intervention take-up components of the study will also include a range of cost data (trip costs, trip distance and duration, taxi maintenance costs, among others), which will allow us to generate estimates of the cost effectiveness of our intervention and its components.

### **Project Budget and Justification**

A project budget and budget justification are attached. We would require a total of \$45,150 USD in top-up funding that will cover expenditures associated with expanding the rollout of the transport intervention, extended monitoring and data collection (interviews, focus group discussions, piloting of the survey), and research assistance support. We have currently secured a total of \$135,000 USD through support from the Hewlett Foundation (\$50,000) and the Max Planck Institute for Demographic Research (\$85,000). Following the study, we will submit grant proposals to several potential donor organizations at which point we will request additional funding support to implement a larger-scale field experiment. We will use findings from this study as evidence for supporting future research in this domain (expansion of the intervention scope, further explorations of gender differences in travel demand, etc.), and we will be able to demonstrate to potential funders that a larger-scale trial can be successfully implemented within the local context.

### **Proposed Grant-Related Activities**

Following a field visit and initial needs assessment, auxiliary data on transport routes, fare rates, and the availability of private taxi services will be collected with support from public and private sector stakeholders in Addis Ababa. Formative in-depth interviews and focus group discussions will also be conducted with passengers, taxi drivers, and public transport workers to assess the current transportation landscape in Addis. Following preliminary data collection, we shall travel to Addis Ababa in January 2022 to: 1) meet with key local partners for this study; 2) submit all protocols to the BU IRBs as well as to the social science research ethics committees in Ethiopia and obtain all essential ethical and operational approvals from local authorities; 3) recruit, hire, and train field staff in the study protocols and implementation of the baseline survey, 4) pilot the baseline survey and other data collection instruments (monitoring forms, order tracking forms, etc.), 5) test the private taxi intervention within selected residential areas, and 6) conduct the follow-up survey with respondents after 2 months. We will meet with our local partner organization, XXX, to hire and train field staff, namely: 1) field managers who supervise intervention staff, monitor data for quality, and supervise intervention activities; 2) field enumerators, who will implement the baseline survey; 3) and intervention staff (minibus drivers, ticket-collectors), who will implement and monitor the transport

intervention across the selected residential areas. Evidence from the piloting of the surveys and intervention will serve to inform the design and implementation of a larger-scale trial.

### **Prior Study-Related Work**

The principal investigator, Mahesh Karra, has worked in Sub-Saharan Africa and South Asia and has prior work and field experience in East Africa (Kenya, Ethiopia, Malawi, Uganda, and Tanzania). Karra is also currently a Research Associate for IPA Malawi for other field experiments and continues to oversee several other projects and initiatives in Malawi in collaboration with IPA Malawi. He has worked in international development for ten years and has experience in implementing randomized controlled trials and impact evaluations in Sub-Saharan Africa and South Asia. Karra will act as Principal Investigator for the study and will provide administrative and technical support for the entire study duration. He has completed the necessary human subjects and data security trainings.

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## **Women's Transport Study Study Objectives and Activity Plan**

### ***Data Collection Activities***

1. Baseline Assessments
  - a. Baseline survey (household travel survey), quantitative,  $N = 600$  households
  - b. Baseline in-depth interviews (IDIs),  $N = 10$
  - c. Baseline focus-group discussions (FGDs),  $N = 10$
  - d. Passenger Surveys – on modes of transport, quantitative assessments ( $N = 100$ )
  - e. Transport Provider Surveys, Mixed Methods,  $N = 30$
2. Intervention Design and Debriefing
  - a. Follows baseline analysis
  - b. Intervention development
    - i. With strong gender component (expanding women's access, choices in mobility, etc.)
  - c. Development of implementation plan for intervention study
3. Impact Evaluation of Transport Intervention
  - a. RCT
  - b. With process evaluation (measurement, implementation monitoring data)
  - c. De-briefing following endline

