Comments on: “Optimal Public Transportation Networks: Evidence from the World’s Largest Bus Rapid Transit System in Jakarta”

Matthew A. Turner

Brown University

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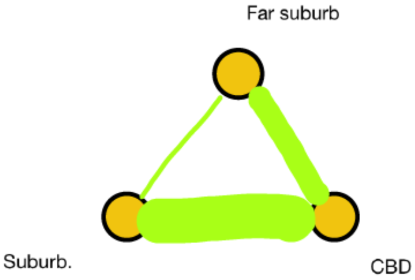
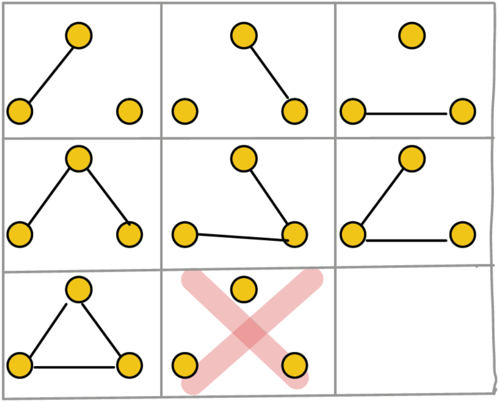
- This paper tries to find the optimal bus network for Jakarta. This is ambitious and complicated.
- Consider the same problem in the context of a toy city with three locations.



- Exogenous travel demand is given by three shares, $s_{\text{CBD,Near}} > s_{\text{CBD,Far}} \gg s_{\text{Near,Far}}$ (green lines). The paper estimates this from cell phone location data.

- Suppose there are only buses, no brt, and no transfers.



- There are 8 possible networks, $N_1, \ldots, N_8$. Drop the last one.

- The planner must allocate given buses across networks/edges:

$$max\{W(N_1), ..., W(N_7)\}$$

This is not computable. Instead,

$$max \sum_{k=1}^{7} p_k W(N_k)$$

and be clever about choosing p_k. This is a calculus problem now.

- $W(N_k)$ is Benthamite welfare over networks,

$$W(N_k) = \sum_{i \in s_{\text{CBD,Near}}} V_{i,(\text{CBD,Near})} + \sum_{i \in s_{\text{CBD,Far}}} V_{i,(\text{CBD,Far})} + \sum_{i \in s_{\text{Near,Far}}} V_{i,(\text{Near,Far})}$$

This is totally standard, but worry about fixing shares.

- $V_{i,(\mathrm{o,d})}$ is utility of a person with travel demand (o,d).

$$V_{i,(o,d)} \equiv max\{v^{\mathrm{bus}}_{i,(\mathrm{o,d})} + \varepsilon_{i,(\mathrm{o,d})}, v^{\mathrm{drive}}_{i,(\mathrm{o,d})} + \varepsilon_{i,(\mathrm{o,d})}\}$$

  where ε is Gumbel (so choice of drive/bus is conditional logit).
- v^{drive} is drive time from cell phones maps in pre-COVID 2020.
- v^{bus} total travel time by bus (more-or-less). Figuring out how to weight travel vs. wait time for buses is the subject of the main empirical exercise.

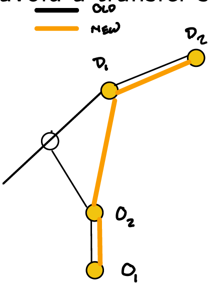
Question 1

The paper concludes that the optimal bus network should (more-or-less) serve all edges at least a little bit.

- Why?
- Is this true for all cities? If so, we don't need to gather data.
- Conjecture: this result is essentially a theorem. (1) With logit bus/drive choice, the upper tail of people travelling between locations will have very high values for bus travel. (2) With no capacity constraints on buses, the opportunity cost of serving small edges is low.

Question 2

- Consider the experiment where a new direct line allows riders to avoid a transfer station.



	Pre		Post	
	N	$\ln N$	N	$\ln N$
$O_2 \leftrightarrow D_1$	100	4.6	80	4.4
$O_2 \leftrightarrow D_2$	10	2.3	20	3.0
$O_1 \leftrightarrow D_1$	10	2.3	20	3.0

- The differences in differences are $\Delta(O_2 - D_1) = -0.2,\ \Delta(O_2 - D_2) = 0.7,\ \Delta(O_1 - D_1) = 0.7,\ \implies E(\Delta(O - D)) = 0.4$
- Substitution from heavily used, short routes to lightly used long routes looks like an increase in ridership ... I think the research design cannot distinguish 'more rides' from 'longer rides'.