

Analysis of historic weekly data on deaths from all causes in Denmark, the Netherlands, Sweden and the U.K.(England and Wales).

There is tremendous variability in historic records of deaths from all causes in Denmark, the Netherlands, Sweden and the U.K. Many recent analyses have compared weekly deaths recorded in March and April 2020 with a 5 year average for the same periods. These comparisons are meaningless without an understanding of the distribution of above average data points. Our standard model applied to samples of deaths above the average rate shows that *none of the events so far should have been unexpected given the data history.*

### What does it mean to be “Far above the average”?<sup>1</sup>

Anybody can calculate an average.<sup>1</sup> And it's equally easy to calculate the difference between, say the 5 year average weekly deaths in England and Wales in the second week of April (10,520) and the number of deaths recorded in the second week of April 2020 (18,516).<sup>2</sup>

The fact that deaths recorded in this particular week were 76% above the 5-year average *conveys absolutely no information.*

To make any meaningful inference about the deaths in the second week of April, you need to know how much variability there is in the weekly death data. The usual assumption is that units of standard deviation can be used to determine the meaning of ‘far’ and that the distribution is normal.<sup>3</sup> This is very unlikely to be the case for the Netherlands and U.K. data sets we have analysed.<sup>4</sup>

### It's the above average deaths that matter

For public policy decisions it's essential to understand the distribution of above average deaths. This matters in preparation for epidemics or pandemics. And it matters in the midst of an outbreak to know if deaths being recorded are indicative of unprecedented danger or within a range that's entirely consistent with the past.

Given a history of weekly deaths, this data provides an ‘empirical distribution’ of deaths above the average level. We should examine this data without *any* assumptions. The critical question to ask is how likely it is that the maximum weekly deaths observed so far will be exceeded and if it is, what the average excess will be.

*That level is the absolute minimum that any responsible government should be prepared to deal with.*

### It may not be easy to answer these questions with any confidence

Conventional statistics attempts to address this sort of problem assuming that the data is normally distributed.<sup>3</sup> Alternatively, Extreme Value Theory can be used, but usually only with a great deal of data—far more than 10 years of weekly death records.

Omega Analysis' technology allows us to make accurate estimates using short data sets. In the case of Denmark, the Netherlands, Sweden and the U.K., the records we have start in 2007, 1995, 2000 and 2010 respectively. Using this data to the end of 2019 allows us to make predictions for 2020 that, so far, are in very good agreement with reality.

### Our predictions from data to Dec. 31, 2019

The data from 2020 were kept out of sample for all of our calculations. For each country we have calculated the average weekly deaths, conditional on exceeding the maximum in the sample up to the end of December 2019 (see Appendix).

As further weekly death numbers become available, we will update the average excesses on the pre-2020 highs.

We have no plans at present to extend this study, but we can be contacted by Public Sector Institutions at [statistics@OmegaAnalysis.com](mailto:statistics@OmegaAnalysis.com) regarding further analysis.

continued.

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### Denmark

The maximum weekly deaths between January 2007 and December 2019 was 1,364 and the average was 1,026. In the 678 weeks of data, there were 282 weeks that had more than the average number of deaths.

Our fit of the above average data put the frequency of exceeding 1,364 deaths in a week at 1 week in 2.9 years. The average excess, should this level be exceeded, is 1,537.

At the time of writing none of the weeks of 2020 has seen deaths in excess of 1,364.

The frequency of exceeding 1,537 is 1 week in 9.6 years and the average excess on 1,537 is 1,786. The latter should only be exceeded 1 week in 32 years.<sup>5</sup>

### The Netherlands

The maximum weekly deaths between January 1995 and December 2019 was 4,092 and the average was 2,677. In the 1,299 weeks of data, there were 562 weeks that had more than the average number of deaths.

Our fit of the above average data put the frequency of exceeding 4,092 at 1 week in 5 years. The average excess, should this level be exceeded, is 4,999.

At the time of writing there have been 4 weeks in 2020 with more than 4,092 deaths. The average is 4,683, below the predicted excess of 4,999.

The frequency of exceeding 4,999 is 1 week in 17.5 years and the average excess on 4,999 is 6,425. The latter level should be exceeded only 1 week in 61 years.

### Sweden

The maximum number of weekly deaths between January 2000 and December 2019 was 2,364 and the average was 1,730. There were 1,043 points in the sample of which 434 had more than the average number of deaths.

Our fit of the above average data put the frequency of exceeding 2,364 deaths at 1 week in 3.7 years. The average excess on 2,364 is 2,689.