### ***Brief Timeline***

1. Initial field visit, stakeholder engagement, research partner identification: July 2021 to August 2021
2. Assessment protocol development, IRB approvals, field set-up: August 2021 to November 2021
3. Baseline Assessments: November 2021 to March 2022
4. Intervention debriefing and design: April 2022 to July 2022
5. Impact evaluation of gender + transport intervention: August 2022 to January 2023

### ***Potential Personnel***

1. Mahesh Karra (BU)
2. Ammar Malik (HKS, BU)
3. Girija Borker? (World Bank)
4. Doctoral Fellow, Anastasiia Arbuzova (1)
  - a. Funded through POWER, IED, and other sources
5. Masters RAs (2)
  - a. Periodically rotate, support fieldwork and oversight
  - b. Funded through GDP Center, POWER

### ***Baseline Assessments***

#### **Household Travel Survey (Quantitative, $N = 600$ ) + Qualitative IDIs ( $N = 10$ ) and FGDs ( $N = 10$ )**

1. Quick HH roster
  - a. HH members
  - b. Children
  - c. Adult men and women



2. For each adult man and woman
  - a. Respondent background
    - i. Education
    - ii. Age
    - iii. Work
      1. Work location
      2. Work schedule
      3. Mode of transport to work
3. Capture baseline travel access at household level for men and women
  - a. Existing transport modes at home for each member, ownership of transport (car, bike, van, etc.), access to transport options (bus, metro, other), transport sharing (carpooling, ride share, etc.)
  - b. Access to different transport modes for different members
    - i. Access to car, bike (drivers' licenses, etc.)
    - ii. Access to resources for public transport
    - iii. Access for disabled / women / people with dependents who accompany them
4. Capture reported travel behavior and overall enabling environment for travel and mobility
  - a. Typical travel origins and destinations for different members
    - i. Shortened travel log?
      1. Last two trips taken outside the house
    - ii. Travel times of day
    - iii. Companionship, with others
  - b. Access to specific destinations
    - i. Health care
      1. Closest health facility
    - ii. Education
      1. School where children go
    - iii. Markets
      1. Market where shop for groceries
    - iv. Telephone / communications provider
    - v. Amenities (theaters)
    - vi. Post office
    - vii. Police station
    - viii. Visiting friends / family in Addis
      1. Neighborhood of friend / relative who visit the most
    - ix. Other public goods and services
    - x. For each of the above destination types, we probe:
      1. Could the respondent go to this destination if she chose to?
      2. In the last month, has this respondent ever been in a situation where she wanted to go to this destination but could not?
      3. If not, what are the barriers that stopped her from going?
        - a. Time?
        - b. Monetary cost?
        - c. Distance?
        - d. Mode of transport / ease of travel?
        - e. Safety?
        - f. Permission from household / partner?

- g. Other considerations (child dependents, etc.)?
- 4. For each barrier, how significant of a barrier was it?
- c. Travel frequency, travel mode, travel constraints (costs, vehicle upkeep, traffic, safety, travel with children, household restrictions, etc.)
  - i. Distance and time to common destinations, resources spent to get there
  - ii. Chained behavior
- d. Experiences with current travel modes (car, bus, taxi)
  - i. Satisfaction
  - ii. Safety / harassment
  - iii. Convenience
- 5. Capture travel preferences
  - a. Ideal travel destinations, transport routes, travel modes
  - b. Demand for transport and mobility
    - i. What would clients do if had access to free, efficient transport?
    - ii. Where would they go?
  - c. If you could instantly travel a) to any three places in the world; b) to any three places in Ethiopia; c) to any three places in Addis Ababa
  - d. Travel norms and preferences for others (for women, for men)
    - i. Travel companionship
    - ii. Travel restrictions (hours / times of day)
    - iii. Destination restrictions
- 6. Capture empowerment through mobility
  - a. Decision-making around travel
    - i. Need to ask permission from anyone to go out?
    - ii. Need to ask permission from anyone to drive?
    - iii. Need permission to take the bus or public transport?
    - iv. Objections from whom?
      - 1. Partner?
      - 2. Other HH / family members?
      - 3. Community?
  - b. Decision-making around:
    - i. Household purchases
    - ii. Household spending
    - iii. Household savings
    - iv. Phone / internet access
    - v. Health care seeking
    - vi. Spending on children

