WHAT HAVE WE LEARNED SO FAR

Predictions one day ahead:
We have calculated the relative error between the observed results and our predictions from the growth curve model one day ahead that have been listed on the TU/e website. All relative errors are within ± 10%, while 22 of the 26 predictions are within ± 5%. The figure below shows the relative error by country. The error bars are the relative errors of the reported 95% prediction limits. Relative error rates below 0% means that we underestimate the numbers and above 0% were over estimated.

![Figure 1: Relative prediction errors for the predicted numbers of confirmed infections one day ahead in the period March 12 to March 16.](image)

For Iran we have been systematically underestimated the number of confirmed infections. Furthermore, the current 95% prediction limits seem to be underestimated due to heterogeneity in the variability around the curve and autocorrelation between the daily accumulated confirmed infections and deaths.

Predictions on the maximum:
Even though we calibrate our predictions for the final number of confirmed cases and deaths, based on China data, the maximum value seems to slowly increase with every update we make. For Italy, we have reported a substantial increase in the final number of confirmed infections. When we started to report the maximum on March 11, 2020, the uncorrected estimated maxima where equal to 14712, 27162, and 25682 for March 09, 10, and 11, respectively. These results gave us the impression that the final number of infections remained relatively stable.

Running additional analysis (with a heterogeneous variance), showed us that the turning point, i.e. the number of days (after the starting point of the data that is being analyzed) at which the growth curve is half way its maximum value, shifts with approximately one day for every day of new data. Figure (left) shows the estimated turning point (from February 21, 2020, when the first confirmed death in Italy was recorded). Figure 2 (right) showed the relative maximum of the growth curve. If the relative maximum is at 50%, the last observed number of confirmed infections (or deaths) is half way the maximum. Thus each day of updated numbers of confirmed infections, Italy seems to be at least half way of the expected maximum, but Italy does not seem to get closer to its expected maximum.

To contrast these figures of Italy, we also run the same analysis for South Korea. The results are given in Figure 3 below. In South Korea we see that the estimated turning point is stable from February 29 to March 14, 2020 at around 10 days after the first recorded death. As a results, we see a steady increase in the relative maximum, starting at around 37% and steadily growing to 100%.

These results seem to show that Italy is in an unpredictable situation, while South Korea is in a predictable situation. We have tried to find differences between these countries.
Figure 2: Sequential analysis of that number of confirmed cases for Italy (Left: the turning point in days; Right: the relative position of the observed number of confirmed infections with respect to its maximum)

Figure 3: Sequential analysis of that number of confirmed cases for Italy (Left: the turning point in days; Right: the relative position of the observed number of confirmed infections with respect to its maximum)

Figure 4: Percentage of confirmed infections with respect to the accumulated number of corona tests (Left: Italy; Right: South Korea).
Investigating the percentage confirmed infections as percentages of the accumulated number of tests for both Italy and South Korea, we see a sharp difference. In Italy there is a steep increase, while in South Korea there is a slow decrease (see Figure 4). This may indicate that the spread of the virus is under control in South Korea, but not yet in Italy.