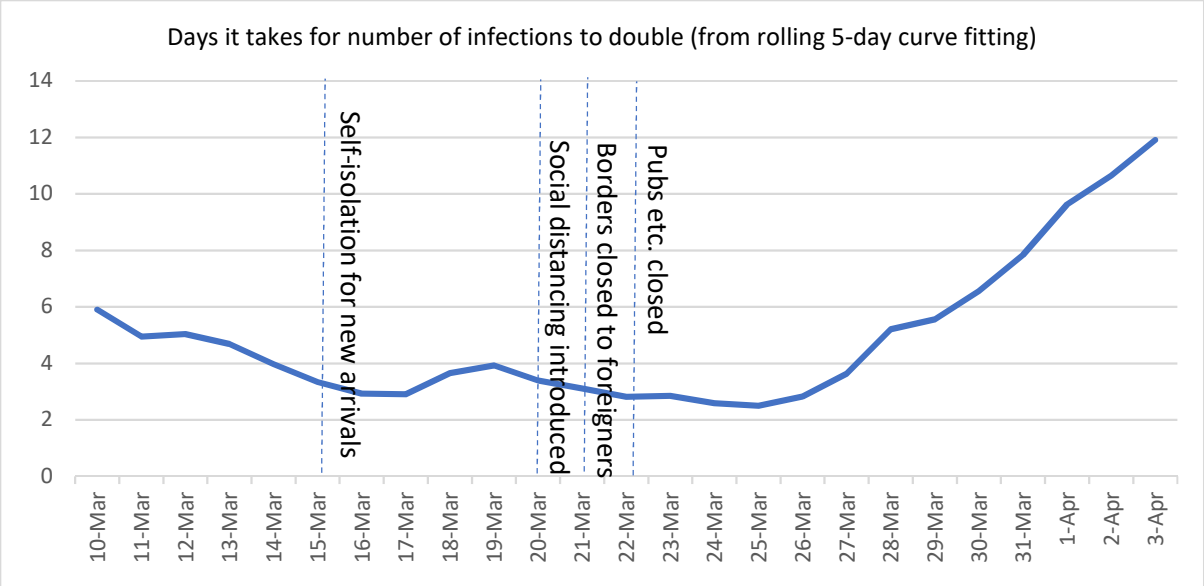
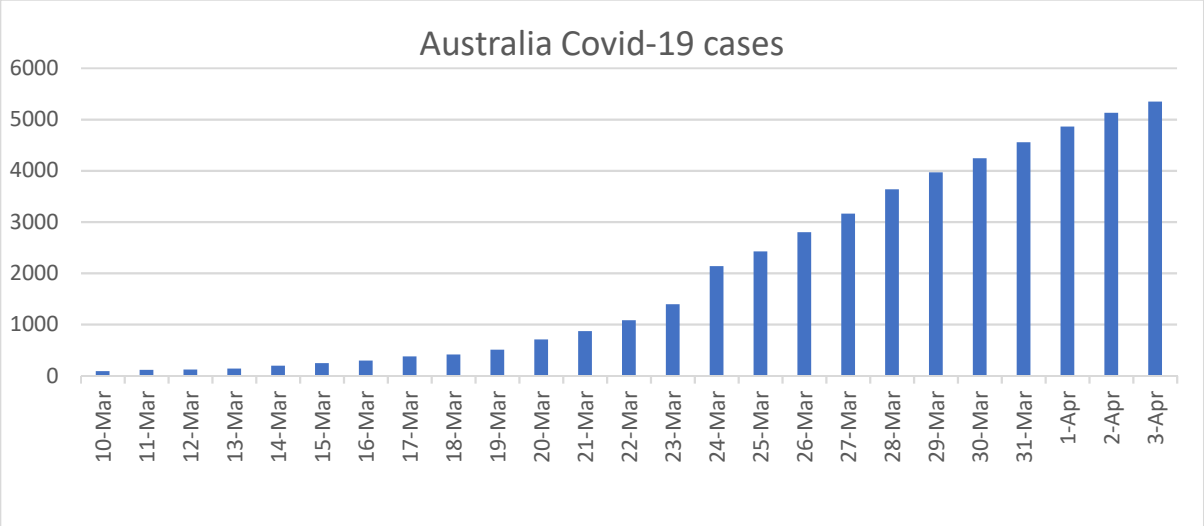
