9^{th} International Conference on Computational Social Science IC^2S^2
July 17-20, 2023, Copenhagen, Denmark

Socioeconomic disparities in mobility behaviour during the COVID-19 pandemic in developing countries

Keywords: Mobility, Inequalities, GPS Data, COVID-19, Policies

Extended Abstract

After almost three years since the beginning of the COVID-19 pandemic, our understanding of the mechanisms behind the virus diffusion, the best strategies to contain the spread and, at the same time, to limit the impact on other relevant sectors in our society (e.g. economy and education) has greatly improved [1, 2]. However, the inherent dependence of these strategies on different aspects of our lifestyle makes it hard to extend the reliability of predictions and discoveries across countries. Moreover, the need for timely, high-quality and fine-grained information at the local level brought most of the researchers to focus on China, Western countries, and high-income countries [3]. This produced a huge gap in the literature, which was only partially filled by single-country analyses performed on middle-income countries. In this work, we use GPS data from smartphone usage to investigate the impact of the pandemic and the enacted restrictions on human mobility in 6 middle and low-income countries: Brazil, Colombia, Indonesia, Mexico, Philippines, and South Africa [4]. In this perspective, our contribution is two-fold. First, from raw GPS data, leveraging the home and work location classification algorithms, we provide evidence for a disproportionate impact of the pandemic and the enacted restriction policies on different socioeconomic groups. Socioeconomic groups are constructed using demographic information from the finest-grained administrative units for each country. In particular, we segmented the groups by taking the wealthiest 20%, the middle wealth 40%, and the low wealth 40% of the population and associating each individual respectively with a High - Middle - Low wealth label based on the demographic features of the area in which her home location falls. The different changes in mobility are found both in the patterns of visit at home locations, namely the share of individuals not leaving their home location (Figure 1) and the migration flow from urban to rural areas, as well as in the commuting patterns from home to workplaces. We track individual movements for the entirety of 2020 and until the end of April 2021. We compute the change with respect to a pre-pandemic baseline period (Feb/01/2020-Mar/01/2020). Figure 1 shows the results for the share of users not leaving their homes. The hypothesis of a differentiated impact of the pandemic on individuals from different socioeconomic groups is confirmed in each one of the studied countries. Moreover, albeit the mobility behaviour of all groups shows a gradual tendency to recover pre-pandemic levels, the gap between high-wealth and low-wealth groups is not recovered and persists over the entire period of study. Interestingly, we also find that during the pandemic there was a reversed migration phenomenon, as the high-wealth users were moving more to rural areas than their low-wealth counterparts with respect to their behaviour pre-pandemic. Coalescing the scattered literature on the differentiated impact of the pandemic on socioeconomic groups with a multi-country analysis, we provide a first evidence for a systemic tendency of our society: individuals from lower-wealth socioeconomic groups are easily exposed to a disproportionate distribution of the burden. This result is independent of the specific wealth of individuals and applies as a selective tendency based on individuals' relative wealth within each of the studied countries.

Second, by focusing only on low-wealth individuals, we also find that the share of users commuting to workplaces in high-wealth neighbourhoods is reduced more if compared with low-wealth individuals working in low-wealth neighbourhoods (see Fig.2. Using a multivariate linear model we quantify the association between different policy indicators and individuals' commuting patterns. We compared regression results between different wealth groups finding that public transport closures were associated with significantly different behavioural responses. Low-wealth individuals working in high-wealth neighbourhoods show a stronger association of commuting patterns with public transport policy closures/reopenings than low-wealth individuals working in low-wealth neighbourhoods. Among the different policies we included in our analysis (closings of schools and universities, closings of workplaces, closings of public transport, orders to 'shelter-in-place' and otherwise confine to the home, and restrictions on internal movement between cities/regions, but also debt-relief policies, and income-support policies [5]), only closings of public transport were found to robustly show significantly different levels of association (see Fig. 3a). This finding can be explained by showing (see Fig.3b) the differences between the home-work distances between low-wealth individuals working in neighbourhoods with different wealth levels: with, on average, smaller distances between home and work location, low-income individuals working in low-wealth neighbourhoods could more easily compensate than those people working in high-wealth neighbourhoods.

