

The “Analog Computer Modell” :
“how to draw relevant conclusions from a simple model”,
“rescaling-shifting, fitting, and the “thumb times PI” estimate.

Comparison of Covid-19 cases,
death and developments in different countries

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Summary: The WPI “Analog computer model” is a simple algorithm to compile a prediction for Austria from the data in countries that are weeks or months ahead, by *rescaling* by the size, by *shifting* to the start of “lock down” (“quarantine”) measures, eventually *fitting* the curves and *extrapolating*. Active Covid-19 cases in Italy, Spain and Austria after introducing area-wide quarantine measures are compared to data of China. Our key assumption for conclusions and recommendation is that “lock-down measures” in Austria are as efficient as in China. Our only free model parameter is the rescaling factor, which is 0.3 for Wuhan-Austria by the data of the first days. The daily increase factor within the last week (20-26 of March) of active cases is very similar to the data of China for the same time period after the Wuhan lockdown. An even better agreement can be observed in the daily increase factor of death comparing Italy, Spain, China and Austria.

Our main conclusions:

- 1) the “measures” have to be as effective as in China, in particular including an obligation to enforcement of “social distancing” that should be enhanced wear “masks”, in particular in situations of possible dense crowds like e.g. in supermarkets.
- 2) In that case we can expect a “peak” around Easter and a “fast decay” within ~ 40 days.
- 3) In that case the number of hospital beds for intense care in Austria should be sufficient.
- 4) The number of new cases per day will not go down immediately, it will probably go up above 1000 per day soon, the increase does not mean that the measures are not working.

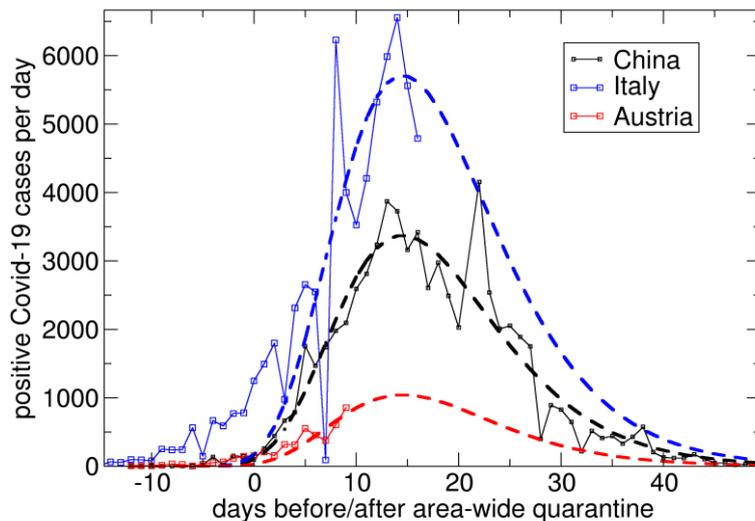
We do not regard this paper as a scientific publication for peer review. All we do is to do correct calculations as simple as possible to get insight how the situation in Austria will evolve under assumptions that we clearly lay out. (The only less rigorous part is the “GrossGlockner Kurve”, obtained by an intuitive mix of data from China and Italy.

The obtained predictions on the “new cases”, for the first 2 days correspond very closely.

Norbert J Mauser

Covid-19 infected and recovered cases

According to the data from Ref^[1], the newly reported Covid-19 cases per day are presented for China, Italy and Austria in Figure 1. The dashed curves are guide lines to the eye according to the data from China. For Austria the dashed curve is the fitting curve of the data from China multiplied by 0.3. For Italy (blue dashed curve) the data from China is multiplied by 1.7. Day zero is the day when area-wide quarantine was introduced, in China 23.1.2020 (Wuhan quarantine) in Italy 8.3.2020, Spain 14.3.2020 and in Austria 15.3.2020.



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Figure 1: Newly reported Covid-19 cases per day are presented for China, Italy and Austria. The dashed curves are guide lines to the eye according to the data from China. For Austria the dashed curve is the fitting curve of the data from China multiplied by 0.3. For Italy (blue dashed curve) the data from China is multiplied by 1.7. Data from: <https://www.ecdc.europa.eu>

The currently reported active Covid-19 cases are shown in Figure 2 (Italy), Figure 3 (Spain) and Figure 4 (Austria). It is worth noting that the daily increase factor deviates significantly before the time of the quarantine but some time (about 1 week) after the quarantine was introduced the daily increase factors become similar. Within the last week Italy, Spain and Austria show very similar daily increase factors as in China in the same time after the lockdown (slope in the logarithmic curve). It might be noted that a discrepancy might occur due to different number of Covid-19 tests performed in different countries at different times.

