COVID Economics Alumni Webinar Series
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Social Distancing and Supply Disruptions in a Pandemic

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May 2020

Disclaimer

The views expressed in this paper/presentation are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or any other person associated with the Federal Reserve System.

The full text of the paper is available as Cambridge INET working paper as well as CEPR DP and Fed Board WP.

Key Question in Current Debate

Most advanced economies mandate public health restrictions to slow the spread of COVID-19.

Main arguments in favor of restrictions

- protect capacity-constrained **health care systems** and lives
  - The mortality rate rises if health care system is strained.
- buy time for medical research to understand better the virus, option value in view of medical breakthrough.

But they also entail **large economic costs**.

1. Can economic costs be avoided by not implementing/lifting a lockdown?
2. Which restrictions improve the economy/health trade-off?

Outline

- Integrated assessment model
- The economic costs of covid without a lockdown
- Improving the economy-health trade-off:
  structured measures that protect essential workers
- Waiting for a vaccine
- (Testing, see paper)

All quantitative exercises are conducted in reference to the US economy, and deterministic.

Literature

Integrated Assessment Model

Why now is time to focus on labor-related supply disruptions

- In the Covid-19 crisis, people are the vulnerable productive factor: they have to stop working when symptomatic, or may refuse to go to work for fear of getting infected or because other household members are sick.
- Impact of the crisis on demand and financial stability will be enormous–despite unprecedented monetary and fiscal expansions.
- But much of this demand impact depends on getting social distancing right today.

Integrated Assessment Model

Rethink health-economy trade off combining

1. Multi-group epidemiological model
    - contact rates, mortality vary by demographics
2. Multi-sector macroeconomic model
    - **core sector: labor intensive, low-substitutability output**
    - **occupational task (work from home)**

    with realistic features capturing vulnerabilities
    - **minimum scale production**
    - **capacity utilization, irreversible investment**
    - State-of-the-Art Fed Board/academic

to discuss social distancing measures structured by

- sector
- occupational task
- age

Economic Model
What is the Core Sector?

Sector	% of GDP	% of Employment
Agriculture ...	0.81	2.65
Utilities	1.58	0.52
Food and beverage ...	1.31	1.86
Petroleum and coal products	0.84	0.12
Food and beverage stores	0.76	2.2
Transportation and warehousing	3.2	5.27
Health care and social assistance	7.47	8.66
Federal government, general services	3.54	0.88
State government, general services	7.78	15.38
Total	27.29	37.56

Note: BEA tables on GDP by Industry, employment shares are based by matching the industries in the BEA table with hours worked data by industry in the Productivity Release of the BLS.

Economic Model
Core Workers More Exposed to Contacts/Contagion Risk

Fewer workers in the core sector can work from home:

- Core sector employs 25% of US population (38% of the labor force).
  Of this, **only 15% can work from Home.**
- Non core sector employs 40% of US population.
  Of this, **up to 40% can work from home.**

Hence core workers are more likely to be infected when working and commuting.

Health measures targeted differently:
Group 1: core workers; Group 2: non-core workers and Group 3: young and elderly, not in the labor force.

Epidemiological Model

Great uncertainty about the parameters governing the spread of COVID-19.

We assume that without social distancing:

- the effective daily contact rate $\beta = 0.2$ for all groups,
- the recovery rate, based on average infection duration of 20 days, $\gamma = 0.05$ for all groups,
- the share of asymptomatic $\iota = 0.4$ (value for working-age individuals in the Diamond Princess cruise ship study)
- to keep analysis clear: we disregard death rates. ('Removed' are only the recovered).

Our baseline is "grim": $\rightarrow \mathbf{R_0 = 4}$; but we play with all the estimates for R_0, ranging from about 1.5 up to 6.