These results provide first, country-agnostic evidence for a potentially higher fragility of low-wealth individuals working in high-wealth neighbourhoods to the pandemic shock.

References

[1] Pullano, G., Valdano, E., Scarpa, N., Rubrichi, S., & Colizza, V., The Lancet Digital Health, 2.12 (2020).

[2] Tian, H., et al. Science, 368(6491), 638-642 (2020).

[3] Jay, J., Bor, J., Nsoesie, E. O., Lipson, S. K., Jones, D. K., Galea, S., & Raifman, J., Nature human behaviour, 4(12), 1294-1302 (2020).

[4] Oliver, N., et al., P. Science advances, 6(23), eabc0764 (2020).

[5] Hale, T., Angrist, N., Goldszmidt, R. et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav 5, 529–538 (2021).

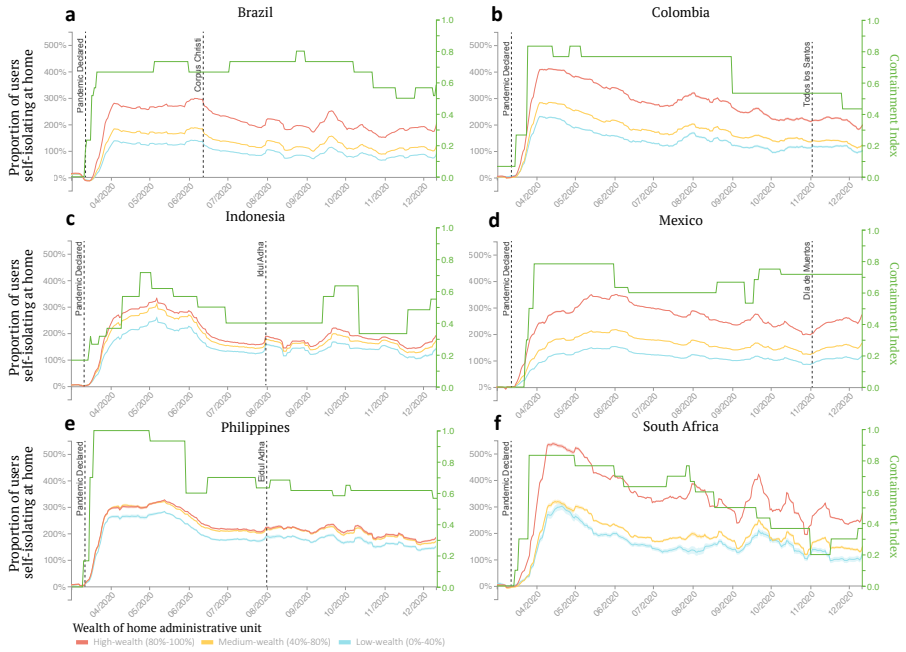

Figure 1: *Change in the proportion of users self-isolating at home by socioeconomic group.* Each panel shows the relative change in the proportion of active users staying at home over the course of a day relative to the pre-pandemic period for the six countries studied. We also report the stringency of containment policies in each country over time (green line). Across all countries, users living in high-wealth places were more likely to isolate when the pandemic hit than those living in low-wealth places.

