

Can Agent-Based Computational Economics Mimic Neoclassical Demand Curve?

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Introduction

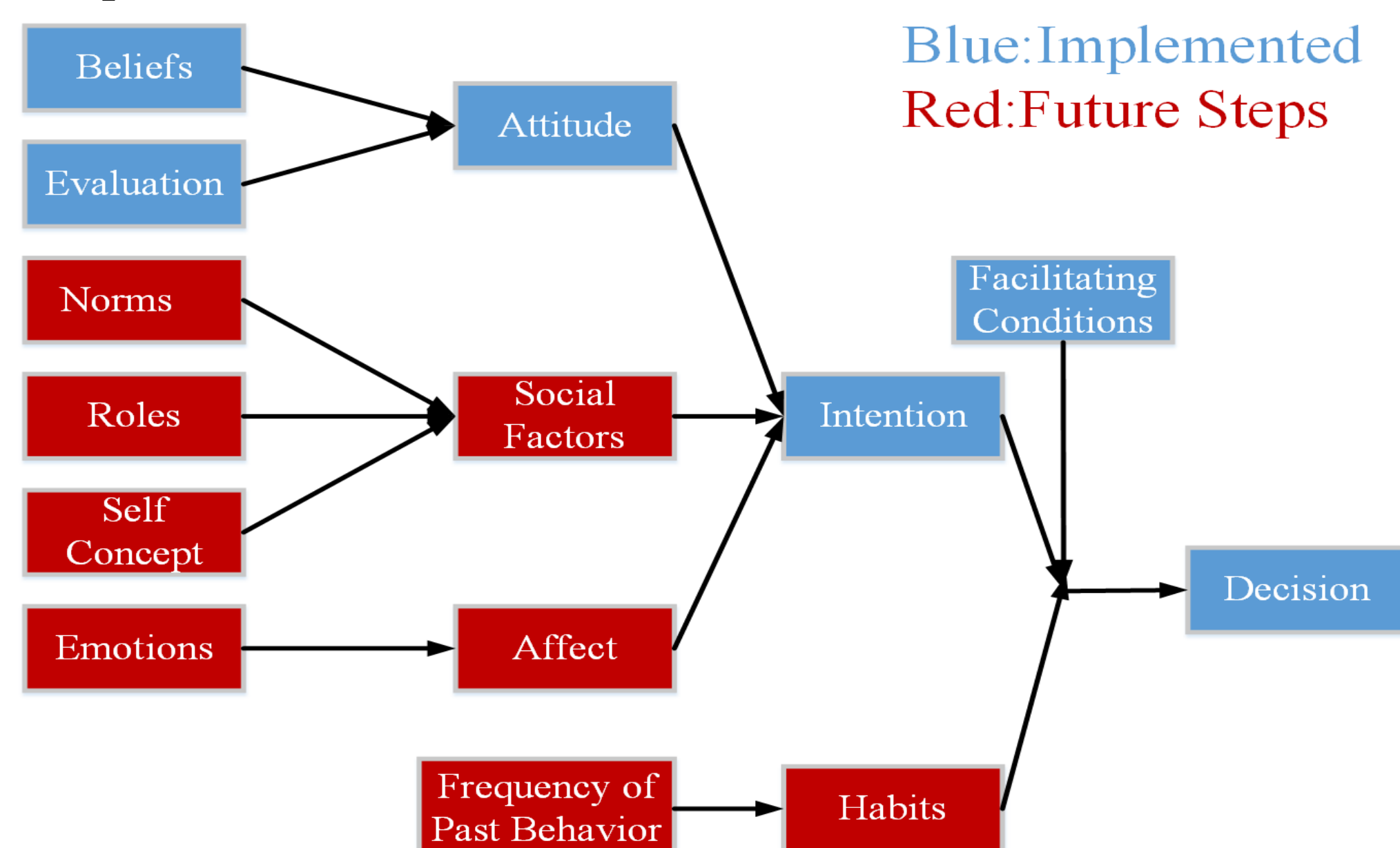
- **BedDeM** (Behavior-driven Demand Model) is a fully fledged agent-based computational economics [ACE] model that focuses on modeling heterogeneous mobility demands of the individuals. In this research, agents represent **real Swiss population**.
- The model is envisaged to embed a rich set of **psychologically** appropriate biases and features. However, as for this piece of research, it is degenerated to mimic neoclassical linear demand curve by way of setting agents hyper-rational and believes equal for all.
- It acquires micro-level data for model building. It generates **macro-social** output e.g. total mobility demand.
- Changes in private car demand in BedDeM with respect to varied price units are benchmarked with neoclassical linear demand curve, which, in turn, is inferred from real world.

