ANALYZING TRANSPORT POLICIES IN DEVELOPING COUNTRIES WITH ABM

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SUPPLEMENTARY MATERIAL

This document contains additional information to supplement the paper presented at the ANNSIM 2024 conference. The first section provides details on the social network, and the next section includes a diagram with the decision-making process. Section C contains details about the validation of the model using historical data and the comparison with the diffusion curve according to the model of Bass [1, 2] . Section D presents the main parameters used to initialize the simulation with the case study information. Sections E and F show results of road accidents and CO2 emissions by transport mode. The following section indicates an external link that contains results from the survey applied to transport users in our case study city and serves as a source to parameterize some of the variables in the model. The final section redirects to a working paper that presents the analysis of the survey results.

A SOCIAL NETWORK

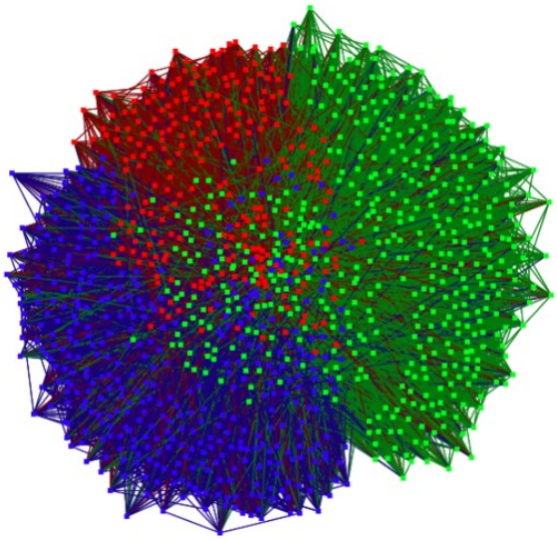

Figure 1: Simulated social network with 1,250 synthetic transport users. Network matrix generated in NetLogo 6.4. Graph processed in ORA software. Blue agents belong to low-class status. Red corresponds to high-class people. Green represents agents in middle-class.

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B DECISION-MAKING MODULE

Agents make decisions following the CONSUMAT approach. Depending on the comparison of the satisfaction and uncertainty levels with the thresholds, agents follow one of these strategies: repeat, imitate, deliberate, or inquiry.

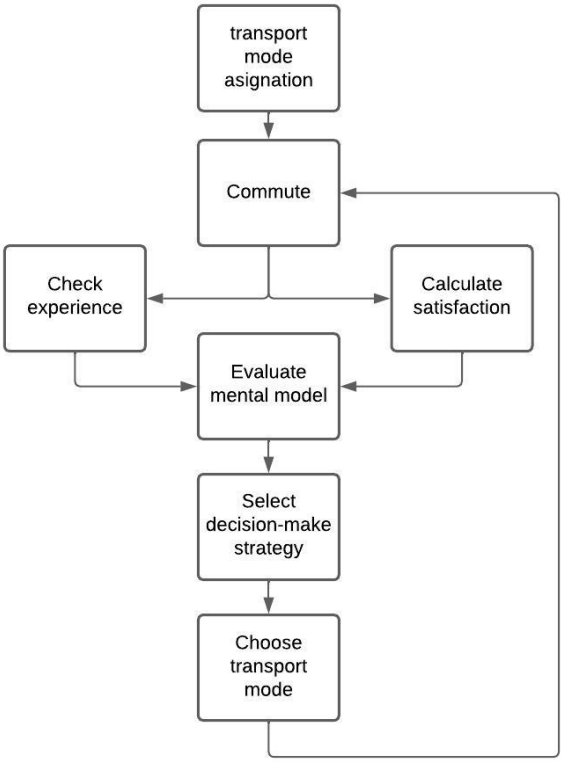

Figure 2: Flowchart of the decision-making process for agents.

C COMPARISON OF SIMULATION RESULTS VERSUS HISTORICAL DATA

Figure 3 presents the results for the average transport users of 100 runs with the simulation model. The simulation was initialized using the real distribution of users in 2018 and the sociodemographic attributes of the agents were parameterized using information from Cali city. We compared the simulated results with the real percentage of users before the pandemic. It can be observed that the simulation represents the general patterns of the real system, having an increase for private options and a decrease of public transit users. The average percentage in the third period matches those percentages in historical data in the year 2020 (period 2 in the plots) [3].

To have a point of reference for the simulation forecast, we contrast plots of the S-curve calculated with the Bass model for motorcycles in Cali city (See Figure 4). We present the real data between 2007 and 2023 and the subsequent years present the forecast with both the Bass diffusion model and the simulation.

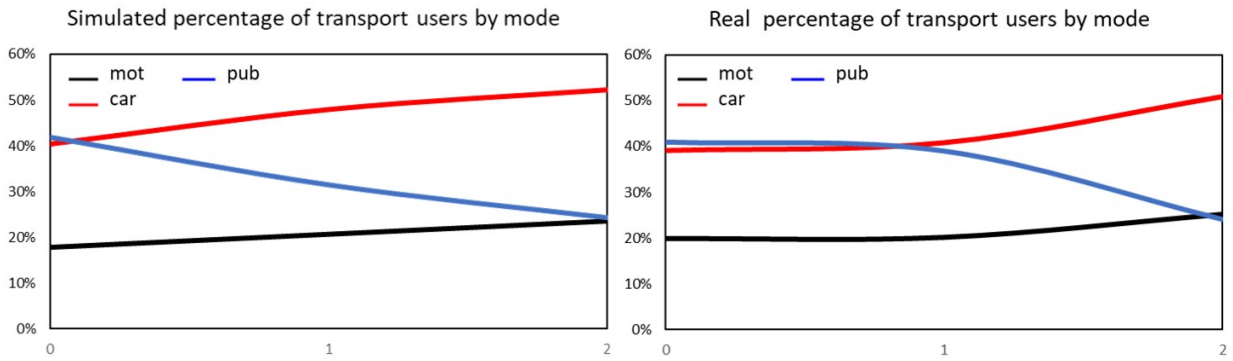

Figure 3: Average percentage of transport users by mode. Simulated versus real data plots.