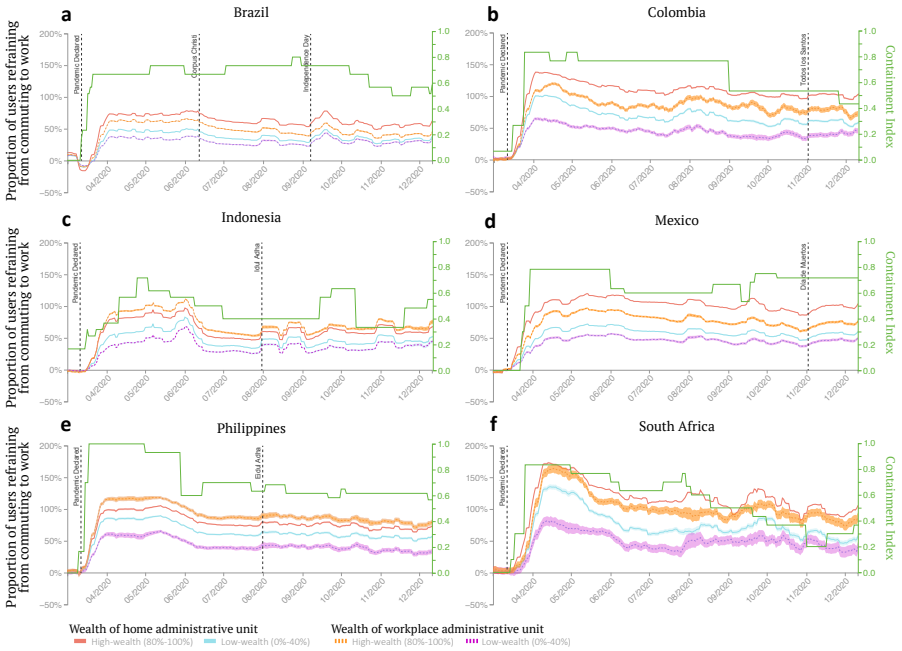

Figure 2: *Change in the proportion of users not commuting to work, segmented by the wealth of their work location.* We look at changes in commuting patterns, disaggregating by the wealth label group of home location (low and high left legend) and workplace wealth (low and high right legend). Commuters from low-wealth individuals working in high-wealth areas (dashed orange line) faced a larger increment than commuters from low-wealth to low-wealth areas (dashed blue line).

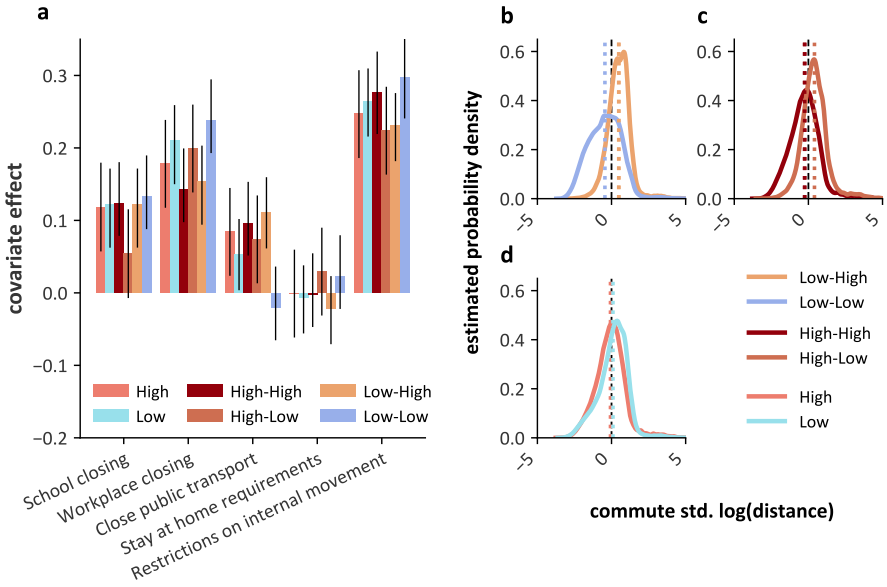

Figure 3: *The disparate impact of public transport closures on wealth group behavioural response.* a) Modeling per-group behavioural response conditioning on workplace wealth. We show the average effect of every policy covariate on different wealth groups. b-d) Probability distributions of the distances between home and workplace for the six different groups. Low-Low stands for low-wealth individuals. Similarly, low-high stands for low-wealth individuals working in high-wealth neighbourhoods.