Hypothesis / Objectives

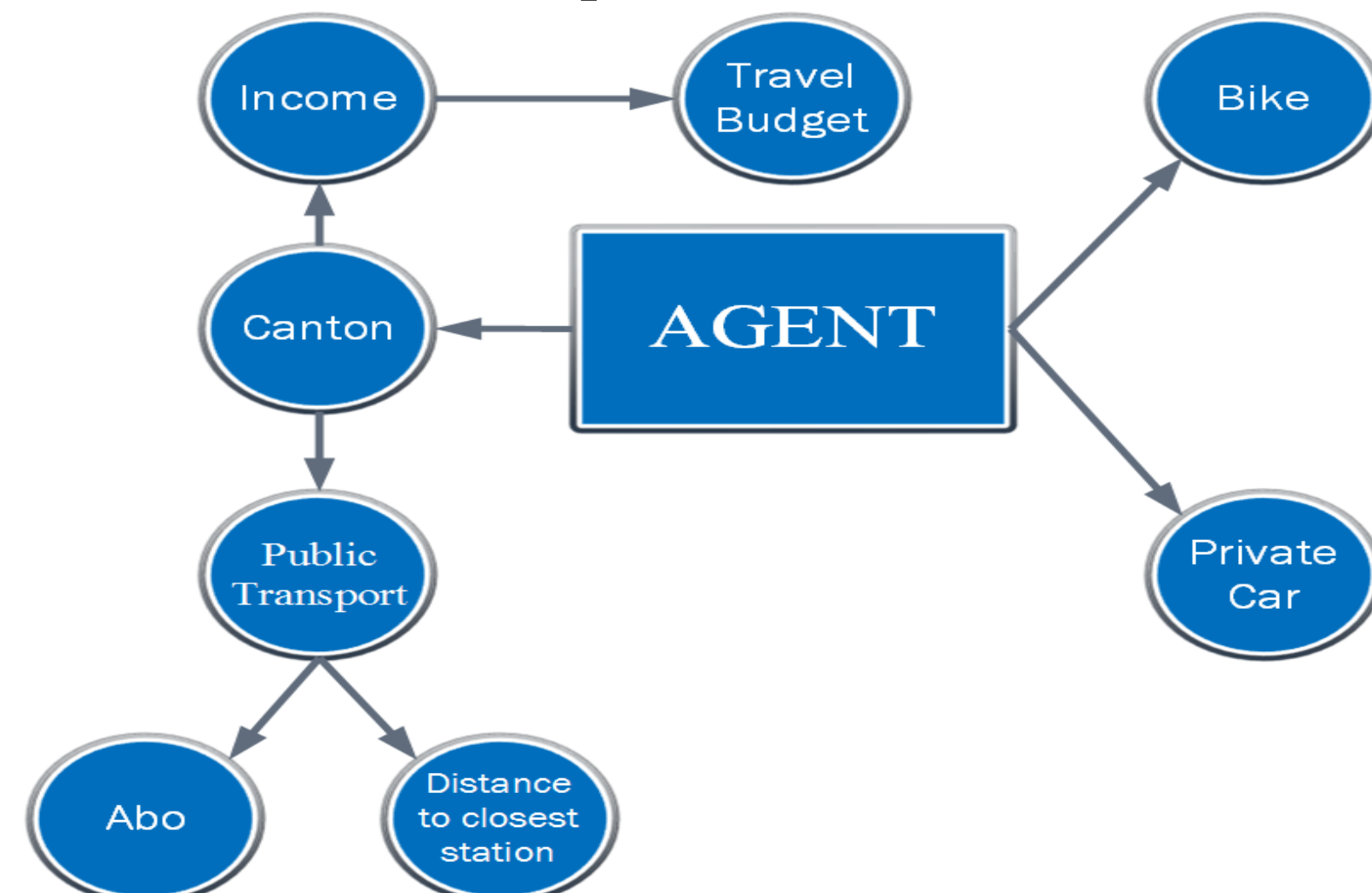
- Hypothesis: -We hypothesize that BedDeM can mimic neoclassical demand curve when the agents are set hyper-rational.
- Objectives: -How do the individuals perform modal choice with two parameters, cost and duration.
-Determine whether BedDeM is capable of mimicking neoclassical linear demand curve.