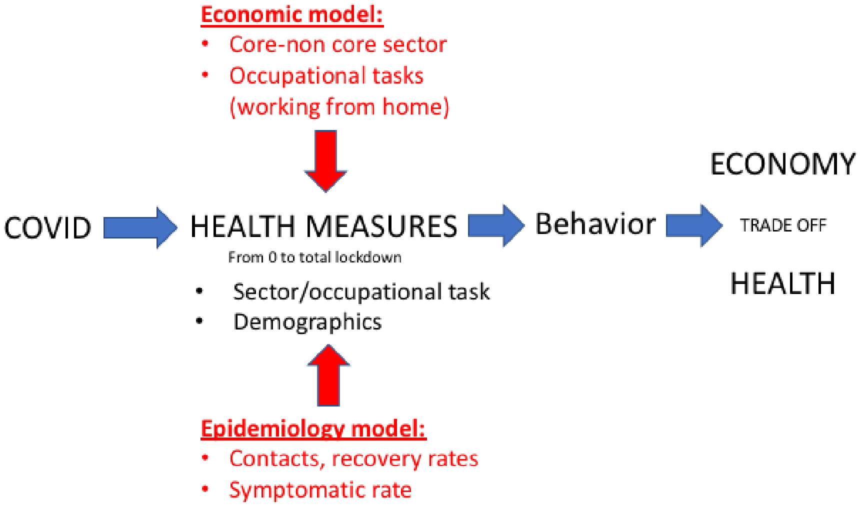
Contact Matrix within Community (U.S.)

Intensity of contact declines sharply by age. But young and middle age have intense contact with other groups: high infection externality

Age Group	0-19	20-49	50-64	65+
0-19	9.76	3.77	1.51	0.60
20-49	3.77	9.43	3.05	0.70
50-64	1.51	3.05	2.96	0.76
65+	0.60	0.70	0.76	1.25

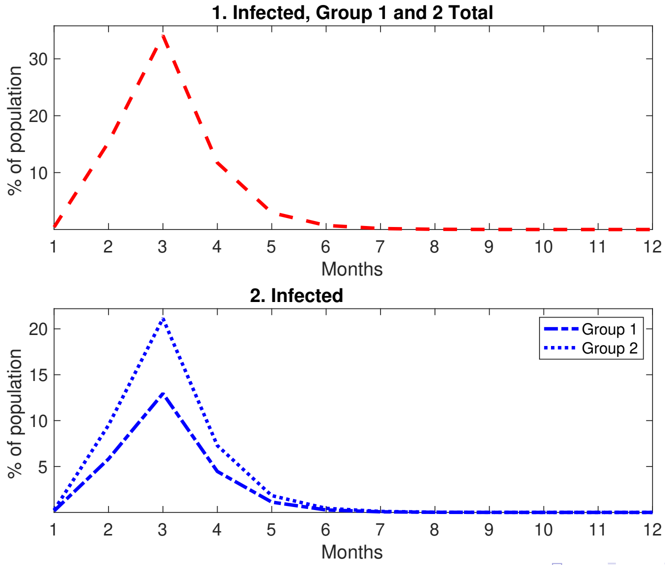
Source: K. Prem, A. R. Cook, M. Jit, Projecting social contact matrices in 152 countries using contact surveys and demographic data. PLoS Comput. Biol. 13, e1005697 (2017).

Integrated Assessment Model



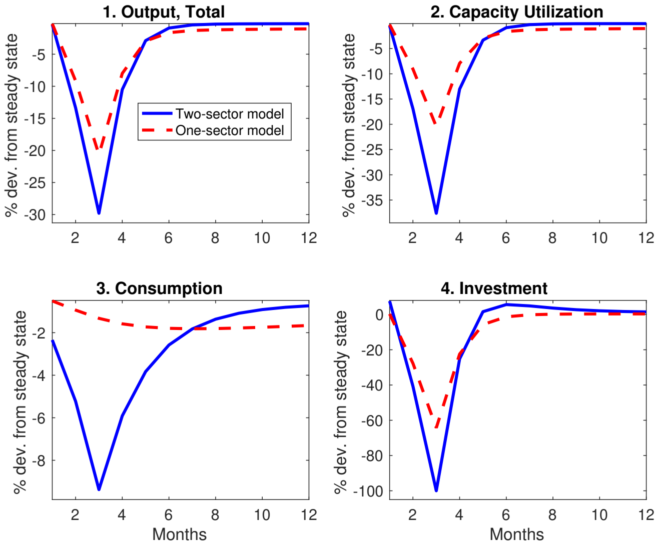
Start with a Counterfactual: No Lockdown

Higher infection among core workers (Group 1)



The Economic Effect of Unmitigated Covid Spread

The Risk of No Social Distancing



Takeaway: if No Lockdown...

Risks for the economy arise from labor supply shortages hitting especially the **"core sector"**:

- Industries that provide inputs essential to other producers and/or for the economy to run.
- In our scenario above, the "missing workers" due to illness in the core and non-core sectors lead to a cumulative loss of output of 8-to-10 percent over 6 months (1/3 more than in the one sector model).
- The fall in GDP would peak at -30% instead of -20%.

