Economists develop computer model for coronavirus measures

July 29 2020

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How do the restrictions imposed by the coronavirus crisis impact the economy? What measures are suitable to minimize the number of people infected and killed by SARS-CoV-2? And how are these two dynamics related? Academics at Bielefeld University have investigated this and now published their findings in a study. Using a computer model with

high predictive power, they simulated how the virus spreads and the effects of different containment measures—both on gross domestic product and unemployment figures as well as on the number of people infected and those who die of COVID-19.

Professor Dr. Herbert Dawid from the Faculty of Business Administration and Economics has been conducting research for decades on computer-based models with which he examines the dynamic effects that very different changes in the economic environment and political measures have on the economy—so it was only logical for him to also devise a model for the coronavirus crisis. At the same time, it fills a void: there are lots of models that can be used to simulate the impact of different containment measures on the economy—and studies that deal with the spread of SARS-CoV-2. "But there are hardly any studies that combine both aspects," says the economist. Yet it is important to consider these two factors together: "It is not just that a lot of containment measures have economic consequences," says Dawid. "By the same token, economic activities can also contribute to the spread of the virus."

To model the spread of the virus, the researchers employed established epidemiological models. From an economic perspective, the model includes one public and three private sectors as well as households with varying age structures. Individual behavior is also taken into account. The channels for spreading the virus are work, shopping, and private meetings.

In their model, the academics first simulated measures to get the spread of the virus under control. There are various ways of doing this, including those that have no effect on economic activity, at least in the model. These include, for instance, more people working from home. The aim of the simulation is always to ensure that the number of infected persons does not rise above a threshold at which the existing

number of intensive care beds is no longer sufficient.

This was almost impossible to achieve in the study with such "soft" measures alone. A very strict lockdown proved necessary, accompanied by the closure of shops, for example—similar to what happened in Germany. This naturally impacts on the economy accordingly. "With regard to the intensity of a lockdown, the fact is that politicians have to strike a compromise between a decline in economic activity and mortality due to the virus," says Dawid. In the model at least, an early lockdown over several weeks, which greatly reduces the number of infections, has proved to be beneficial under these circumstances. "If, on the other hand, the measures are only carried out for a short time, there is always the risk that there will be second wave of infection and everything will be locked down again," says Dawid. This would not only result in an increase in the virus mortality rate, but also in the overall economic loss.

The model also simulates the reopening phase after a lockdown. This raises questions for politicians: when should they end a lockdown? Which restrictions should be lifted immediately, which bans should continue to apply for the time being? What additional individual prevention measures are appropriate to contain the spread of the virus? The authors of the study recommend that after a long lockdown, such as that in Germany, a full relaxation of restrictions should be allowed quickly—provided the number of infected persons per week does not rise above five per 100,000. "However, this only applies if the relaxation is flanked by individual prevention measures," says Dawid. If it is not possible to uphold measures such as keeping a distance or continuing to wear masks to the same extent as during lockdown, Dawid advises a more cautious relaxation. "We believe that everything—from shops to sports clubs—should reopen quickly if the supplementary measures reduce the risk of infection when meeting infected people by an average of around 60 percent," says Dawid. "Failing this, a slow reopening would

be more appropriate." Otherwise, there is a risk that the virus will return and a second lockdown become necessary—not only with more deaths, but also with corresponding economic consequences.

Economic support policies have also proved to be important. "Regardless of the form the restrictions take, our simulations have shown that complementary economic support measures make sense," says Dawid. "They considerably reduce the decline in gross domestic product, but do not increase public debt in the long term." Possible measures include, for example, a short-time work scheme and supporting companies that get into economic difficulties as a result of the containment measures.

The academics have compared the model with data on past developments in Germany. The model was able to reproduce the German figures for the 63 days between 9 March and 10 May 2020 in terms of economic and virological data. This comparison with the German figures shows that the model is reliable. "We consider the model to be very suitable for understanding and predicting the spread of an infectious and potentially fatal virus and its consequences for the economy," says Dawid.

Furthermore, the model can equally be applied to other countries. "Of course, this means changing a few parameters, but that is easily done," says Dawid. These include, for example, the age structure of the population, the economic conditions and, in particular, the number of intensive care beds. Should there ever be a pandemic with a different virus, the model could also be helpful for predicting the consequences of political measures. "In that case, we would have to modify the infection probabilities and age-related case fatality rates accordingly," says Dawid.

More information: Basurto et al., Economic and epidemic implications of virus containment policies: insights from agent-based simulations. (2020). DOI: 10.4119/unibi/2944282