¹ <https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide>

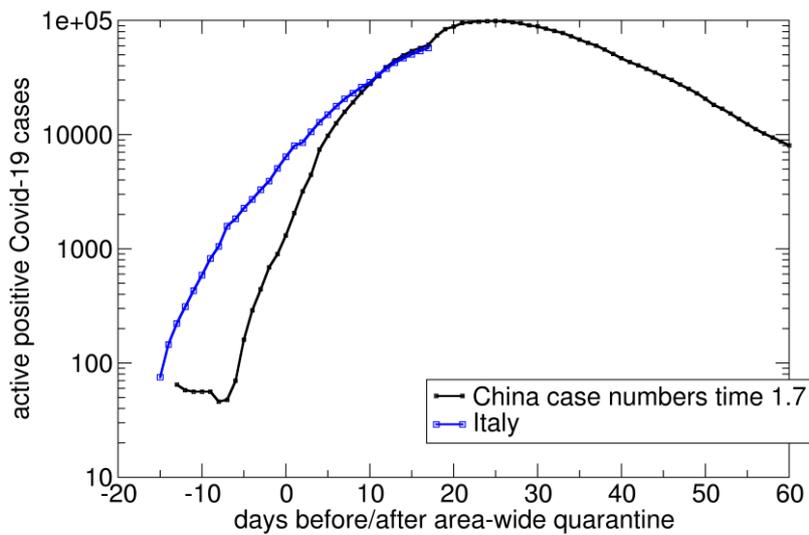


Figure 2: Currently active (new cases minus deaths minus recovered) Covid-19 cases as function of the time before/after area-wide quarantine. The case numbers of China are scales by a factor of 1.7. Data from: https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Italy https://en.wikipedia.org/wiki/2019%E2%80%9320_coronavirus_pandemic_in_mainland_China

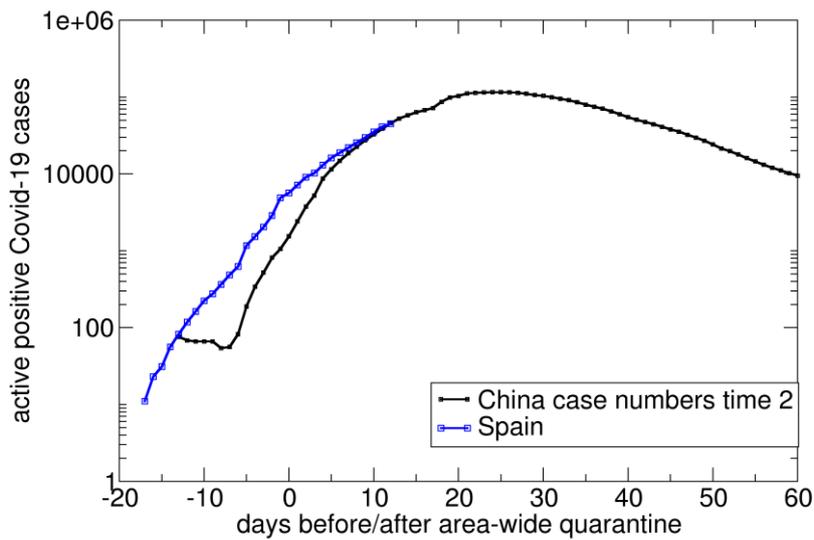


Figure 3: Currently active (new cases minus deaths minus recovered) Covid-19 cases as function of the time before/after area-wide quarantine. The case numbers of China are scales by a factor of 2. Data from: https://en.wikipedia.org/wiki/2019%E2%80%9320_coronavirus_pandemic_in_mainland_China https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Spain