Economic risks thus reinforce the epidemiological argument in favor of preventing any hike in infection, not to overwhelm the health care system, and suffer hikes in mortality rates.

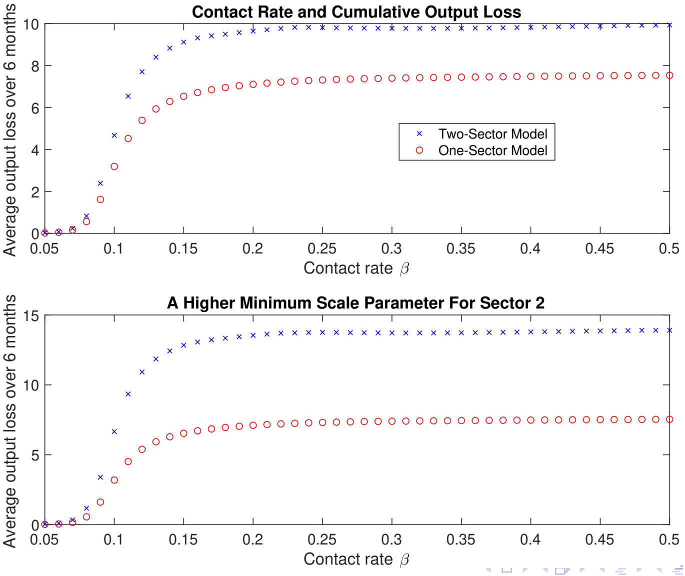
Takeaway: if No Lockdown...

Objections: people would adopt "spontaneous" social distancing smoothing out the infection peak

- Yes, but in the middle of a rampant epidemic, this would likely create larger labor supply shortages.

Sensitivity to Contact Rates, Minimum Scale Production

Losses lower for $R0 => 2$ (recall: $1.5 < R0 < 6$)

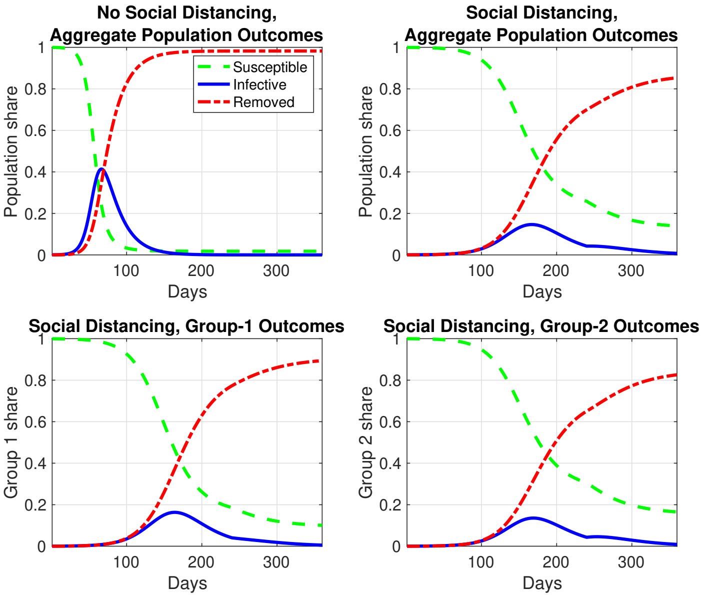


Baseline: Structured Social Distancing

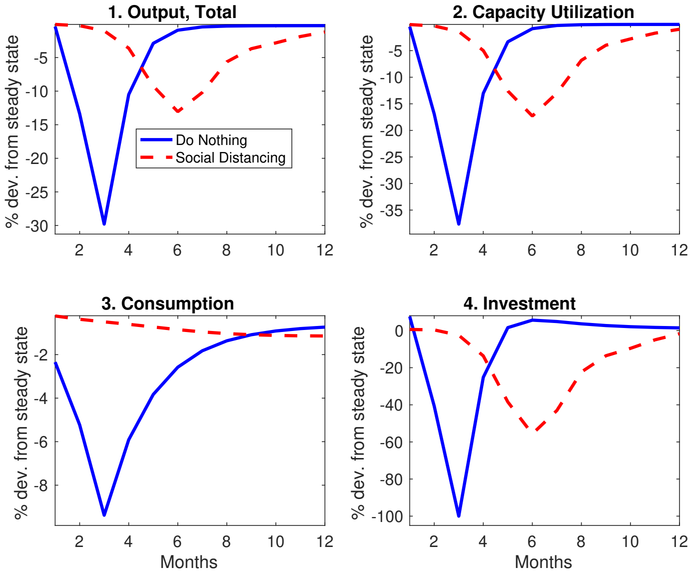
Social distancing targets workers who can continue working from home.