Experiment-1

- Agents in BedDeM are constructed on a psychosocial architecture that comes from Triandis' Theory of Interpersonal Behavior.



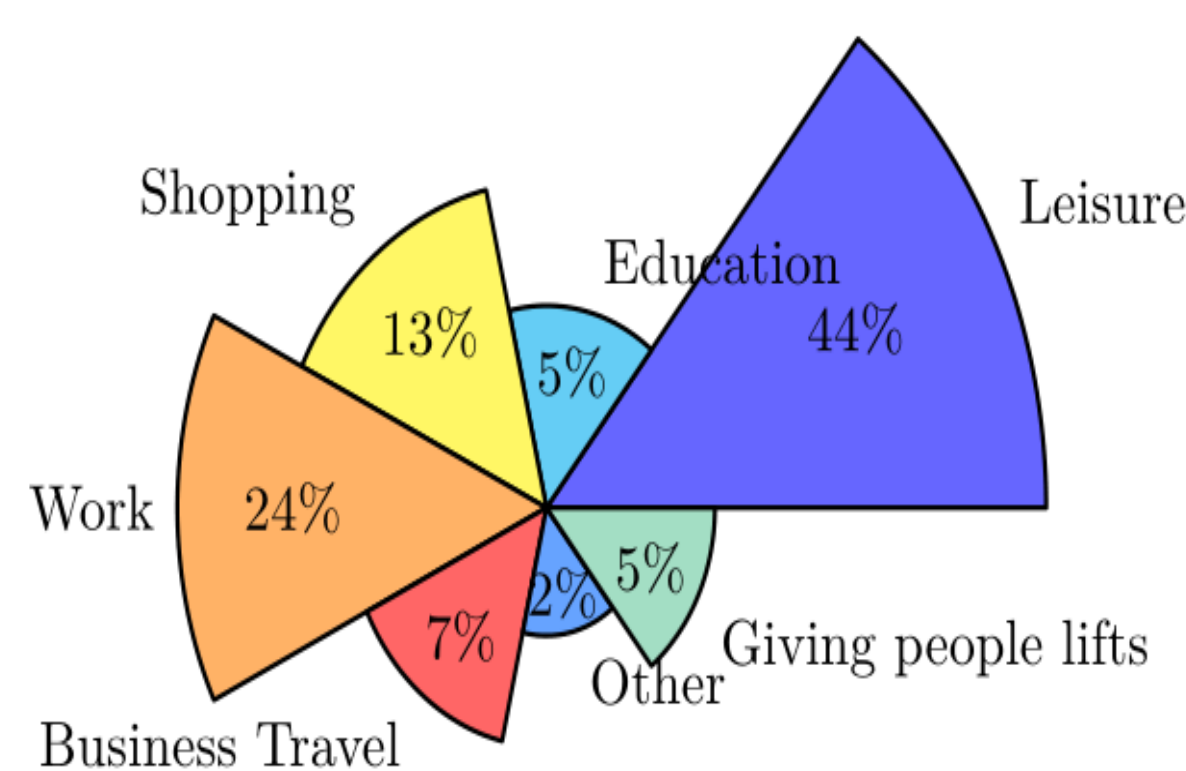
- Agents are differentiated with respect to the agent attributes. These attributes are used for reasoning when modal choice takes place.



