Epidemiological and Economic Effects of Lockdown
by Alex Arnon, John Ricco and Kent Smetters

Discussion by: Alessandra Fogli
Minneapolis Fed

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How effective are NPIs?

- How effective are NPIs in saving lives?
- And what are their costs in terms of employment?
- Impressive use of micro data and integrated approach to separately identify the effect of NPIs from behavioral response
An integrated approach

- Explicit modeling of behavioral response
- Diff in diff approach to estimate direct effects of NPIs and fear on contacts
- Integrate estimates with EPI model to evaluate effects on deaths
Main Findings

- Local NPIs explain small fraction decline in contact rates
- NPI in US avoided 33000 deaths (30%) during first 3 months of COVID
- Business closures least effective of NPIs
The effects of NPI: international studies

- Flaxman et al. (Nature 2020) and Hsiang et al. (Nature 2020) study effects of NPIs in various countries using similar methodology.
- Both find very large effects:

<table>
<thead>
<tr>
<th>Cases Averted (Ratio to actual)</th>
<th>This paper deaths</th>
<th>Hsiang cases</th>
<th>Flaxman deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>0.3</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>US</td>
<td></td>
<td>16</td>
<td>23</td>
</tr>
</tbody>
</table>

- Why such a large difference? Very Important Question!
• Comments on estimation of $\phi^\kappa$: role of heterogeneity in local responses
• Comments on EPI model: role of heterogeneity in type of contacts
Comments on the Estimation of $\phi^\kappa$

- Why heterogeneity in local responses matters

$$\ln(\kappa_{it}) = \omega_t X_i + \phi_i P_{it} + \rho c_{it} + \nu_{it}$$

$$c_{it+1} = \gamma \ln(\kappa_{it}) + \delta c_{it} + \epsilon_{it}$$

- Impact of NPI $\phi_i$ is heterogeneous across locations
- NPIs introduced at random times after period 5
- True Model: $\omega_t = 2$ (No time varying precautionary motive),
  $\phi_i \sim U[-3, 0], \rho = -0.8, \delta = 0.95$
- If no heterogeneity in $\phi_i$, OLS estimates recover true parameters
Decomposition of decline in contacts

- If location \(i\) and \(j\) have same policies but different declines in contacts. Model tries to fit differences by increasing precautionary motive (which varies with location characteristics) and lowering estimates of \(\phi\).

- If effects of NPIs are heterogeneous and they are estimated with a homogeneous model, their effect substantially underestimated \((-1.5 > -0.9)\)
Why heterogeneity in local responses?

- Differences in compliance and enforcement
- Differences in initial number of contacts
A network model of contacts and NPIs

- Network:
  - set of $M$ nodes
  - set of edges connecting nodes ($M \times M$ symmetric matrix $G$ of 0/1)

- Each node/person has health status

- Evolution of health status depends on health and economic status of connections
Experiment

- Start network with 99.9% of nodes susceptible, 0.01% infected
- Location 1 (New York): 8 active contacts per node
- Location 2 (Minnesota): 4 active contacts per node
- Both locations adopt stay at home order which bring number of active contacts to 2
- Key: same policy implies different reduction in contacts!
Same policy, very different impacts!
Comments on the EPI model

- Why heterogeneity in type of contacts matters
- Paper assumes all contacts have the same effect on infections
- Network analysis suggest heterogeneity in how contacts impact infections (Azzimonti, Fogli, Perri and Ponder 2020)
  - Contacts with small group of close nodes have little impact on infections
  - Random contacts with far away nodes have very large impact
Differential impact of infections from cutting same number of contacts

- Even if some NPI have small effect on contacts (i.e. non essential business closures), they might have large impact on infections.
Conclusions

• Important paper that challenges consensus view on NPI
• Consensus view: NPI have large impact
• This paper: Impact much more limited
• +: allow for behavioral responses
• -: does not allow for heterogeneity