

**ENAC**

School of Architecture,  
Civil and Environmental  
Engineering

**LEURE**

Laboratory of  
Environmental and Urban  
Economics

**EPFL**



## **Modeling COVID-19 scenarios with a Computable General Equilibrium model**

SIGIT PERDANA, MARC VIELLE

MODELING BRIEF

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## A macroeconomic analysis: an economic recession

The COVID-19 pandemic has led to a severe global economic crisis. By its nature and magnitude, the outbreak runs into an unprecedented exogenous economic shock with detrimental impacts, including on the energy sector. A comprehensive analysis of the economic impacts of COVID-19 requires macroeconomic models in complement to model with the bottom-up approach, such as the energy model. Following the current development of this global situation, some studies dealt with, has become less comprehensive, partial, and outdated.<sup>1</sup> Reformulating the modelling approach thus becomes essential to provide secondary feedback and an updated analysis of this current situation.

In our opinion, the development of scenario analysis in our modelling should incorporate the epidemiological assumptions of the pandemic and the government response, especially the full or partial lockdown strategies. Unarguably, these lockdown strategies, as of today, have the highest economic impacts. The scenario could also have assumed the economic recession will be temporary, and the economic growth will recover to the actual path after an unprecedented downturn. The current global situation probably emerges into three **main** scenarios:

- An optimistic one, with “quick exit” from the pandemic. It relates to the medical treatment of the virus or a vaccine. The economic impacts will be severe, but recovery can be expected in several years.
- A less optimistic scenario, with a high deathly case, especially in developing countries. There is a significant economic disruption with economic recovery in one decade.
- A very pessimistic scenario. It represents the recurrent waves of the pandemic, significant economic disruptions, and recovery after several decades.

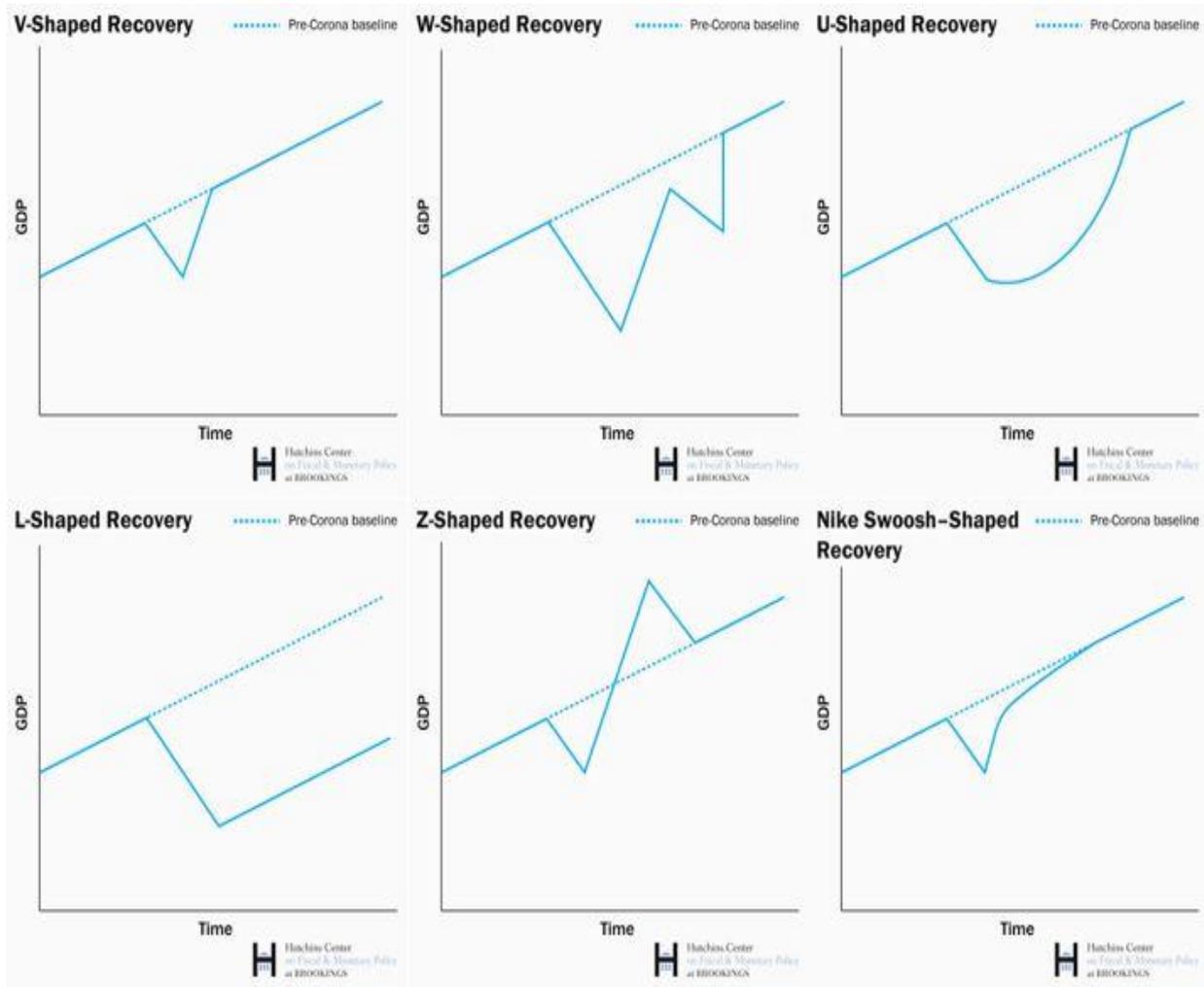
Modeling these scenarios in macroeconomic models requires to impose several exogenous shocks, followed by assumptions on the dynamic profile of the recovery phase. The conjuncture of the shocks and the recovery periods could be diverse. Based on the recent study of Criqui (2020), the curvature of dynamic recovery periods should depend on the pursuit of (de) globalization, level of international cooperation, and ecological transition.<sup>2</sup> Figure 1 illustrates these.

