

Model Error for Exponential

Ioannidis, dangerously ignorant

WP, Ap 9 2020, Zakaria: Stanford's John Ioannidis, an epidemiologist who specializes in analyzing data, and one of the most cited scientists in the field, believes we have massively **overestimated** the fatality of covid-19. "When you have a model involving exponential growth, if you make a small mistake in the base numbers, you end up with a final number that could be off 10-fold, 30-fold, even 50-fold," he told me.

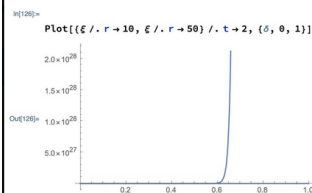
That ignorant John Ioannidis said that things that grow exponentially AND are subjected to huge errors can lead to... underestimation. **He did not get that uncertainty model error WORSENS the bad outcomes.**

The intuition is that an exponential is convex to the rate of growth: simply $\frac{d^2 \exp(t)}{dt^2} = e^t$, and that for all derivatives that remain exponential. Consider the error rate δ . The bias from the error assuming half the time $r(1+\delta)$, the other half $r(1-\delta)$ is ξ , from Jensen's inequality.

$$\xi = \frac{\exp[r(1+\delta)t] + \exp[r(1-\delta)t]}{2 \exp[rt]} - \exp[rt]$$

$$D[\xi, \delta] = \frac{1}{2} e^{-rt} [-e^{r(1-\delta)t} r t + e^{r(1+\delta)t} r t]$$

which is positive.
And his error is explosive.



$\ln[\cdot] :=$

$\text{Out}[\cdot] :=$

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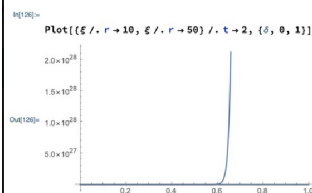
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Bias from assumption is given as ξ .

Nassim Nicholas Taleb @nntaleb

John Ioannidis does not get that model uncertainty **WORSENS** possible outcomes under exponential growth & should lead to **MORE** reaction. Dangerous ignorance. Here is a derivation from Jensen's ineq.

10:26 PM · Apr 11, 2020

41 248 822 108

Post your reply

Nassim Nichol @ · Apr 11, 2020

More elegant. It is hard to live on a planet where the most cited person in epidemiology, John Ioannidis, doesn't understand exponential, hence multiplication. Yet he tries to make policy.

$$\xi = \frac{\exp[(1+\delta)t] + \exp[(1-\delta)t]}{2 \exp[t]} - \exp[t] = \cosh(\delta t)$$

$$\frac{d\xi}{d\delta} = t \sinh(\delta t)$$

15 78 323 11

Bruno Vt @Bruno · Apr 12, 2020

Thanks Nassim!! Also, Lombardy outbreak - including detail info by provinces, municipalities and ages- conclusion can now be estimated much more precisely, so CFR points to 1% as original

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```
In[ ]:=  $\xi = \frac{\text{Exp}[r (1 + \delta) t] + \text{Exp}[r (1 - \delta) t]}{2 \text{Exp}[r t]}$  // FullSimplify
```

```
Out[ ]:= Cosh[r t  $\delta$ ]
```

Take rate of change of this.

```
In[ ]:= D[ $\xi$ ,  $\delta$ ] // FullSimplify
```

```
Out[ ]:= r t Sinh[r t  $\delta$ ]
```

```
In[ ]:= Plot[{ $\xi$  /. r -> 10,  $\xi$  /. r -> 50} /. t -> 2, { $\delta$ , 0, 1}]
```