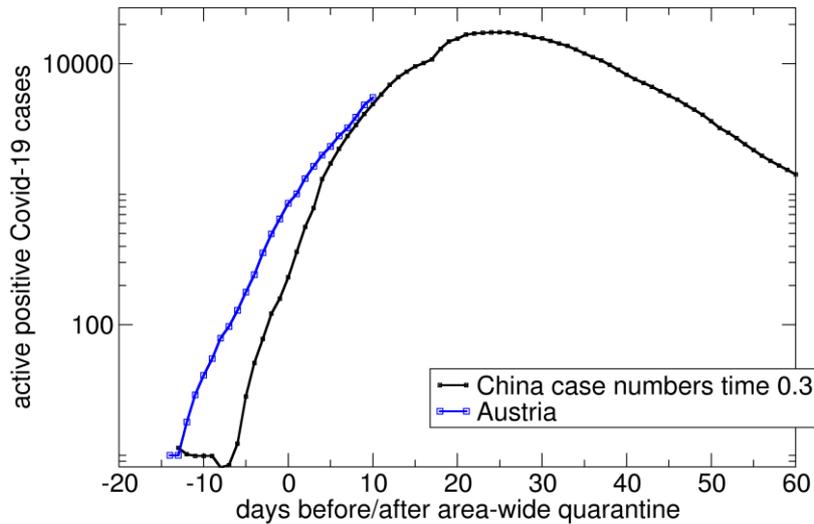


Figure 4: Currently active (new cases minus deaths minus recovered) Covid-19 cases as function of the time before/after area-wide quarantine. The case numbers of China are scaled by a factor of 0.3.

Data from:

https://en.wikipedia.org/wiki/2019%E2%80%9320_coronavirus_pandemic_in_mainland_China

https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Austria

In China, the maximum number of cases was reached about 25 days after the quarantine (lockdown) in Wuhan. A maximum in active cases about two to three weeks after strict quarantine is also reported in a study from Imperial College². Here different measures for Great Britain were evaluated. With a closure of 75% of schools and universities and a 75% reduction in outside the home, school or workplace, the researchers report that the maximum number of intensive care beds needed will be needed about 16 days after the measures are introduced.

The number of recovered cases is shown Figure 5. Here again the numbers of China are scaled by a factor of 0.3 in order to make the active cases in the same order of magnitude in China and Austria.

² Ferguson, Neil M., et al. "Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand." London: Imperial College COVID-19 Response Team, March 16 (2020), <https://doi.org/10.25561/77482>,

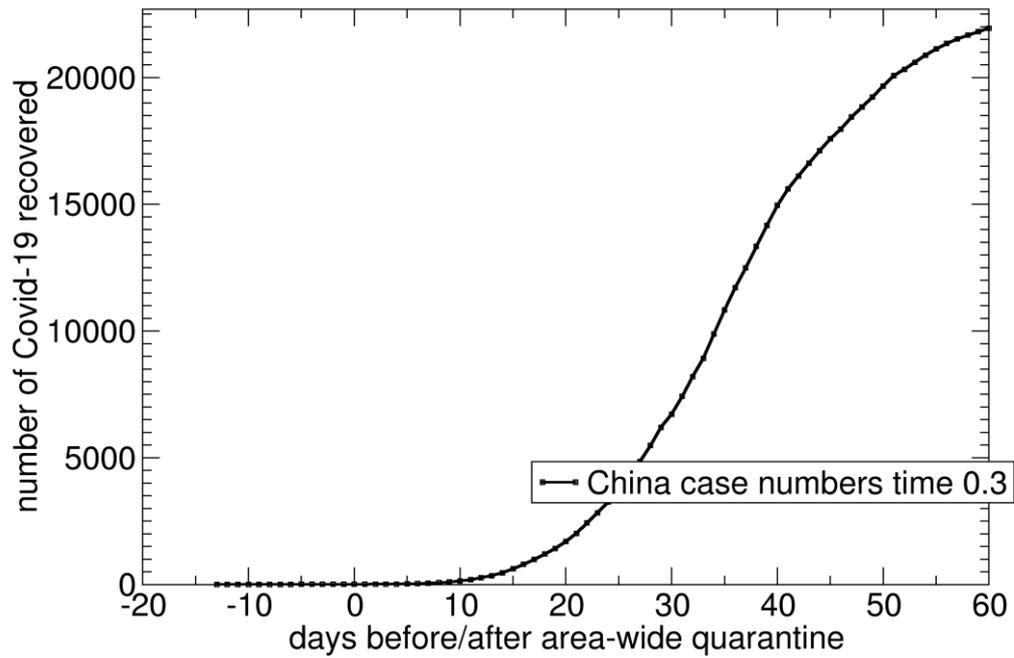


Figure 5: Number of Covid-19 recoveries in China multiplied by 0.3. The same multiplication factor was used to match the active Covid-19 cases in Austria and China.

