

## **Operational Research in the time of COVID-19:**

### **the 'science for better' or worse in the absence of hard data<sup>1</sup>**

#### **Abstract**

How can policymakers and planners make informed decisions during a pandemic? What kind of (big) data are needed, and who and when is supposed to provide these? With the Operational Research community unable to get hold of reliable hard data – especially during the pandemic, the solutions promoted from analytics seem questionable. We may have to employ instead auxiliary data from social media and rapid market surveys.

**Keywords:** Operational Research; Crisis; COVID-19; Hard Data; Auxiliary data.

## **The context: a devastating contradiction**

Policymakers, planners, and decision-makers during COVID-19 operate in uncharted territory. Operational Research (OR) - the 'science of better', aims to support decision making by equipping them with prescriptive and predictive analytics systems. Be that as it may, analytics do come with a caveat: they need hard data.

To make our challenge crystal clear: the stakeholders who, at the time of crisis need our models and forecasts, are the ones denying us these data. The recipients of our research, unfortunately, have an incentive to conceal such hard data. For instance, if they made all supply chain data available to us, and thus to the wider public, not only they would be risking the disclosing of competitive information, but they would be attesting for the inefficiencies in their organisational systems. This comprises the major predicament in employing OR in times of crisis, a devastating contradiction in fact: those mostly in need of our modelling exercises, are the very ones not providing the hard data.

## **The way forward: a comprehensive repository**

There is, therefore, a huge void: an absence of hard and reliable supply chain data. To fill this, there is an eminent need to create a comprehensive data repository for critical products and services across a wide range of industries. We posit that academia has a key role to play in facilitating this process by securely anonymising and reliably transforming the incoming proprietary data in such ways that industry and government stakeholders only see benefit and no risk in sharing it with us. The times we live in call for a collaborative spirit.

To that end we urge Research Councils and the OR Society to consider this as an eminent priority, now, during the pandemic. This repository could be held and maintained by a consortium of universities<sup>1</sup>, with secure access from all interested stakeholders. It can provide, in one place, the data necessary for forecasting and planning the onset of future supply chain disruptions so that in any future waves our society is better prepared.

---

<sup>1</sup> To that end the team of authors is prepared to take a lead on this and send an open invitation to others who may be willing to contribute and bid for a respective RCUK grant to support the initiative.

## **An interim solution: OR with auxiliary data**

Academics could in the interim rely on auxiliary data, such as google trends, twitter complaints and Amazon reviews (Nikolopoulos et al. 2021). Although such data can be immediately available, they can be inaccurate and do require significant cleaning, thus, inhibiting our ability to use them as reliable sources for forecasting supply chain needs and disruptions during the pandemic.

We provide here an illustrative example of applying OR with auxiliary data: forecasting the national excess demand for critical<sup>2</sup> products. We identify the start of the first wave of COVID-19 as the first day after which the number of cumulative cases continuously increases (in the UK February 27, 2020<sup>3</sup>). We also find the peak of the pandemic for the first wave: for the UK that was May 1, 2020. We can calculate the number of days until the excess demand starts growing for critical products/services, after the start of the first wave. This can be determined from trends in consumers or via real data from respective suppliers from our proposed repository. We can also calculate the difference between the peaks of the two curves, the pandemic, and the excess demand of the product under consideration. This can be negative (due to panic-buying), zero for services peaking at the same time as the peak of the pandemic (for e.g., ICU hospitalizations), and positive for all the services/purchases delayed for after the pandemic (for e.g., elective hospital operations).

For example, demand for pasta in UK reached its peak on 17<sup>th</sup> March<sup>4</sup> while the pandemic had a peak on May 1<sup>st</sup>, so 45 days of difference for pasta in the UK. The demand for groceries is considered stationary before the pandemic<sup>5</sup> so we could also find the excess demand using information from credible news sources (55% increase<sup>6</sup> reported in pasta sales in UK), consumer trends and government announcements. These calculations could be useful for the next wave of a pandemic and inform prompt action from the respective stakeholders: stockpiling, rationing, lockdowns.

---

<sup>2</sup> <https://hbr.org/2020/04/we-need-a-stress-test-for-critical-supply-chains>

<sup>3</sup> Data from <https://coronavirus.data.gov.uk/details/cases>

<sup>4</sup> Figure "Sales of Dairy Products and Fruits and Vegetables Rise in March" in (last access 31-5-2020) <https://www.criteo.com/insights/coronavirus-consumer-trends/>

<sup>5</sup> <https://www.ibisworld.com/united-kingdom/market-research-reports/pasta-product-manufacturing-industry/>

<sup>6</sup> <https://www.ft.com/content/e5e60434-6de7-11ea-89df-41bea055720b>

## And a question for the future

OR with auxiliary data provides a half-baked solution, that inevitably comes with associated risks if it is going to drive important decisions: this for many is better than no solution at all. Without hard data in hand, and in need of immediate modelling with even imperfect information, do our models really provide useful outputs? This leaves us probably no wiser to answer our original question, that future and targeted research in this journal and beyond should try to address: *In times of crisis, is Operational Research a 'science for better' or 'for worse'?*

## References

Nikolopoulos, K., Punia, S., Schäfers, A., Tsinopoulos, C., Vasilakis, C. (2021). Forecasting and planning during a pandemic: COVID-19 growth rates, supply chain disruptions, and governmental decisions", *European Journal of Operational Research*, Volume 290, Issue 1, Pages 99-115.