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<sup>1</sup> See W. McKibbin and R. Fernando (2020) *The Global Macroeconomic Impacts of COVID-19: Seven Scenarios* CAMA Working Paper No. 19/2020 and *Economics in the Time of COVID-19* Edited by R. Baldwin and B. Weder di Mauro (2020). This paper offers a preliminary analysis of COVID-19 and macroeconomic impacts in China and the world. Yet it has not been fully representable in the current situation with Europe's humongous number of cases and the USA as the new epicentral of this pandemic.

<sup>2</sup> Available at: <https://www.enerdata.net/publications/executive-briefing/economic-energy-climate-scenarios-after-covid.html>. Under these assumptions, this study classifies the long-term future paths of economy and energy into four tentative scenarios. We briefly address these scenarios on the subsequent section to discuss the long term implication.

**Figure 1: Possible Pathway of Economic Recovery Profiles Post Covid-19**



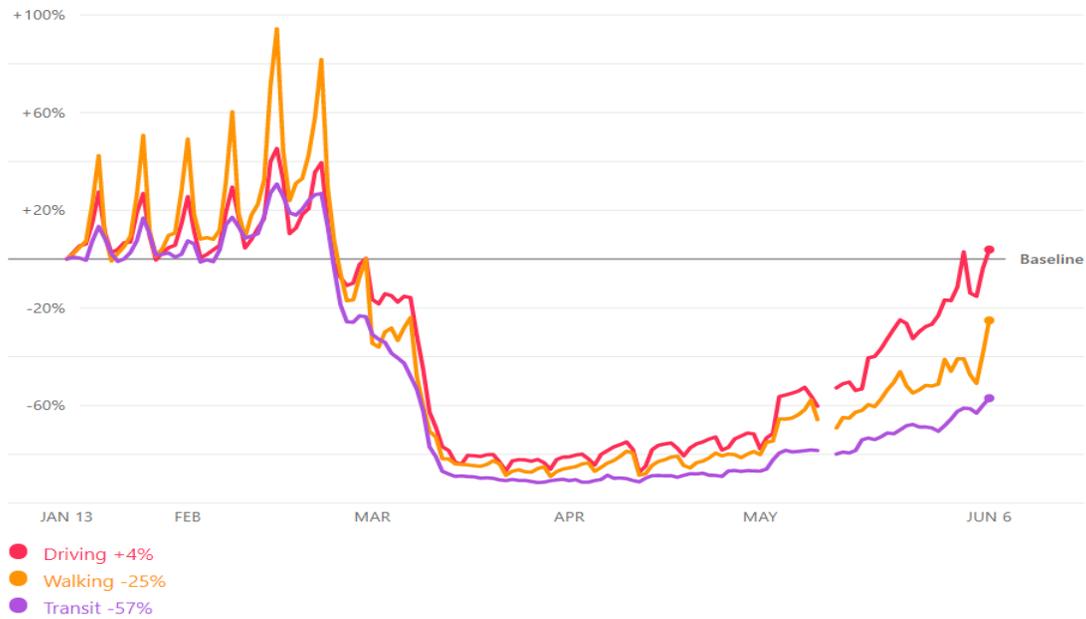
source: Criqui (2020)