A comparison of the daily increase of Covid-19 cases in different countries is shown in Figure 6 and Figure 7. (For example, 1.4 means there is in average a 40% increase of the cases per day). The increase factor is evaluated if in this country the number of Covid-19 cases is larger than 50. The last day is March 23th 2020.

The following curve is obtained by an intuitive inconsistent mixing of data from China and Italy, this curve is just a simple very nonrigorous try to predict the number of new cases per day.

The shape of the curve looks like a mountain, e.g. the „Großglockner“; it predicts the number of new cases per day. The computation of march 23rd for the new cases per day corresponds well with the data of march 24.

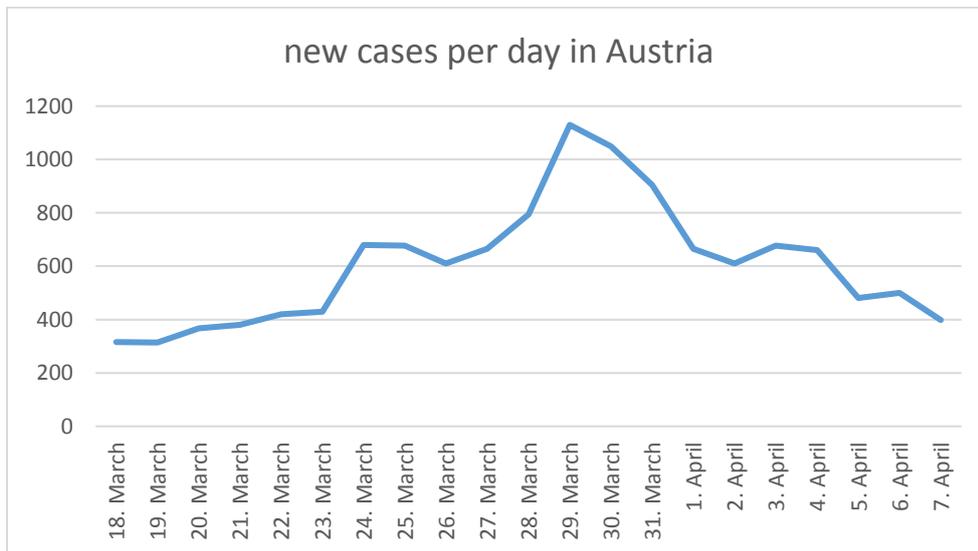


Figure 1-bis. The „Großglockner-Kurve“ shows how the number of new cases per day will probably not go down immediately, it will probably go up above 1000 per day soon, maximum of 1160 around end of march, if the lock down measures are equivalent to the Chinese version. An intermediate increase of 1-2 days does not necessarily mean that the “lock down measures” are not working.

