

$R < 1$ as an Economic Constraint: Can We
“Expand the Frontier” in the Fight Against
Covid-19?

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Two Simple Points

1. It may be useful to conceptualize $R < 1$ as a constraint, with traditional economic and social goals as the objective
 - ▶ Simple way to incorporate the dynamics of the problem we face into widely-familiar static optimization
 - ▶ Simple way to talk about:
 - ▶ Tradeoffs — what activities maximize welfare subject to $R < 1$
 - ▶ Expanding the production possibilities frontier
2. We urgently need to figure out how to “expand the frontier”
 - ▶ Lockdown vs. laissez faire: both are terrible choices
 - ▶ Lockdown: 33 million unemployment applications, widespread business distress
 - ▶ Ignore: 2 million plus deaths in U.S. not even factoring in overwhelmed medical system (Imperial study)
 - ▶ Could some relatively simple interventions meaningfully expand the frontier?

$R < 1$ as a Constraint

▶ Economists:

max Social Welfare (1)

subject to

Technological Constraints

Incentive Constraints

▶ Health response:

min Spread of Covid-19 (2)

subject to

Keep Society Functioning

▶ Possibly useful:

max Social Welfare (3)

subject to

Technological Constraints

Incentive Constraints

$R < 1$

Why $R < 1$: Exponential Growth

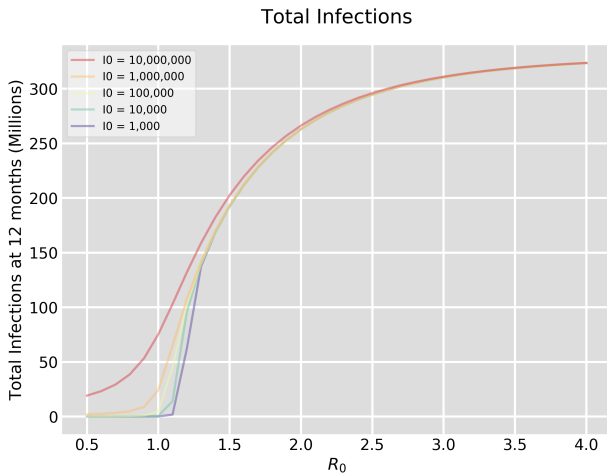


Figure Notes: Output is based on the standard SIR model. Each line depicts a different initial infection seed. γ is fixed throughout at $1/7$. β is set such that $\beta/\gamma = R_0$ as depicted on the horizontal axis.

Why $R < 1$: Exponential Growth

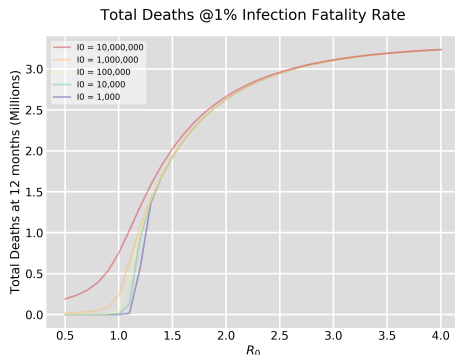
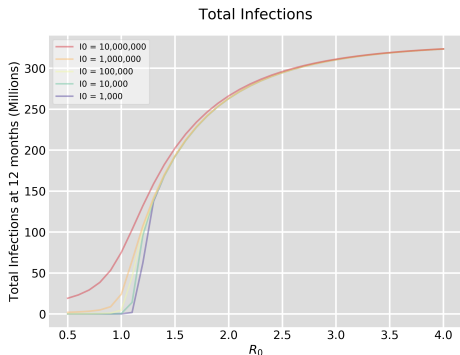
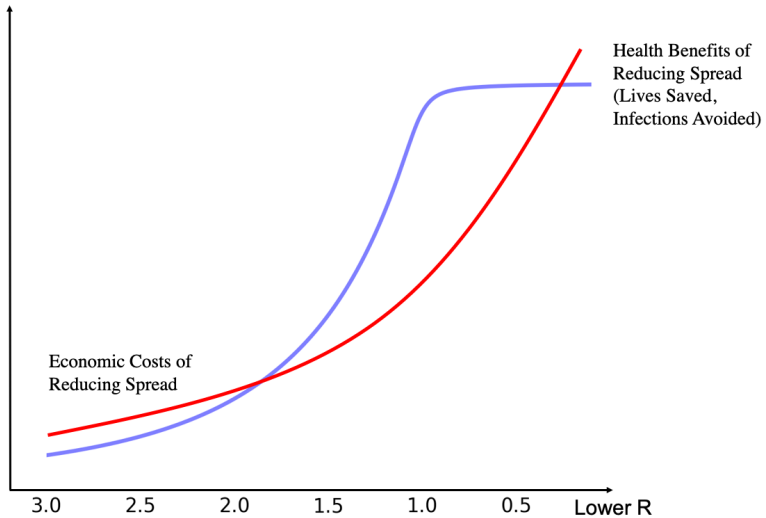