In representing these recovery profiles, some leading (proxy) indicators, such as mobility trends and changing in electricity consumption, could be used to calibrate. For the mobility trends, a complete dataset from Apple is potential for its features on daily changes of mobility trends for countries/ regions, sub-regions, and cities.<sup>3</sup>

Figure 2 exhibits the changes in mobility trends in the case of Italy, recorded from this application. Figure 3 illustrates the changes in electricity consumption.

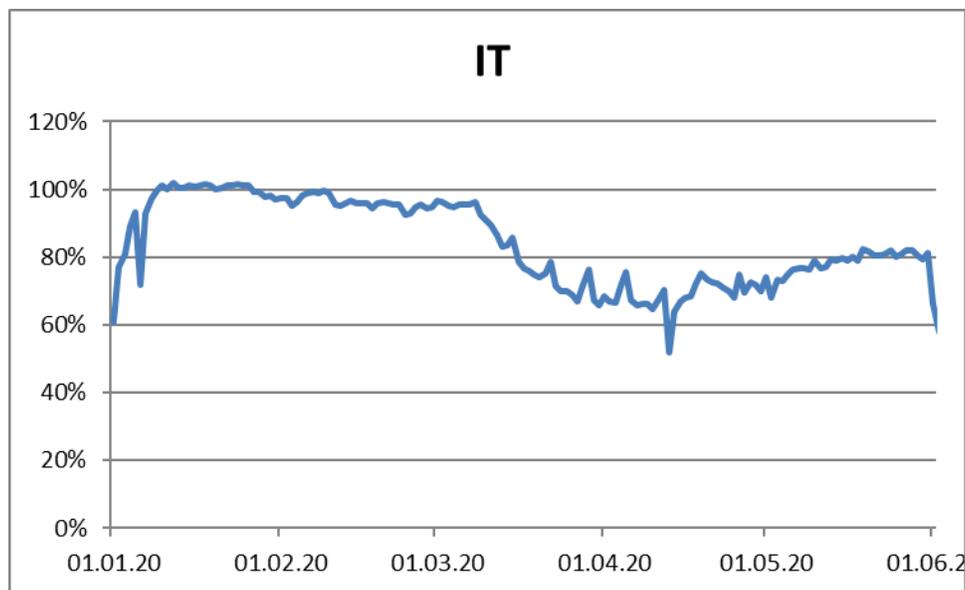
<sup>3</sup> <https://www.apple.com/covid19/mobility>

**Figure 2:** Italian mobility trends from January to June 2020 (Driving, Walking & Public Transporting)



source: Apple (2020)

**Figure 3:** Italian daily electricity consumption from January to June 2020



source: Moulinier (2020)<sup>4</sup>

<sup>4</sup> Jean-Marc Moulinier: *Estimation de la perte d'activité économique due à l'épidémie COVID 19 et de la reprise.* (2020)

Following this, the calibration of the parameter is highly uncertain and requires an in-depth analysis at the regional level and sectoral level. These parameters include:

- Epidemiological assumptions: mortality and morbidity rates that will affect health consumption and labor supply.
- Changes in consumption preferences that will directly affect sectorial activities (mostly services such as tourism, accommodation & food service businesses, and aviation).
- Economic lockdown that creates a supply shock (loss of productivity) followed by a demand shock. In a long-term perspective, including the recovery period, it will undoubtedly affect investment decisions and capital allocation.
- Government responds to:
  - a. the pandemic itself, some countries succeed to avoid intense lockdown (e.g. Taiwan and South Korea),
  - b. the economic crisis through fiscal policies to firms and households.