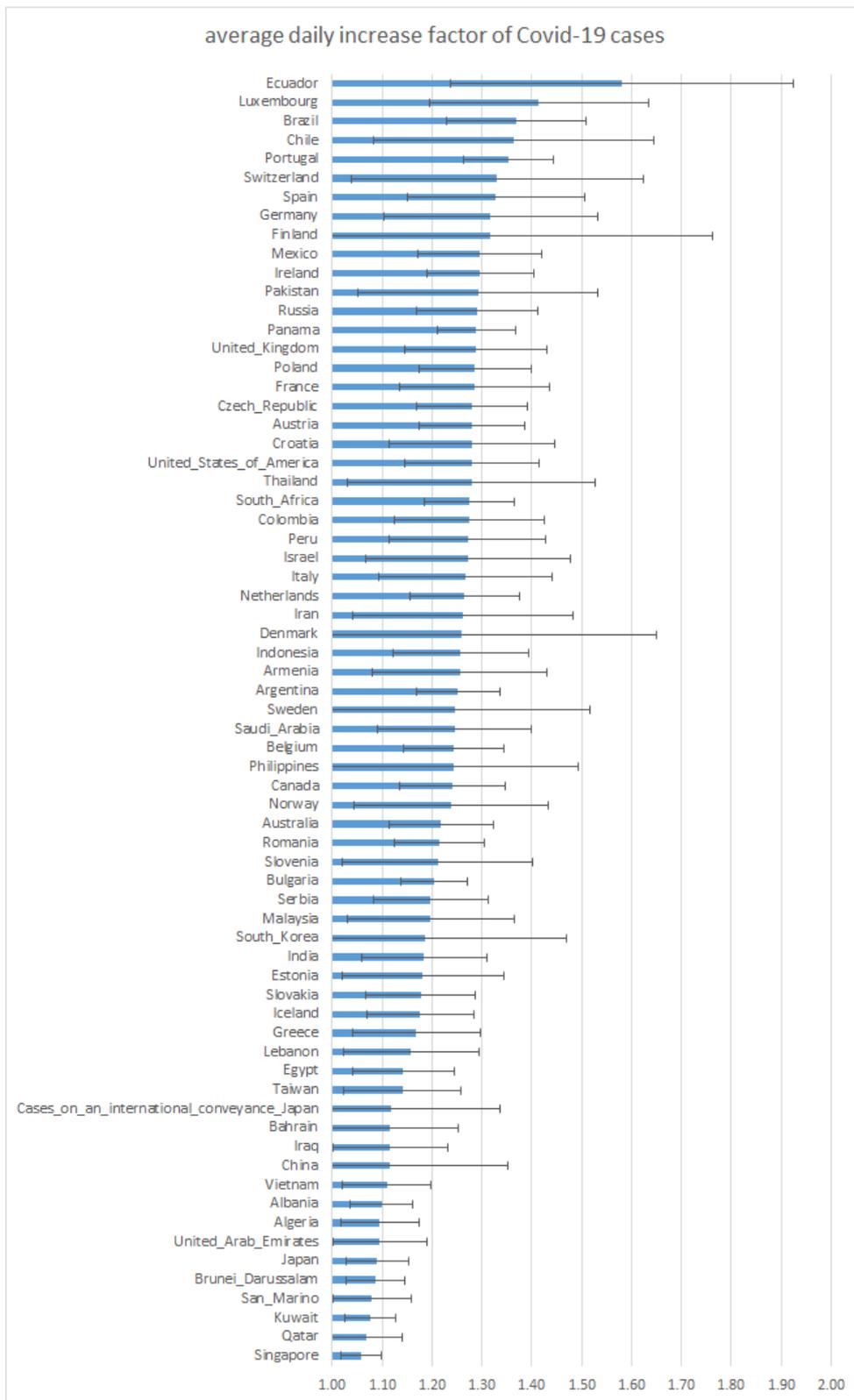


Figure 6: Daily increase of Covid-19 cases in different countries. The data is collected for countries and days if the number of new Covid-19 cases is larger than 50. The error bars show two times the standard deviation (data until March 23, <https://www.ecdc.europa.eu>).