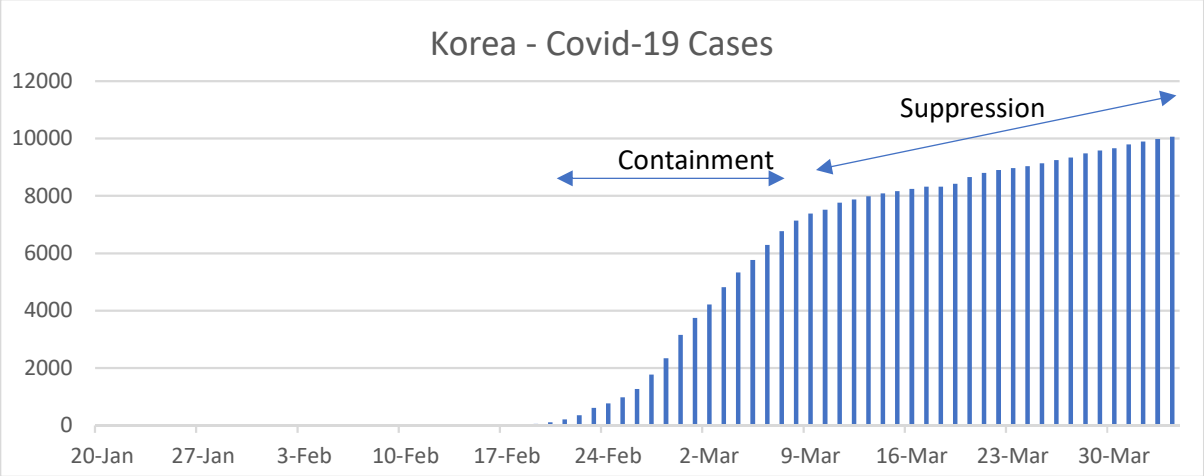
Managing Covid-19 in Australia