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Why $R < 1$: Simple Price Theory



Important Notes on the Formulation

- ▶ Is $R < 1$ possible?
 - ▶ Yes. Multiple examples.
 - ▶ Intuition: R_0 est'd 2.5-3.0 with unaware population, no interventions
 - ▶ We know a fair amount about how the virus spreads
 - ▶ So 2/3 reduction (i.e., $\frac{3-1}{3} = \frac{2}{3}$) not crazy
- ▶ Is $R < 1$ enough?
 - ▶ If current Infected population already very high then may want a period of $R \ll 1$ to reduce Infected pop'n, then transition to $R < 1$, to satisfactorily approximate health objective in (2)
 - ▶ “Hammer and Dance”, AEI “Road Map to Reopening”
- ▶ Is $R < 1$ too much?
 - ▶ This formulation implicitly assumes mortality rate is high and Susceptible population is high.
 - ▶ If not then $R < 1$ likely too restrictive
 - ▶ Similarly: if mortality rate is sufficiently low for a sufficiently large sub-population, then $R < 1$ may be too restrictive

Tradeoffs, Frontier

- ▶ The $R < 1$ formulation makes it simple to talk about two important economic ideas:

1. Tradeoffs

- ▶ $R < 1$ constraint places a shadow cost on activities that increase transmission (λr_i for activity i)
- ▶ Evaluate actions by ratio of social-welfare benefits to disease-transmission costs ($\frac{v_i - c_i'}{r_i}$)
- ▶ Policy question: what activities maximize social welfare while keeping $R < 1$?

2. Production Possibilities Frontier

- ▶ Once we have a shadow cost, leaps out how valuable it is to expand the frontier
- ▶ Policy question: are there technologies that increase how much social welfare we can achieve while keeping $R < 1$?

Could Masks and Gloves Save the Economy?

- ▶ Caveats: not a medical expert, science rapidly evolving
- ▶ We know a fair amount how the virus spreads. Spread is primarily through:
 - ▶ Droplets from an Infected person (cough, sneeze) directly reaching a Susceptible's nose or mouth
 - ▶ Susceptible touching a surface contaminated by Infected, then touching their face before they wash their hands
 - ▶ Close personal contact (talking, singing) between Infected and Susceptible for non-trivial duration (Gawande discusses 15 or 30 minutes)
 - ▶ Asymptomatic can spread without knowing they are infected
- ▶ Masks and Gloves:
 - ▶ Infecteds less likely to spread
 - ▶ Susceptibles less likely to get infected

Could Masks and Gloves Save the Economy?

- ▶ Given this understanding of how the virus spreads, hypothetically suppose that some variation on the following set of policies can reduce R to below 1
 1. Widespread public education: “Wash your hands”, “Don’t touch your face”, “Keep your distance”
 2. Mandatory home-or-hotel quarantine for those with potential virus symptoms – ideally supported by testing / contact-tracing and compensation
 3. Mandatory use of masks in many situations outside the home — e.g., all contexts where it is unavoidable to come within 6 feet of others for non-trivial duration
 4. Mandatory use of gloves in many situations outside the home — e.g., all contexts where it is unavoidable to touch surfaces that strangers will also touch without being able to quickly disinfect
- ▶ If these kinds of policies could together reduce $R < 1$, then we could have a mostly-functioning economy
 - ▶ Albeit with masks and gloves for a while
 - ▶ (until treatment or vaccine)

Can We Expand the Frontier?

- ▶ My point of course is not this specific list of policies
- ▶ My point is that the urgent priority should be figuring out whether some combination of these kinds of policies could succeed.
 - ▶ Some policies seem like “free lunches”
 - ▶ Others are not costless but do not shut down the economy
- ▶ We need to get more creative about ways to bring $R < 1$ without an indefinite period of severe lockdown
- ▶ If R_0 were 10 this would seem helpless
- ▶ But with
 - ▶ R_0 on order of 2.5-3
 - ▶ Relatively clear understanding of how the virus spreads
 - ▶ Several empirical examples to learn from
- ▶ Maybe it's achievable. Maybe medical experts and economists can together help the economy and society return to some semblance of normalcy.

Additional Discussion Points

- ▶ Romer mass testing
 - ▶ Ingenious. I hope we can do it.
 - ▶ This is a technology that enables significantly more social welfare while containing $R < 1$
 - ▶ Need not let perfect be enemy of good: testing can help reduce R even when not yet at Romer scale
- ▶ Masks
 - ▶ Evidence in support is accumulating (Abaluck et al, Howard et al, etc.)
 - ▶ Masks are a simple technology that enables more social welfare while containing $R < 1$
- ▶ Data gaps
 - ▶ Mortality rate - overall and heterogeneity
 - ▶ Effects of various interventions on R
 - ▶ Super-spreaders and non-compliers (is $R \ll 1$ in some sub-populations?)