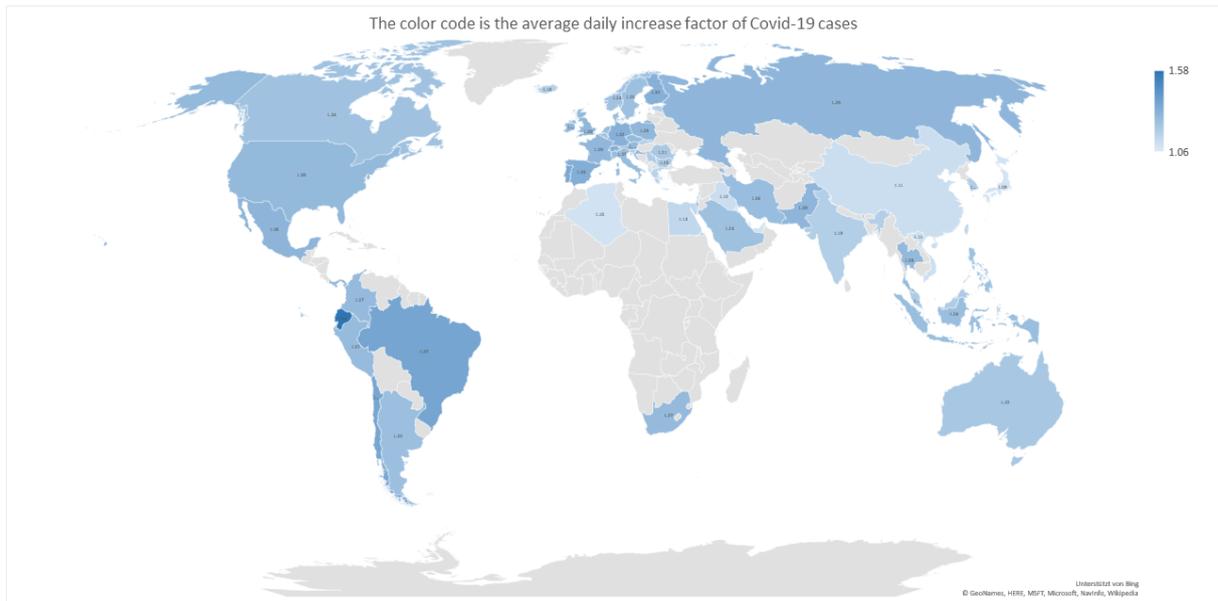


Figure 7: Worldmap of daily increase of Covid-19 cases in different countries. The data is collected for countries and days if the number of new Covid-19 cases is larger than 50. (data until March 23, <https://www.ecdc.europa.eu>).

The reported numbers above might significantly depend on the number of tested people in the countries. In Figure 8 it is shown that the number of tests in various European countries by more than a factor of five. Considering the high number of unreported cases expected in the countries³ in the following we focus on Covid-19 deaths, in order to minimize the effect of unreported cases.

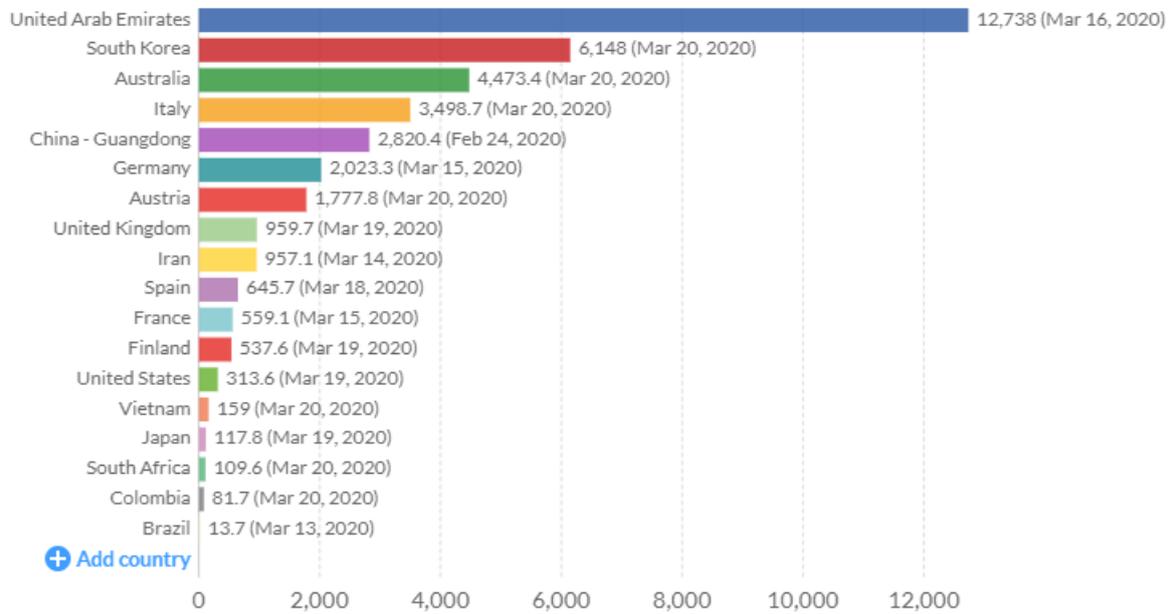
³ <https://orf.at/stories/3159008/>

COVID-19 data as of 20 March: Total tests performed per million people



Data collected by Our World in Data from official country reports.

For some countries the number of tests corresponds to the number of individuals who have been tested, rather than the number of samples.



Source: Our World in Data
Note: Data for the United States corresponds to estimates from the COVID-Tracking Project.

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Figure 8: Performed Covid-19 tests per million people.⁴

Covid-19 deaths

Statistics on positive tested cases will significantly depend on the number of tests performed. For example, in Iceland 6.163 people were blind tested and from these 52 lead to a positive test result⁵.