**Passenger Survey (on public transport bus, matatu, taxi, bus), Quantitative (N= 100)**

- 1. At bus station
- 2. On matatu, bus, taxi, bicycle taxi
- 3. Track routes of passengers getting on and off (station to station, as well as capture origin and destination)
- 4. Capture time taken, convenience, and costs
  - a. Travel experience
  - b. Traffic and time costs

## **Transport Provider Survey (conductors, bus operators, drivers, and owners), Mixed-Methods ( $N = 30$ )**

1. Map routes
2. Client volume
3. Client type
  - a. Men
  - b. Women
  - c. Disabled
  - d. Children / minors
4. Record profits and fees for services charged
  - a. Fares
5. Record operating costs
  - a. Maintenance
  - b. Fuel
  - c. Licenses
6. Salaries and contract structures
  - a. For each type of provider
7. Experiences with transport
  - a. Driver qualifications, training
  - b. Safety concerns
  - c. Maintenance
  - d. Traffic concerns
8. Demand satisfaction
  - a. Desired client base
  - b. Expectations and aspirations

## ***De-Briefing Activities, Intervention Development and Design***

### ***RCT Design***

#### **Eligibility Criteria (Target Sample):**

- Men and women in households.
- No household member owns a car

#### **Proposed Intervention:**

Four-arm randomized design:

1. Control arm: access to status quo modes of transport
2. Treatment Arm 1: Subsidized (50 percent) or free for public transport options (bus, metro)
  - a. *Logistical and implementation challenges:* to develop vouchers that can be redeemed by bus and metro operators, collaboration with bus and transport authorities, design of vouchers / ID cards for passengers to prevent gaming, repayment to operators, monitoring and recording trip data
3. Treatment Arm 2: Access to private transport that charges the equivalent of public transport options for the trip
  - a. *Logistical and implementation challenges:* establishing network of private taxi / transport providers, coordinating taxi routes across clients, establishing cost equivalents for

trips taken by clients (fixed subsidized rate per mile? Costs by zoning?),  
documentation of trip data

4. Treatment Arm 3: Access to free private transport
  - a. *Logistical and implementation challenges*: establishing network of private taxi / transport providers, coordinating taxi routes across clients, documentation of trip data

To simplify treatment arms, we can eliminate Treatment Arm 2.

## **Contributions to Literature and Review of Evidence**

### *Review of Key Evidence*

1. Refer to key studies that are most relevant and important for our own study
  - a. Christiansen and Osman Egypt study
    - Contribution and key findings that relevant for our study
    - Limitations – and where our study could do better (i.e. the value added of our study)
  - b. Girija Borker's India study (transport and education)
  - c. Kate Vyborny and Erica Field Pakistan study on gendered transport
  - d. Others? Malawi study on subsidizing rural transport (bus fares) in rural Malawi, done with IPA Malawi (Rebecca Thornton and Dean Yang)  
<https://www.poverty-action.org/study/access-transport-rural-malawi>

### *Contributions*

1. Summary contributions and value added of our study
  1. Research design and innovation
    - Intervention design and approach
    - Sample of interest (target population)
    - Local context (SSA and Ethiopia where Uber and high quality, affordable rideshare options are not yet available)
  2. Methodology and the research question
    - Direct evidence of gender differences in transport, household bargaining in transport
    - Direct comparison of an intervention that aims to close gender gaps
  3. Measurement and outcomes
    - Measurement of transport and mobility outcomes
    - More general empowerment measures that are relevant for women's well-being