As at 3 April, there were 5,350 cases of COVID-19 in Australia, an increase of 217 cases over the preceding 24 hours. The effectiveness of abatement initiatives can be measured via τ—the time it takes for the number of infections to double. Over the past nine days, τ has improved from 2.5 to 11.9 days. As a result, the number of new cases has been declining and our cumulative numbers seem to be coming under control.

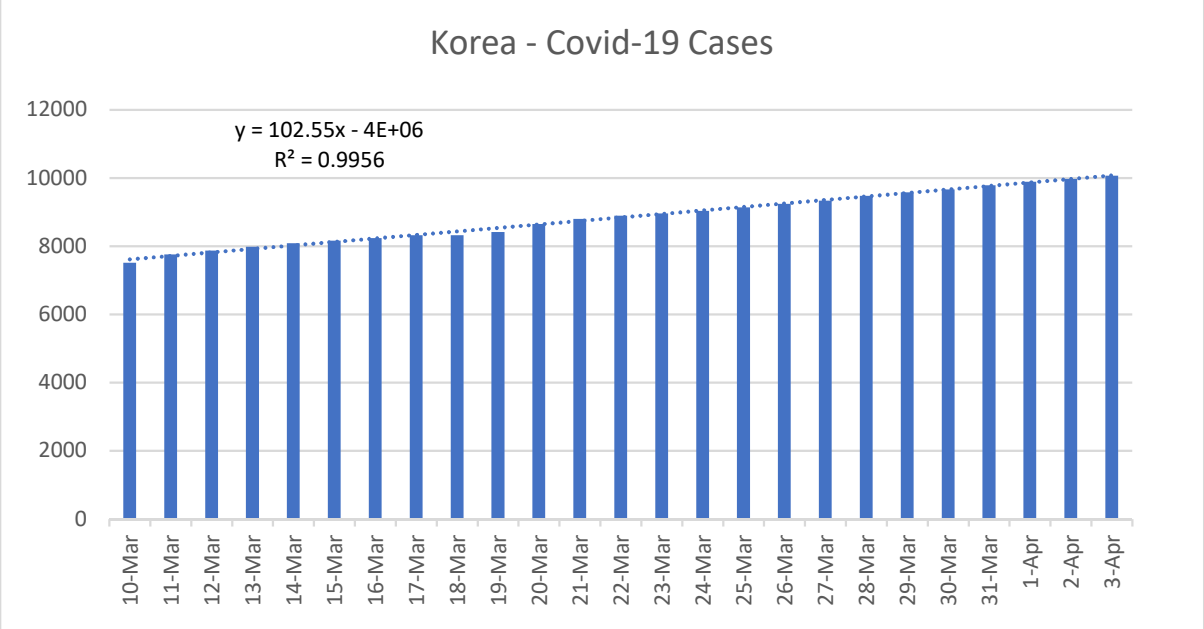




The growth in τ has been sufficient for Australian officials to announce that we have entered a 'suppression phase' of managing the epidemic. However, based on the experience of South Korea, we should not expect the number of new cases asymptote to zero. Instead we should expect a steady but low number of new cases each day. (That might take some time to emerge given the release of potential new infections from beleaguered cruise ships, but that will pass with time.)



Looking closely at the South Korean data reveals that they are getting around 100 cases on average each day, see below (note the glitch in WHO data around March 18).



Because Covid-19 cases resolve in a couple of weeks, Korea is experiencing a constant additional load on its health system, which appears to be sustainable.

The emergence of a roughly constant stream of new cases is indicative of a stock problem with sinks and sources, like a fishery with a constant sustainable catch rate. There may be something to learn about the transmission of the virus from studying this equilibrium.

What does this mean for Australia? Because the virus requires physical proximity for transmission, the steady-state flow of new cases should be an extensive variable. That is, we should expect the steady-state flow of new cases to be proportional to the size of the population. Thus, because Australia has a population half the size of Korea, its steady-state stream of new cases should be half

that of Korea's, all other things being equal. That's not really a consolation because we also have a health system half the size of Korea's.

And all other things are *not* equal. For example, we have a lower population density, which should work in our favour. There are also important differences in testing rates and containment measures. My impression (which needs to be checked and elaborated on) is that our testing has been less extensive then Korea's but our public health measures (e.g. lockdowns and travel restrictions) have been more drastic.

If a steady state flow of new cases emerges in Australia, we can (in theory at least) adjust our public health measures to achieve a level of flow that minimises the total cost of containment plus disease. That is, we can seek the efficient level of disease by finding the optimal trade-off between economic damage on the one hand, and health/mortality costs on the other. In doing so, the usual tools of marginal analysis will apply. (Such a trade-off is always present, but a steady-state regime makes it much easier to conceptualise and hopefully optimise).

The difficulty and risk of trying to fine-tune the flow would be significant. Further analysis of the experience of Korea and similar countries would help, as might geographically limited experiments with varying public health measures within Australia. Most critically, it remains an open question as to how the growing scale and speed of testing can best be used to reduce the economic and health costs due to Covid-19 including, but not limited to, a steady-state regime.

However, even if we manage to fine-tune the flow of new cases to minimise the overall damage, we cannot be sure that we have found the (mathematically) global, as opposed to local, optimal response. Indeed, with talk of economic disruption extending up to six months, the integrated cost over time of maintaining a sustainable equilibrium of new cases will be substantial, as will the health/mortality costs.

An alternative would be to take advantage of being an island and sterilise the population of the disease using group testing. While the logistics of such a feat is intimidating, it would be a one-off event of finite duration with costs that don't accumulate month after month. The challenge of sterilising the entire population could be reduced by adopting a 'cordon and search' program whereby geographic regions are isolated and tested in turn. Note: there are suggestions that Germany might soon be able to test up to 400,000 people a day, which is more than the population of Tasmania. If nothing else, it may be easier to muster public support for a 'moon shot' solution of this sort than it would be for months of lockdown awaiting a vaccine.