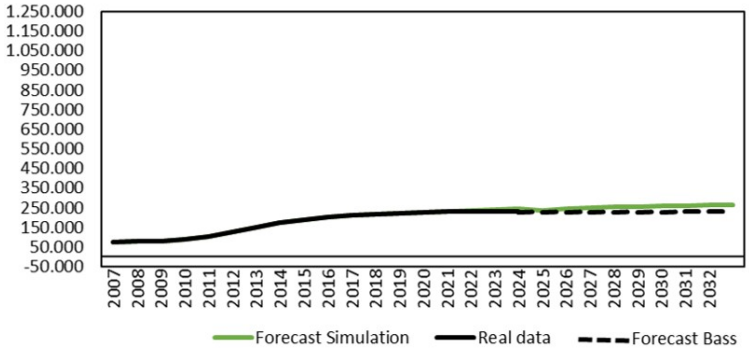

Figure 4: Comparison of diffusion curve for motorcycles: Real data vs forecast

D EXPERIMENT PARAMETERS

Table 2 presents some of the most important parameters to initialize the simulation, differentiated by attributes of the transport mode (Table 1) and the parameters that allow the customization of the model for a specific city (Table 2).

Table 1: Experiment parameters associated with transport modes.

Parameter	Value
% emissions motorcycle	126g/km CO2
% emissions car	204g/km CO2
efficiency motorcycle	120km/gal
efficiency car	50km/gal

E ACCIDENT RATE BY MODE

Figure 5 shows the accident rate for the three transport modes.

F CO2 EMISSIONS BY MODE

Figure 6 shows the CO2 emissions by mode throughout the simulation.

Table 2: Parameters associated with the city.

Parameter	Value	Parameter	Value
% income-level 1	34%	average speed motorcycle -peak hour	20km/h
% income-level 2	42%	average speed car -peak hour	18km/h
% income-level 3	24%	average speed public transit -peak hour	16km/h
% motorcycle users	20%		
% car users	43%		
% public transit users	37%		
accident rate probability for motorcycle	0.2		

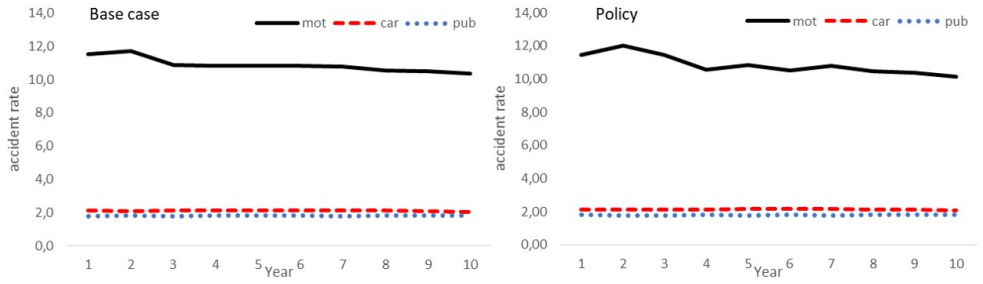

Figure 5: Accident rates by mode.

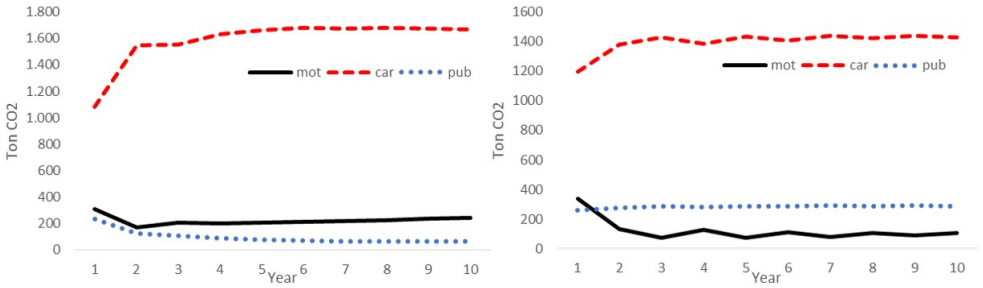

Figure 6: CO2 emissions by mode.

G SURVEY RESULTS

A summary with results of a survey conducted in the city of the case study that was used to determine and calibrate the parameters of the model is available in this link: https://public.tableau.com/app/profile/jes.s.d.az.blanco/viz/Encuestas_16844425109290/Surveysummary

H CHARACTERIZATION OF TRANSPORT USERS IN CALI COLOMBIA

In this paper Salazar-Serna et. al [4] results from the survey summarize the characteristics of transport users in Cali, Colombia, the case study city.

REFERENCES

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[4] K. Salazar-Serna, J. D. Diaz, and I. C. Garcia, "Characterizing the mode-choice behavior," *arXiv preprint arXiv:2402.07958*, 2024.

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