- BLS American Time Use Survey: 15% of workers in Group 1 and 40% of workers in Group 2 can work from home.
- These should be under lockdown. Note: Measure is more than simply "work from home if you can". These workers need to be out of transportation, shopping, any any other situation involving contacts.
- Assume that 30% of Group 3 is under lockdown, the same proportion as for the overall population.
- Set length of lockdown to avoid a resurgence of the epidemic once these measures are lifted: 8 months.

Social Distancing Flattens the Infective Curve



Social Distancing Smooths Out Economic Contraction



Deeper and Longer Social Distancing

Takeaways: Structured Lockdown

Characteristics of lockdown:

- is skewed towards the non-active population and workers in the non-core sector
- targets the share of workers who could reasonably keep performing their occupational tasks from home.

Effects of lockdown:

- higher share of individuals at home, reduces the infection rate among the workers in core industries (**moderate the infection externality**),

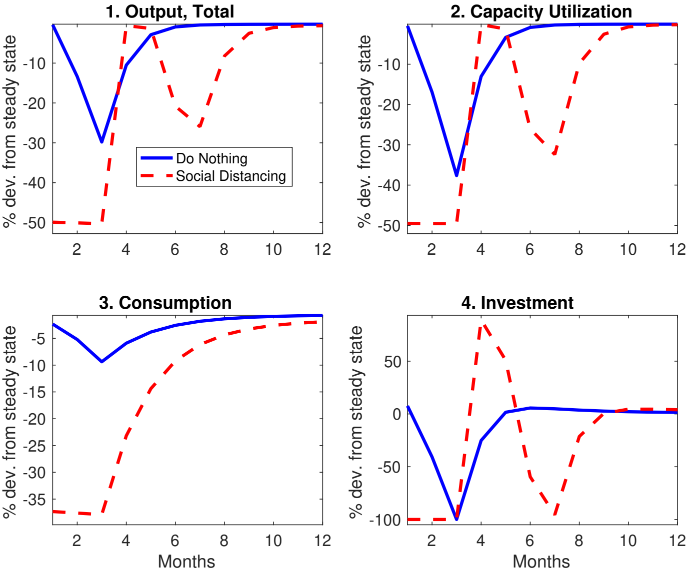
$\rightarrow$ **Mitigates but does not eliminate decline in economic activity**

A bad idea? Stricter Measures for Less Time

Experiment

- 40 percent of individuals in Group 1 under lockdown,
- 90 percent of individuals in both Group 2 and Group 3 under lockdown,
- Lockdown lasts 3 months, then all measures are removed.

Social Distancing Gone Wrong



Takeaways: a Stricter and Shorter Lockdown

Strict lockdowns may temporarily prevent the share of infected individuals from surging.

But

- the economic costs might be steep
- and with little herd immunity developed, disease spreads after lifting measures causing additional severe economic harm.

Unless breakthrough on vaccine, treatment, or contact tracing, strict lockdowns may simply delay herd immunity and reactivate the epidemic.

Waiting for a Vaccine

Two aspects featuring strongly in public debate:

- the need to reduce the peak of infected individuals
- the possible arrival of a vaccine.

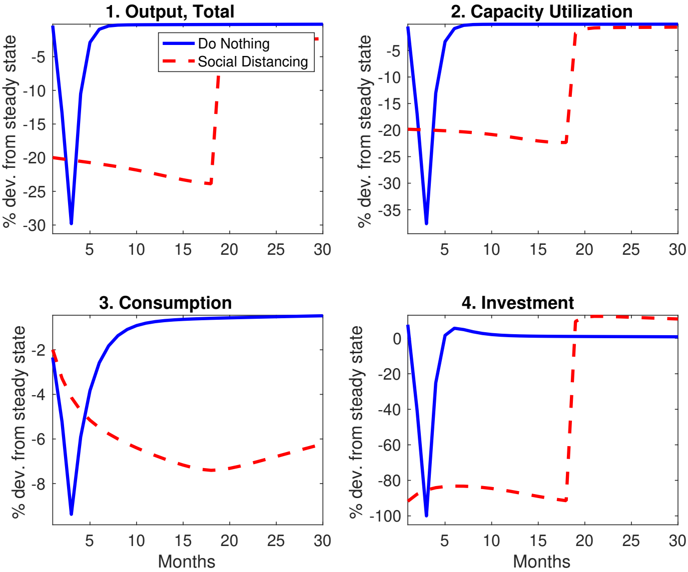
The following experiment assumes:

- vaccine arrives in 18 months (and is administered immediately)
- lockdown shares of 25, 60, and 47% for groups 1, 2, and 3.