### **Impacts on the energy sector and the risk of downgrading climate change priority**

The impact of this current crisis is mainly channeling through a decrease in energy demand. The onset of COVID-19 has resulted in the fall of international oil prices in just a few weeks while increasing speculation on the period to stabilize. The decrease in energy demand, however, will have a negative impact on CO<sub>2</sub> emissions in the short term.<sup>5</sup> But in the long run, the impacts are all rather uncertain. The fall on fossil energy prices and the drop in investments induced by the recession would probably postpone investment in renewable and energy savings.

The economic crisis would probably put some existing priorities like the Green Deal below the recovery plan target. In line with this, the European Commissioner for the economy Paolo Gentiloni points out that the European priorities now are saving lives, saving jobs, and saving companies. The other priorities will come after.<sup>6</sup> The latest declaration of 10 European Climate and Environment Ministers is fully aware of this possibility and asked the Commission to start working on a comprehensive EU recovery plan integrating the green transition and digital transformation.<sup>7</sup>

Economic recovery will also become the main priority for Asia. Production contracted sharply in most Asian countries as the pandemic paralyzed the economic activities across the globe. Following China, the export of Japan and South Korea falls sharply since last month.<sup>8</sup>

The impacts on other developing countries are also highly uncertain. The healthcare system is less reliable relative to developed economies; thus, this crisis is disproportionately deteriorating the social and economic aspects over months and years to come. Easing the economic impacts

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<sup>5</sup> Carbon Brief suggests that the coronavirus could trigger the largest ever annual fall in CO<sub>2</sub> emissions in 2020, their first estimate is a decrease of 1'600 Million tons of CO<sub>2</sub>.

<sup>6</sup> Bruegel Podcast: Answering the concern about the EU Green Deal.

<sup>7</sup> See declaration of 10/04/2020.

<sup>8</sup> <https://www.weforum.org/agenda/2020/04/asias-factory-activity-coronavirus/>

by giving more social protection across society, providing food security, and better healthcare will be the main priority.<sup>9</sup>

### Long Term Implication

Behind this economic recession, one fundamental question that emerged is on the structural impacts of COVID-19. Undeniably, the crisis has affected our way of living and perspective on development. These changes are likely to be persistent. The Green Deal essentially could capture these effects, such as relocation of economic activities and reversal of globalization. But some changes, such as travel restriction or control on the movement of people, will go to a more questionable direction. Designing the new energy system that fits with these structural impacts will require critical thinking.

Following the recent data analysis and possible recovery pathways of Criqui (2020), we could use this study as a preliminary reference. There are four tentative scenarios for the future economy and energy sectors. Assuming the different levels of globalization, degree of international cooperation, and ecological transition. These scenarios are illustrated in a matrix below (Table 1).

**Table 1:** Scenarios typology of a post-Covid19 futures

	<b>Deglobalisation</b>	<b>Cooperation</b>
<b>Return to the status quo</b>	1. Every man for himself. Growth profile V then W?	2. Save the whole ship. V (or Z)
<b>Ecological transitions</b>	3. Back to the territories. U or more likely, L	4. New Green Deal. U

*source: Criqui (2020)*

Amongst these, only scenario 4 conveys the returning of the international coordination, the importance of energy acceleration, and the significance of ecological transition. The trajectory of the recovery pathway will be in U shaped, which represents longer, gradual, yet steady economic transition. It represents a New Green Deal scenario that outlines the global policy directions to deal with the global warming issue and the global financial crisis due to this pandemic.<sup>10</sup>

<sup>9</sup> It is predicted that high mortality rates in some developing countries give excess burden for recovery post-crisis. The poverty will increase, and the need of international cooperation and financial support would be crucial.

<sup>10</sup> <https://climateactiontracker.org/publications/addressing-the-climate-and-post-covid-19-economic-crises/>.