Economy loss through COVID-19 if no special measure to contain the disease is in place.

Here I attempt a back of the envelope estimation of the total GDP loss to the USA alone if COVID-19 is allowed to run its course without any containment measures in place.

This assumes a conservative figure (30%) of the oft-repeated range (25 – 75%) of total incidence rate of COVID-19 if no quarantine or stay-at-home types of segregation measures are taken.

I have used the 2010 demography numbers of the US population by age and sex, and used the life-expectancy table of 2010 for US population from the last US census.

Here are some broad stroke assumptions I made for this rough estimation:

1. 2010 US census age and sex distributions
2. 2010 US life expectancy distributions
3. Infection rates follow normal distribution (this is the epidemiological standard)
4. Males and females are equally infected (though not equally affected)
5. 30% of the population are ultimately infected within 1 year (the range provided by epidemiologists are from a low of 25% to a high of 70%)
6. All age groups are equally infected (though not equally affected)
7. I have used a sliding scale of treatment weight for various age groups, assuming 100% treatment rates for all age groups, except the above 65 years, in which I assumed 80% treatment rates (an ad hoc assumption but something that is seen in Italy where the resources are saturated).
8. Used a sliding scale of death rate (0.01 – 0.035) per age group. The upper range is a low estimate. Current mean rate according to WHO is 0.045 (which is widely considered to be an over-estimate, but current >75 years age group mortality rate is ~14.8%, so I have erred in favor of an under-estimation)

Using these parameters, I have calculated the DALY lost due to COVID-19 in one year. DALY, Disability-Adjusted Life Years is an economic measure used to estimate the loss to economy due to a particular health issue.

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\text{DALY} = \text{Number of cases} \times \text{disease duration} \times \text{Disability weight} + \text{YLL}
\]

Here, number of cases was estimated according the assumptions stated above; disease duration was assumed to be 2 weeks for below 65 years and 3 months for >65 years; disability weight was 0 for all age groups except for 65+ years which on average was assumed to be 20%.

YLL is more complex, and is automatically calculated by the R-package “DALY” within R from the provided demographic distribution, and is defined below (ref: https://www.ncbi.nlm.nih.gov/pubmed/23927817)
Below is a snapshot of the input data:

Results: And below is the resulting distribution of DALY estimated with the above parameters:
The mean value of DALY loss turns out to be: 41,056,030 years. This is the estimated mean loss to the economy due to COVID-19.

To translate that to the loss to economy, we will need to multiply the total annual GDP of the US by this number:

Total estimated loss to GDP in one year due to COVID-19 if no measure were in place
= 41,056,030 years x (per capita GDP of 2019) per year
= 41,056,030 x $65,116
= $2.67 x 10^{12}
= $2.67 Trillion

Assuming again the US GDP of 2019, this means ~13% expected drop in GDP in 2020.