Goal is to:

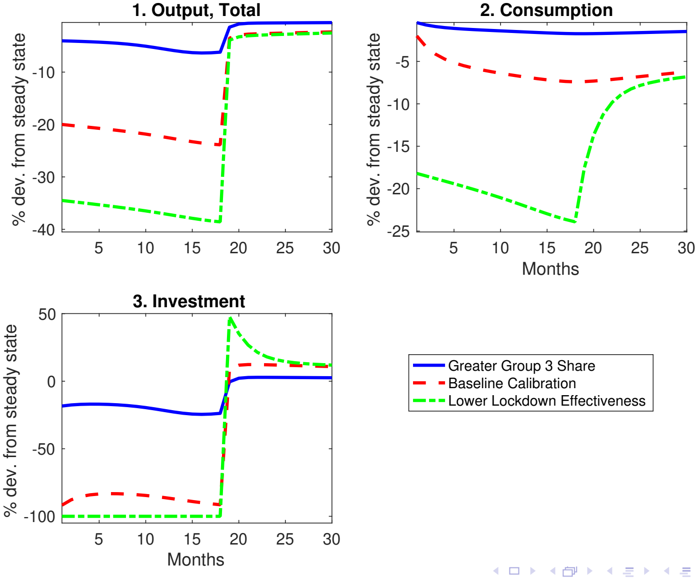
- limit peak infection share to 1.5 percent,
- reduce costs by equalizing loss in value added across sectors.

Waiting for a Vaccine



Waiting for a Vaccine

Higher lockdown rates for group 3 vs. lockdown less effective



Range of Estimates of the Cost of Waiting for a Vaccine

The cost estimates are sensitive to:

- **lockdown effectiveness**—lowering effectiveness from $\vartheta = 1$ to 0.8 as in Alvarez et al (2020) could almost double the output cost.
- **share of individuals in lockdown** for Group 3—pushing the lockdown for Group 3 to 80% could lower the cost to about 5% of output.

  Not shown in the figure:
- The **effective contact rate**—with $\beta = 0.1$ and $R_0 = 2$ limiting lockdown to those who can work from home reduces peak share of infective individuals to 0.3 % indefinetely, with no reduction in the labor supply.

Conclusion

- In our model, the **direct** economic cost of the disease stems from the inability of symptomatic infected individuals to continue working.
- The **indirect** costs come from the constraint that malfunctioning core industries may place on other industries via input-output linkages.
- Simulations of our integrated assessment model for infectious diseases suggest that structured public health restrictions may actually improve economic outcomes relative to inaction.
- Model estimates suggest that the cost of waiting for a vaccine can span a wide range.
- Because of the lingering uncertainty on the way the disease spreads, these estimates cannot be but useful blueprints for further analysis.

Way ahead

The above analysis abstracts from a range of key aspects

- financial frictions
- nominal rigidities
- fiscal and monetary policy
- consumption demand channel

But investment dynamics, capital utilization capture some of these issues beyond the current literature.
Ongoing work: integrating contact rates by occupational task and age. Solve for robust policies given the uncertainty about parameters.

Literature

Quickly growing economic literature :

- Covid Economics: Real Time Vetted and Real Time Papers
- Optimal social distancing: Alvarez, Argente, and Lippi (2020); Eichenbaum, Rebelo, and Trabandt (2020); Jones, Philippon, and Venkateswaran (2020); Acemoglu, Chernozhukov, Werning, D. Whinston (2020);
- Economic effects/policies: Bayer, Born, Luetticke, and Mueller (2020); Glover, Heathcote, Krueger, and Rios-Rull (2020); Guerrieri, Lorenzoni, Straub, and Werning (2020);
- Other: Kremer (1996); Greenwood et al. (2020); Alfaro et al. (2020); Baker et al. (2020), Correia et al. (2020).

Long tradition of mathematical epidemiology:

- Kermack and McKendrick (1927); Hethcote (1989); Brauer, Driesche, and Wu (2008); on COVID-19: Russel et al (2020); Moghadas et al (2020).