In the following a comparison of deaths in different countries due to Covid-19 is presented. The fatalities (deaths) in Italy and Spain due to Covid-19 are extremely close to a scaled (y-axis is scaled) curve in China. One should note that in Spain the cases are also very close to the scaled curve from China but it has a slightly larger increase factor. Austria has at the moment (25. March) an even smaller daily increase.

In order to minimize the difference between the data of China and the other countries we minimize the residuum *res* by varying the parameter α .

$$res = \min_{\text{for } \alpha} \sum_{i=-23}^N |\alpha d_{China,i} - d_{Italy,i}| \quad (1.1)$$

⁴ <https://ourworldindata.org/covid-testing>

⁵ <https://orf.at/stories/3159008/>

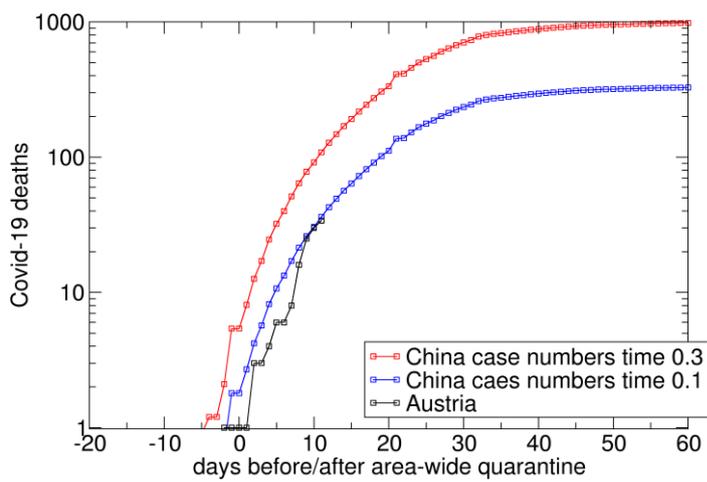
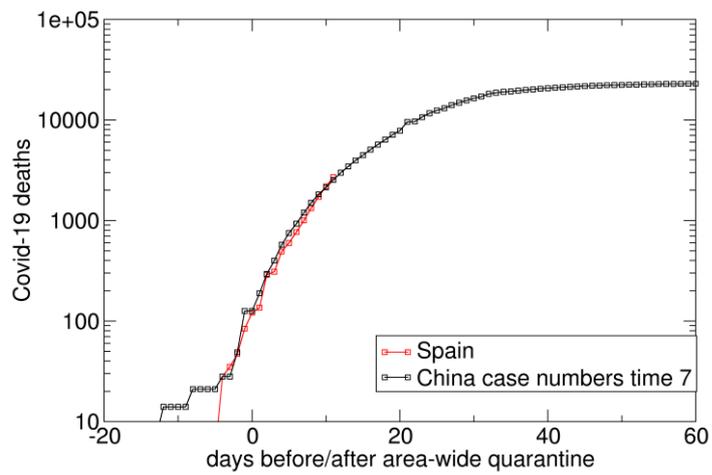
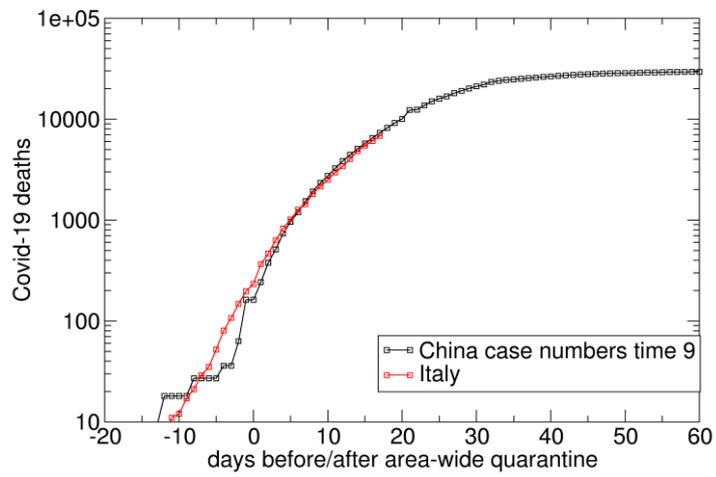


Figure 9: Daily Covid-19 death in Italy, Spain, Austria and China. Area wide quarantine is assumed for China 23.1.2020. (Wuhan quarantine), Italy 8.3.2020, Spain 14.3.2020 and Austria 15.3.2020. <https://www.ecdc.europa.eu>.