At the time of writing there have been 3 weeks in 2020 with more than 2,364 deaths. The average is 2,472, also below the predicted excess of 2,689 deaths.

The frequency of exceeding 2,689 is 1 time in 12 years and the average excess is 3,158. This should be exceeded 1 week in 40 years.

### U.K. data (England and Wales)

For England and Wales, the maximum weekly deaths between January 2010 and December 2019 was 16,237 and the average was 9,863. In the 521 weeks of data, there were 219 weeks which were had more than the average number of deaths.

Our fit of the above average data put the frequency of exceeding 16,237 at 1 week in 4.6 years. The average excess, should this level be breached, is 20,058.

At the time of writing, there have been 5 weeks in 2020 with deaths in excess of 16,237. Their average is 19,441, below our predicted value of 20,058.

The frequency of exceeding 20,058 is 1 week in 15.6 years. The average excess on 20,058 is 25,902 — which should only be exceeded 1 week in 53 years.

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### Conclusions

The predictions we have made have so far been somewhat greater than the realised values. We hope that will remain the case as it will mean that weekly death tolls are falling. Our results could also allow the monitoring of excess deaths, if any, which may appear later as a result of the actions taken to control the virus. In this, Sweden will serve as a useful control case.

The approach we have used is exactly the same one we have used successfully to measure market risk (and by which we predicted the major drawdowns in equity markets in March of this year).<sup>6</sup>

In previous applications outside of finance, we have successfully predicted flood levels and damage due to hurricanes and to terrorist attacks.

So we were not surprised that our results seem, so far, to be in very good agreement with realised weekly death tolls.

Whether or not that will persist, and at what intervals the analysis should be repeated incorporating new data, will only be known in the future.

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<sup>1</sup> NEW: a lot of data on reported Covid deaths is highly suspect..., John Burn-Murdoch  
<https://twitter.com/jburnmurdoch/status/1254461123753054209>

Global coronavirus death toll could be 60% higher than reported. J. Burn-Murdoch, V. Romei and C. Giles, 26 April 2020, Financial Times  
<https://www.ft.com/content/6bd88b7d-3386-4543-b2e9-0d5c6fac846c>

<sup>2</sup> U.K. Office of National Statistics <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/weeklyprovisionalfiguresondeathsregisteredinenglandandwales>

<sup>3</sup> EuroMOMO Bulletin, Week 16, 2020 <https://www.euromomo.eu/bulletins/2020-16/>

<sup>4</sup> For a simple test that can easily rule out Normality, see A. Cascon and W. F. Shadwick, The CS character and limitations of the Sharpe Ratio, IMCA Journal of Investment Consulting, Vol 8, No.1, Summer 2006 pp 36-52.

<sup>5</sup> In the 15 May 2020 update we have given the unconditional frequencies for exceedances, as these are the ones needed to make contingency plans. In the original article we gave frequencies conditional on being above average.

<sup>6</sup> Accidents Waiting to Happen — the U.S. Equity Market, 13 January 2020 and Accidents Waiting to Happen Update U.S. Equities, 31 March 2020. <https://www.omeganalysis.com>

<sup>7</sup> Coronavirus and the Stats. Your Questions Answered. Intelligence<sup>2</sup>, 23 April 2020.  
[https://goto.webcasts.com/viewer/event.jsp?ei=1308078&tp\\_key=4e676e55f5](https://goto.webcasts.com/viewer/event.jsp?ei=1308078&tp_key=4e676e55f5)

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### Appendix - The Data Sets

The first data set we obtained was the U.K. weekly deaths for England and Wales. This was chosen in part because Omega Analysis Limited is based in England. And also, in part, because we had heard a discussion of the U.K. Corona Virus statistics<sup>7</sup> during which only one of the expert panellists (John Ioannidis) understood that the variability in the weekly deaths data meant that no conclusions could reliably be drawn from simple comparisons with averages.

Sweden was chosen because it appears to be the only developed country which has decided not to shut down its economy to fight the virus. Unfortunately it provides only a weak comparison to countries such as the U.K. and the Netherlands which have much higher population densities. Statistics Sweden has published daily and weekly data from 2015 and very kindly provided us with weekly data back to 2000.

Denmark was chosen as a natural comparator to Sweden, but one which has substantially shut down its economy.

Finally the Netherlands was chosen as a second example of a country with high population density.

In each case we have also tested our estimates out of sample within the data series using a previous high so that we could compare our predictions with the subsequent realised data. The data from 2020 were kept out of sample for all of our calculations.

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