Gender Gaps in Urban Mobility

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Introduction

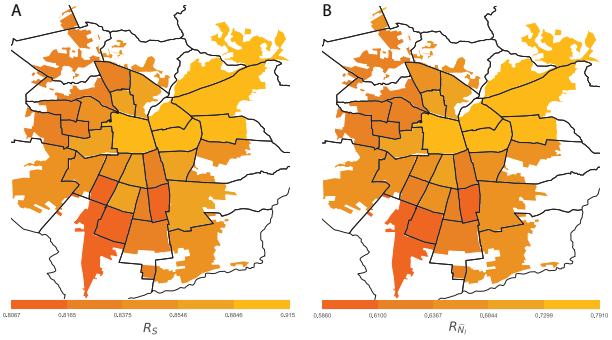
Mobility is gendered. For example, the household division of labor in many societies leads women and girls to take more multi-purpose, multi-stop trips than men. Women-headed households also tend to work more in the informal sector, with limited access to transportation subsidies, and use of public transit is further reduced by the risk of violence in public spaces.

This brief summarizes a recent analysis of gendered urban mobility in 51 (out of 52) neighborhoods of Santiago, Chile, relying on the call detail records (CDRs) of a large sample of mobile phone users over a period of three months. We found that: 1) women move less overall than men; 2) have a smaller radius of movement; and 3) tend to concentrate their time in a smaller set of locations. These mobility gaps are linked to lower average incomes and fewer public and private transportation options. These insights, taken from large volumes of passively generated, inexpensive data streaming in real-time, can help policymakers design more gender-inclusive urban transit systems.

Our Approach

We analyzed the mobility patterns of 418,624 residents of Santiago, using around 2.15 billion CDRs collected between May 1 and July 30, 2016. The sample contains sex and socioeconomic information of individuals, and is strongly representative of the population, sex ratio, and income distribution (Figure 1A) of the Santiago Urban Metropolitan Area Region at the neighborhood (comuna) level. Women made up 51% of the user sample. For each individual, we computed the number of distinct locations visited, the number of distinct locations that make up 80% of a user's calls (Figure 1B), how equally trips were distributed across locations, and the radius of movement. The study area was divided into 726 cells, approximately one square kilometer in size and regularly spaced based on the positions of cell towers. We also labeled public transit stops in the city area.

Figure 1. (A) Socioeconomic status in Santiago; lighter colors indicate wealthier comunas. (B) Measure indicating the number of distinct locations that make up 80% of calls, by comuna; lighter colors indicate a greater number of distinct locations. Note the relationship between wealthier areas and a greater number of distinct locations.



Results

Over the three month study period, women traveled to, on average, nine fewer locations than men. Women's trips were more localized, with their radius of movement about 1.1 km shorter than men. Women also distribute their trips among a few highly preferred locations, while men distribute their trips among many locations with almost equal probability. These differences are not simply due to gender differences in mobile phone use; when we examine comparable subsamples (for example, of the most active phone users), the gender gaps persist.

We investigated the causes of these patterns, and found that gender inequalities grow wider as socioeconomic status worsens. For example, poorer women tend to be more localized, relative to their male counterparts, than better-off women. However, gender gaps persist even

among the wealthiest classes; income alone does not lead to mobility equality. We also found that mobility inequality is significantly correlated to the gender gap in employment.

Child care duties are also important; a higher fertility rate and larger households (suggesting more dependents) are associated with a greater mobility gap. Education, however, is not a significant predictor of mobility inequality. Public transport options increase the mobility of both women and men, though they do not close the gap entirely—having a stop nearby is associated with 1.39 more locations visited for men, but only 0.76 more for women. The inequality is even more pronounced when considering socioeconomic status; having a stop nearby tends to close the gender gap for the wealthier classes, but the same is not true for poorer individuals (Figure 2).

Implications

Women's and men's travel behavior in the metropolitan area of Santiago differ, and such differences can be exposed by the analysis of anonymized, sex-disaggregated mobile phone data. These data are sensitive enough to capture the different mobility patterns of men and women, thus providing urban planners the information needed to design gender-responsive solutions to overcome existing cultural, infrastructure, resource, and safety constraints. Further, our analysis shows that income, employment, and gender mobility equality are all positively correlated, confirming the value of mobile phone-derived mobility metrics as a proxy for human development.

The use of mobile phone data to study gender mobility comes with limitations. First, the user sample might not be representative of the population under study: the sample size and composition will depend on the operator market share. Second, mobility patterns are inferred through user calling activity, which is known to be affected by age and gender, among other individual features. In our work, we controlled for these biases, but we could not address some potential confounding effects, related to users' age for instance, a variable not available to us. Overall, our work—the result of a data collaborative including academic research centers, international organizations, and private companies—shows the potential of digital data in closing critical gaps in our understanding of the lives of women and girls.

Figure 2. Estimation plots of the difference in the number of locations visited by women (A) and men (B). Each dot is a geographical cell ranked by socioeconomic quartile. Q1 represents the richest quartile and Q4 the poorest.