Experiment-2

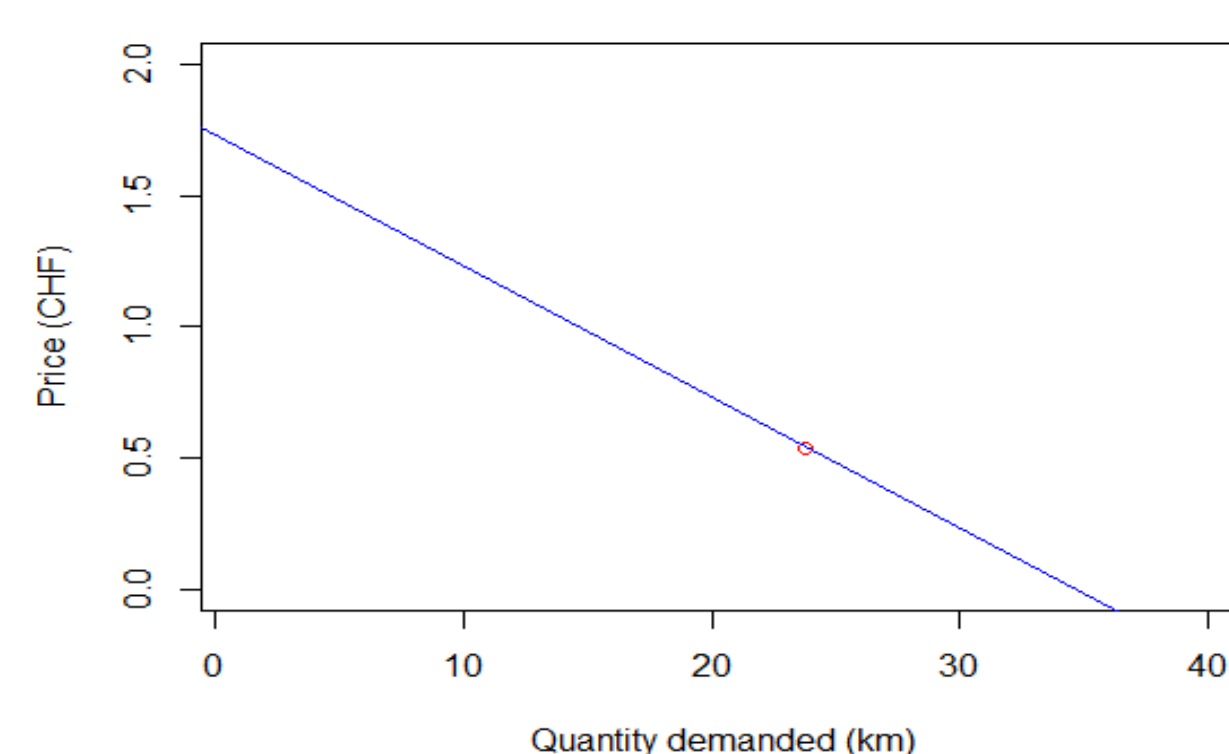
- Trips in the schedule are distinguished according to purposes which have different weights for two parameters, price and duration. Agents pick the option that has the minimum disutility according to the following reasoning equation (P =price; D =duration; WP =weight of price).

$$OF = P * WP + D * (1 - WP)$$



- A point that contains current price unit (p) per km by private car and quantity demanded (q) is used with a slope (m) that is gained through point elasticity (e) of demand, to construct a linear curve.

- $p = 0,54$; $q = 23,8$; $e = -0,45$
- $e = (1/m) * (p/q)$
- $m = -0,05$
- $y = -0,05x + 1,73$

