Optimal Lockdown in a Commuting Network

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Lockdowns in a network

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- Want to restrict edges with highest infection transmission, lowest economic impact
- Key challenge: shutting down an edge has repercussions across the network and across time

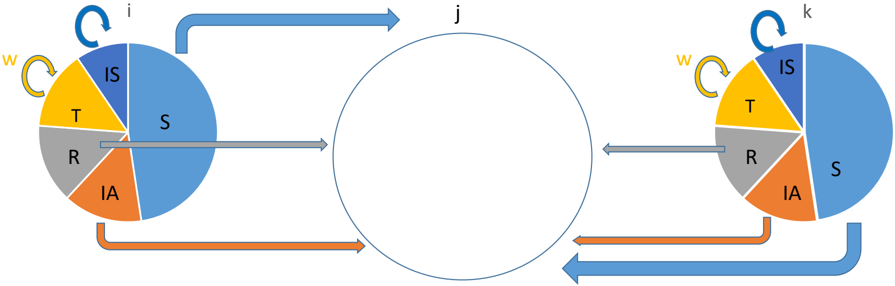
This paper

- Write down a commuting/shopping network of a city, add temporary pandemic (COVID)
- Solve for Pareto frontier of flows across city locations, and over time
- Calibrate to three cities and compare observed flows during COVID to frontier
- Main finding: observed flows are suboptimal, we can do better, save lives and $!

My discussion

1. Quick graphical summary
2. Praise and comments
3. Can we do even better?

The production/infection block



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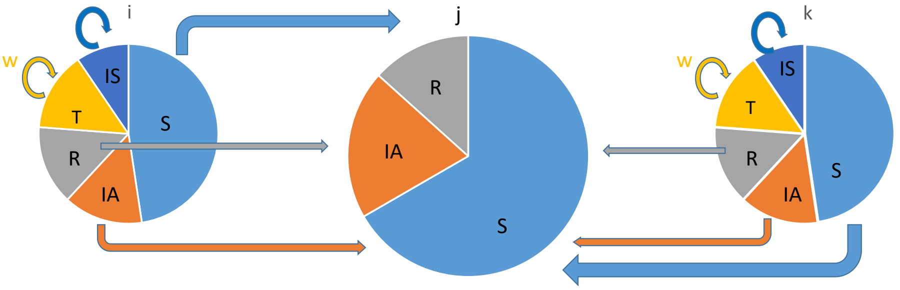
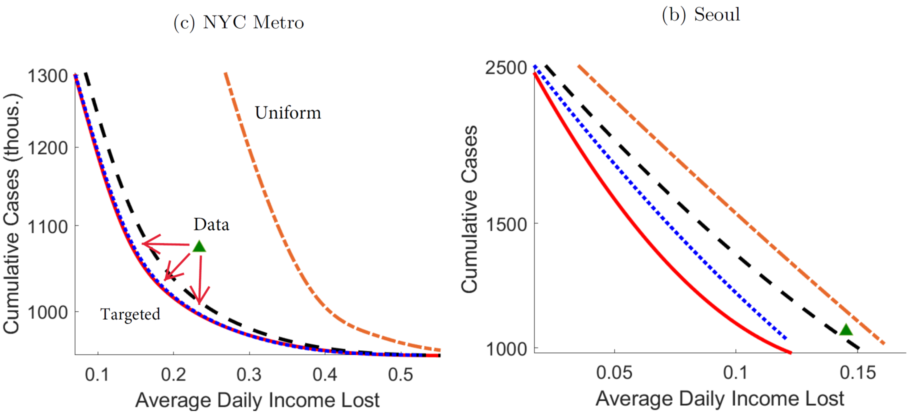


- Output: $[(S_i + IA_i + R_i)\chi_{ijt} + (S_k + IA_k + R_k)\chi_{kjt}]w_j + (T_i + T_k)w_j$
- Infections: $(S_i + S_k)(IA_i + IA_k)\chi_{ijt}\chi_{kjt}dens_j$
- Flows can't depend on status (no testing)
- In targeted lockdown χ_{ijt} can depend on characteristic of the locations ($w_j, dens_j, IS_k, ..$)

Key results



(c) NYC Metro
Uniform
Data
Targeted
Cumulative Cases (thous.)
1300
1200
1100
1000
0.1
0.2
0.3
0.4
0.5
Average Daily Income Lost
(b) Seoul
Cumulative Cases
2500
1500
1000
0.05
0.1
0.15
Average Daily Income Lost

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- Hard problem to solve as χ_{ijt} impacts output today, but has dynamic impact on future infections
- Love the planner approach and comparison with data. Is the current allocation is efficient? if not, what is the direction of the inefficiency, need more or less lockdowns?
    - Crucial in current policy debate across US states
    - No need to directly tackle behavioral response!

Implementation of optimal lockdowns, 1

- Model: planner can directly control flows of people from location i to j by '*lockdown measures, providing incentives, broadcasting information*'
- Practice: assessing the impact of these policies on flows require understanding of behavioral responses

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- Practice: assessing the impact of these policies on flows require understanding of behavioral responses
- Example: if authority cuts subway rides but people packs existing rides. Overcrowded PT, no reduction in flows and higher infection!

Implementation of optimal lockdowns, 2

- Model: planner can directly control flows of people and goods from location i to j
- Practice: people and goods can move from i to j in many ways (through $k, m, ..$), so controlling flows from i to j might be hard

Implementation of optimal lockdowns, 2

- Model: planner can directly control flows of people and goods from location i to j
- Practice: people and goods can move from i to j in many ways (through $k, m, ..$), so controlling flows from i to j might be hard
- Example: if authority restricts moving from Brooklyn to Manhattan, people can go through Queens!

Estimation detail

- Model: fraction of tele-commuters δ is constant
  reduction in output $\simeq$ reduction in commuting flows
- Practice: large increase in tele-commuters (for economists 0 to 100%),
  reduction in output $<<$ reduction in commuting flows
- Easy fix: estimate time variation in δ directly from data

The importance of the shopping block? GE?

- Model: χ_{kjt} also affects (in a iceberg way) the cost of shopping from k to j. Local output $=$ local spending
- Practice: most shopping is either done locally (within k) or online (SOE). Large city level CA imbalances
- Suggestion: just solve the model relaxing GE (does not seem appropriate for cities) and without shopping block

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- Suggestion: just solve the model relaxing GE (does not seem appropriate for cities) and without shopping block
- My prior: similar results but sharper message!

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- Maybe instead of shut down Manhattan and leave Queens open, shut down all bars in Manhattan and Queens? or close theme parks in Fla? ski resorts in the alps?
- Targeting business types might be more efficient and easier to implement