	Italy	Spain	Austria
α	8.40	7.11	0.094
res	2105	1529	36
N	18	12	11

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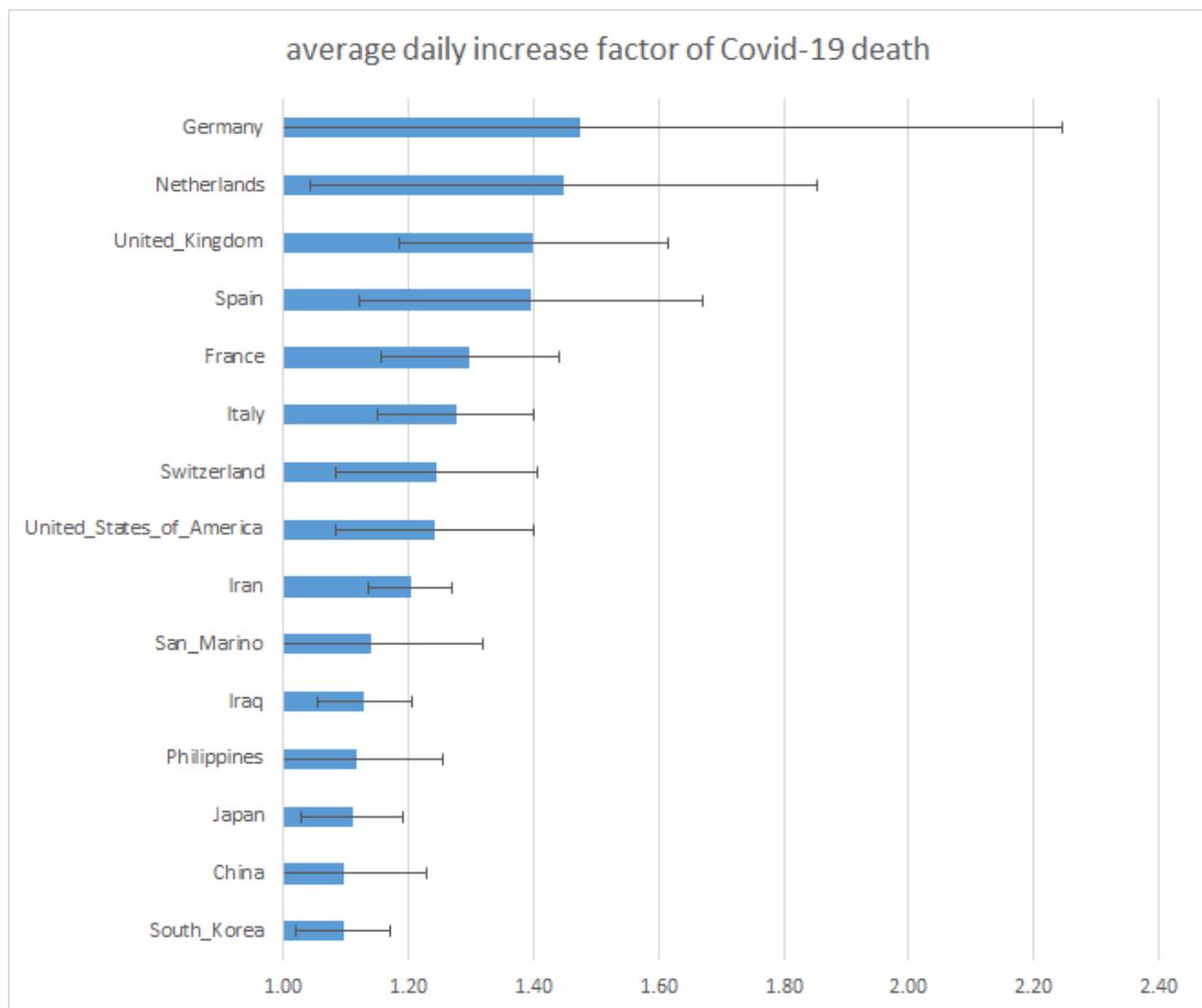


Figure 10: Daily increase of Covid-19 deaths in different countries. The data is collected for countries and days if the number of new Covid-19 cases is larger than 10. (data until March 23)