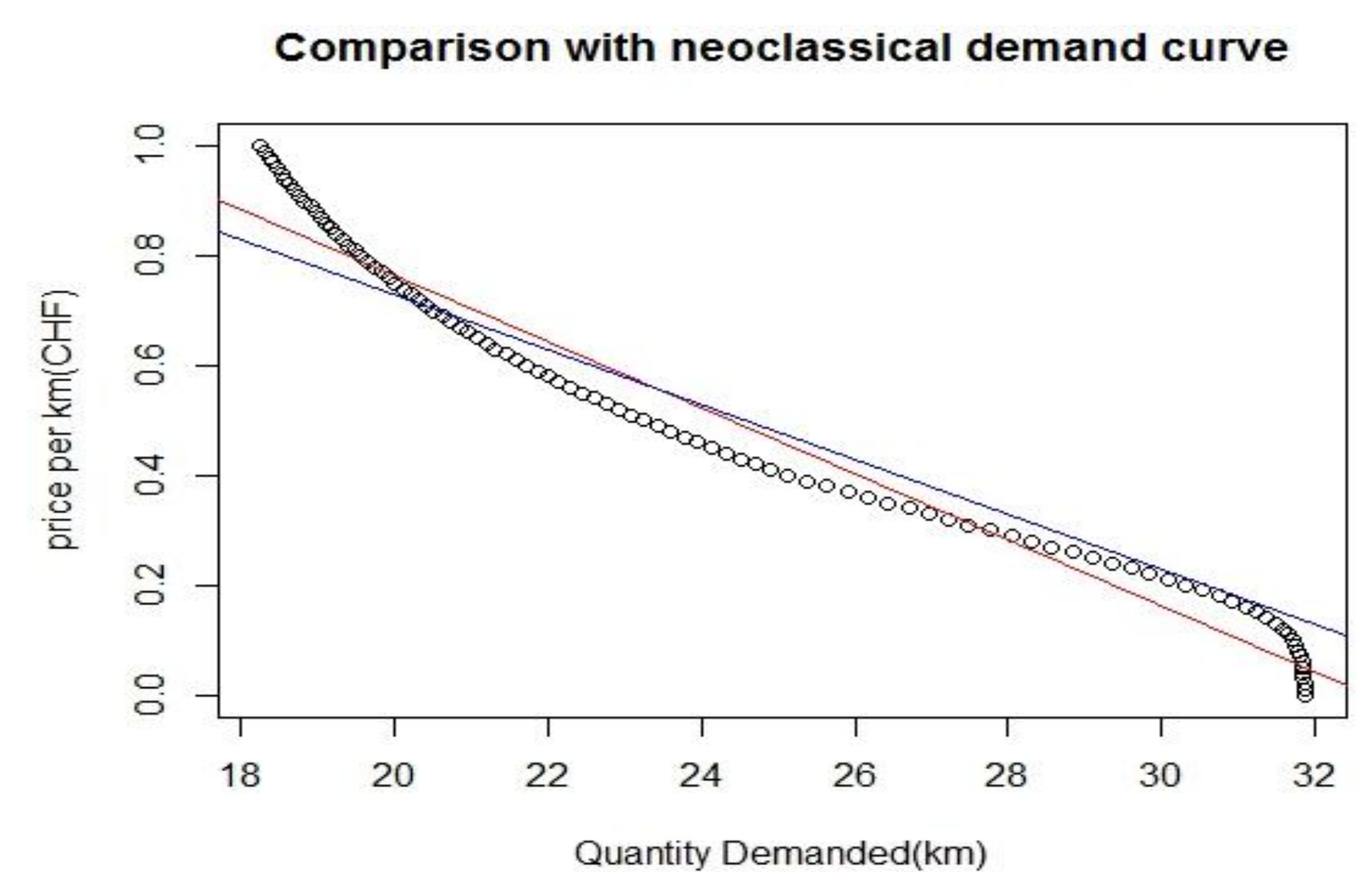


Acknowledgements

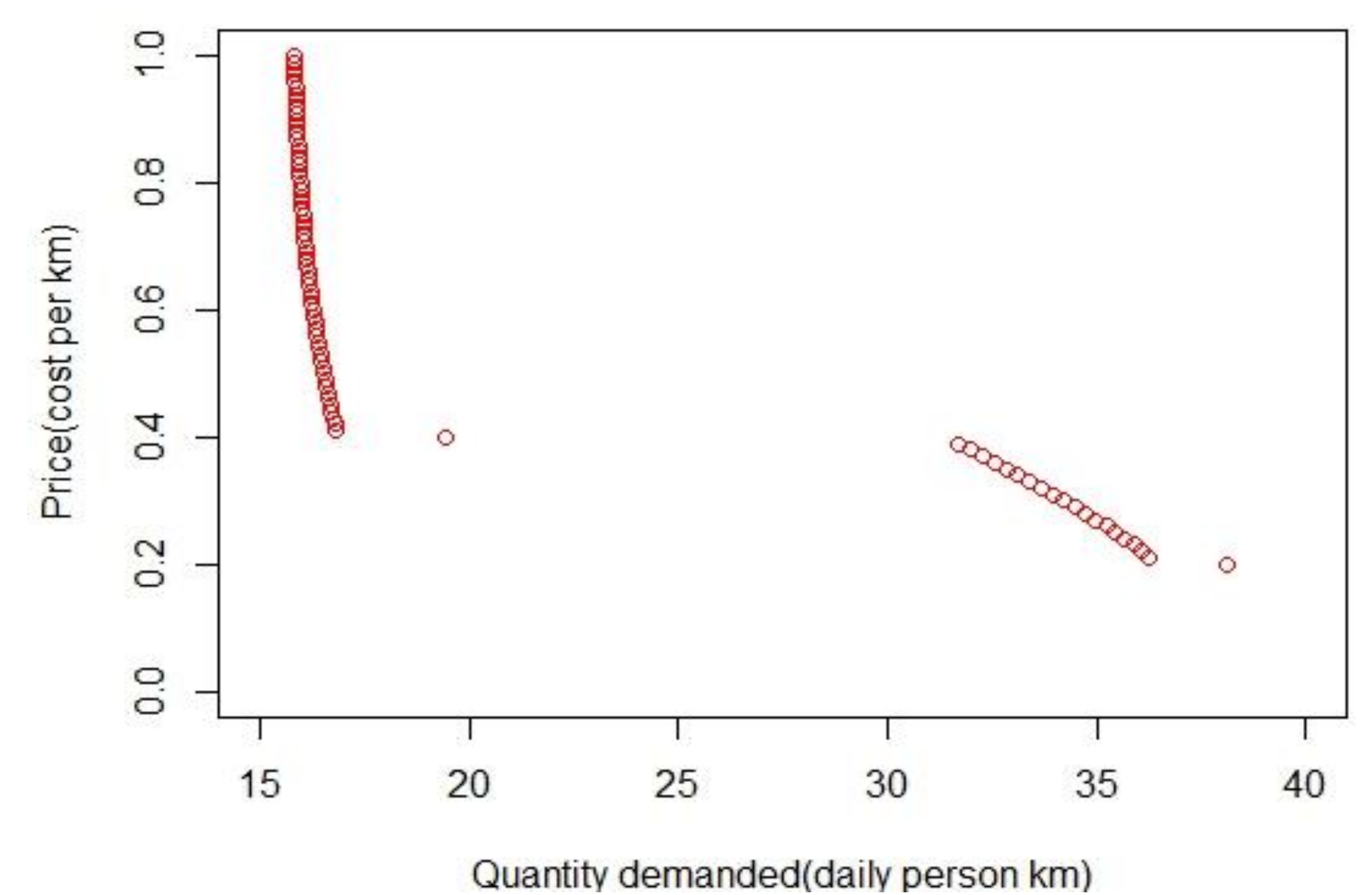
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Results-1

- The observed values that BedDeM creates are benchmarked with the expected values that are gained through linear demand curve ($WP=0$; blue=neoclassical demand curve; red=linear regression line of the dots that BedDeM creates).



- Shape of demand curve is disjointed when the weights of purposes are set to 1 and to 0 for price and duration respectively ($WP=1$).



Results-2

- Correlation coefficient (ρ) = $\sim -0,98$ (correlation between price and quantity of private cars in BedDeM).
- Coefficient of determination (R-squared) = $\sim 96\%$. It indicates that 96% of variation in expected values can be explained by observed values.
- NRMSE: 6,024861 - Observed values are different by 6,024861% from the expected values.

Future directions

- Testing psycho-socio-economic approaches in mobility domain by BedDeM.
- Determine BedDeM's capability to depict diffusion of innovations in mobility.
- Investigate influence of imitation on emergent individual behavior in BedDeM.