SUPPLEMENTARY MATERIAL

Novel coronavirus (2019-nCoV) early-stage importation risk to Europe, January 2020

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This text provides computation details of the methods illustrated in the main paper, and a plot of additional results.

Computation of the probability of importing at least 1 case in Europe

Considering a given infected area in China acting as seed of exportation, p_{EU} is the probability that an individual travels from that area to Europe computed on the travel flows. If x cases are exported, the risk of importation of at least 1 case to Europe is computed as $1-(1-p_{EU})^x$.

Computation of the probability of importing 1 case in Europe except France, conditioned to observing 3 imported cases in France

Let us define:
n : number of cases exported from China;
m : number of countries in Europe with detected cases;
$\vec{x}$: m-dimensional vector encoding the number of cases in each European country with detected cases;
$c=\sum_{j=1}^{m} x_j$: number of detected cases imported to Europe;
$\vec{p}$: m-dimensional vector encoding the importation probabilities in each European country with detected cases;
$g=\sum_{j=1}^{m} p_j$: probability of importing to any of the m countries;
q : probability of importing to Europe except the m countries;
y : cases potentially imported to Europe except the m countries.

We need $P(y|\vec{x})$. We decompose it as follows, and compute separately the numerator and the denominator:

$$P(y|\vec{x}) = \frac{P(y,\vec{x})}{P(\vec{x})}$$

Both numerator and denominator come from multinomial distributions. The distribution for the denominator is $(m+1)$-dimensional: probability of importing to one of the m countries, and probability to import somewhere else. The distribution for the numerator is $(m+2)$-dimensional: probability of importing to one of the m countries, to import somewhere to Europe except the m countries, and probability to import somewhere else.
Putting these together, we get

$$P(y|\vec{x}) = \binom{n-c}{y}\left(1-\frac{q}{1-g}\right)^{n-c}\left(\frac{q}{1-g-q}\right)^{y}.$$

Setting $y = 0$, we can compute the probability of having at least one case as

$$P(y>0|\vec{x}) = 1-\left(1-\frac{q}{1-g}\right)^{n-c}.$$

Country-specific importation risk vs. country population size

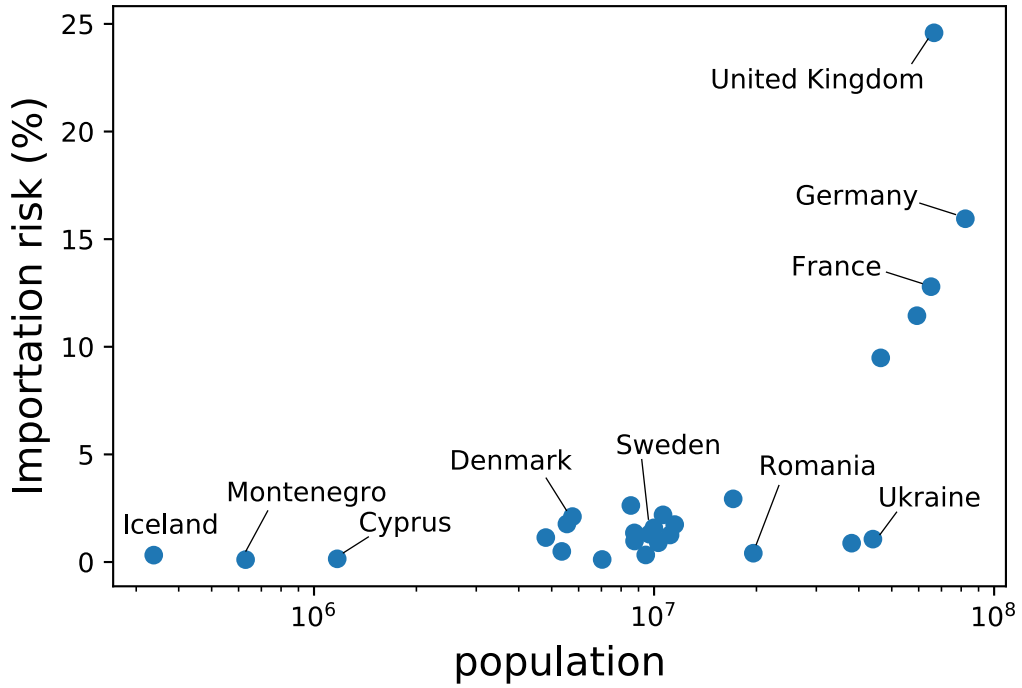

FIGURE S1: The estimated country-specific importation risks are shown as a function of the country population sizes.