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Economics lessons

The economic turmoil of 2020 seems likely to continue into 2021, putting economics at the forefront of discussions. But what can physicists learn from economists?

2020 was a year of economic turmoil in many parts of the world — and 2021 promises much of the same. In the UK, the full effects of Brexit remain to be seen, but already the COVID-19 crisis has led to an overall 8% loss in GDP from February to October 2020, and a re-alignment of the economy, with the tourism sector decimated, but postal and courier activities growing[1]. But apart from these obvious reasons to take an interest in economics, what else can physicists learn from it?

At first, this may seem like a strange question to ask. To be sure, both disciplines make use of mathematical modelling. But physics, for all its breadth, is a natural science, whereas economics is a social science. However, the broad historical sweeps of the two disciplines have some intriguing parallels.

Both disciplines traditionally aim at quantitatively understanding systems by abstracting away layers of complexity to reveal a tractable core. In physics, this venture involves designing tightly controlled experiments. For instance, in fluid dynamics, understanding turbulence remains a major challenge, but much has been achieved by using wind tunnels to study flows in smooth and regular pipes, which suppress phenomena that would arise from roughness or pressure gradients and allow 'canonical' wall-bounded turbulence to be observed. In economics, analytical tractability was obtained by assuming that agents are rational and have full information to use in their aim of maximizing profits. This approach, known as neoclassical economics, has successfully led to a body of work describing how the economy works when it is in equilibrium, that is, when no agents have an incentive to change.

The assumptions of neoclassical economics have been increasingly questioned in recent decades. One approach that asks such questions, known as complexity economics, is sketched out by Brian Arthur in a Perspective in this issue. Complexity economics deals with the questions one can ask and answer assuming that economic agents do not have full information and are allowed to meaningfully differ from one another. Arthur argues that although such models are more difficult to study, and typically require computer simulations rather than analytical approaches, the gain in realism is worth the cost.

In physics, there has often been a culture of studying idealized models in the search for mathematical elegance, in which studying realistic systems is seen as 'engineering'. Yet there are limitations to what a clean experiment or an idealized model can tell us. In the example of fluid dynamics, although experiments on canonical flows have shed light on turbulence, the phenomena that are suppressed for the sake of an interpretable experiment are exactly the phenomena that exist in the 'real world'. It has been suggested that "we may have reached a point of diminishing returns in studying canonical flows" and that a more fruitful approach will be to find questions to ask and answer about more complicated flows[2]. And with the rise of data science and machine learning, there are calls for physicists to step away from models as a guide to what to look for or where to find it and turn to data-driven approaches instead[3].

Data-driven approaches are also on the rise in economics. In a Comment in this issue, Andy Haldane and Shiv Chowla describe how economists are turning to new 'fast indicators' based on big data to observe the economy on much faster timescales than measures such as GDP, which is estimated quarterly. In another Comment, János Kertész and Johannes Wachs discuss how applying network science measures on economic data can reveal the hidden traces of misbehaviour such as fraud and corruption. In a Review in this issue, César Hidalgo discusses how trade data can be used to construct measures that predict how an economy will diversify.

Doubtless some of the techniques developed to deal with economics data will also be relevant for physics data, and vice versa. But the deeper issues about what questions attract research effort are also worth discussing across the disciplines. Both physics and economics have benefited greatly from research programs that focus on what can be cleanly and definitively understood, but both are starting to embrace messier approaches using new tools. As physicists, we should pay more attention to what economists are doing and learn what we can from them. To help continue this dialogue, we are launching a Collection of economics-related articles from *Nature Reviews Physics* and our sister journal *Nature Physics*.

1. Stephens, M., Wright, H. & Luckwell, G. Coronavirus and the impact on output in the UK economy: October 2020. https://www.ons.gov.uk/economy/grossdomesticproductgdp/articles/coronavirusandtheimpactonoutputintheukeconomy/october2020 (2020).
2. Smits, A. J. Some observations on Reynolds number scaling in wall-bounded flows. *Phys. Rev. Fluids* **5**, 110514 (2020).
3. Ourmazd, A. Science in the age of machine learning. *Nat. Rev. Phys.* **2**, 342–343 (2020).