COVID-19 effect on the research-innovation-commercialisation phenomena

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Abstract: The COVID-19 epidemic and the policy response is disrupting life around the world, with significant impacts also on the economy. This economic downturn will impact R&D expenditure, and therefore, on innovation and commercialisation. Apart from specific sectors that could receive more funds, for example, pharmaceuticals more than health, surveillance and defence, communications, digital markets, and distant education, investments in every other sector are expected to plunge. The opportunity to innovate and commercialise new products, process, or methods in a free market economy is expected to follow the dropping investments.

Keywords: research and development; R&D; innovation; commercialisation; gross domestic product; GDP; COVID-19 measures.

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1 Introduction

The 2019 coronavirus epidemic (COVID-19) is ongoing since December 2019, when the outbreak was identified in Wuhan, China. As per 29 April 2020, the number of reported coronavirus cases in need of medical attention is 3,139,588, and the number of deaths is 218,024. Opposite to other viral epidemics such as SARS, MERS, or Ebola, it has affected so far mostly Western Europe and the USA than every other geographical area of the world. The way to address this epidemic has been characterised so far by strong political motivations. No specific antiviral or vaccine is available for COVID-19. Almost certainly no specific antiviral or vaccine will be available in 2020. Restrictive policies
have caused dramatic changes in society, bearing large economic effects. Entire sectors have been shut down or forced to operate at reduced capacity.

Demand for merchandise and services have radically diminished. Lockdowns and limitations on import/export have not only increased the costs of producing and trading but often prevented the supply of goods or services. Import/export of goods such as food or medical supplies has been banned. Complex value chain production has been interrupted by the shortage of components produced overseas (Gopinath, 2020). Despite large-scale fiscal and monetary interventions, economic indicators have dropped to record lows in the USA, Europe, and China (Evenett, 2020).

Figure 1  The R&D expenditure 1996 to 2018 in % of GDP from the World Bank (see online version for colours)

Source: Credit UNESCO institute for statistics

Research and development (R&D) and innovation are different concepts, however, they strongly linked each other where R&D is based on investments and transforms these investments into knowledge. Innovation then creates business opportunities out of this knowledge, defining new products, processes, or methods based on new knowledge. R&D is a component of the innovation cycle, situated at the very front end. R&D produces knowledge. Innovation transforms this knowledge into ideas generating products, processes, or methods. Innovation ultimately gives economic value to a nation or multi-national group knowledge through commercialisation, that is the process of transforming products, processes, or methods into greater wealth for national or multi-national businesses, and ideally and theoretically for the society at large. Commercialisation is also a component of the innovation cycle, situated at the very back end, and it is by profit motives in an ideally free market. Thus, R&D is a way to increase the economic growth and productivity of a nation, and this is the reason why countries invest in R&D. This is often an indication of the dedication of a country to science and technology, but the fields of application of R&D, innovation, and commercialisation are much wider than that. Intuitively, R&D expenditure and gross domestic product (GDP) are interrelated. Few studies have analysed the impact of R&D expenditure on the GDP of a nation, or even the impact of the GDP on the R&D expenditure. The gross domestic expenditure on R&D (GERD) represents the effort of a country to support R&D. This is the percentage of the GDP spent to support R&D. The world average is shown in
Figure 1. Data are from the World Bank. Across the world, the R&D expenditure has been growing since 1996 from about 2% to the latest 2.2% of 2018.

Figure 2  Geographical indicators for R&D expenditure across the world, (a) R&D expenditure* (b) the number of researchers per million people** (c) GDP per capita*** (see online version for colours)

There are many other criteria to consider. Figure 2 presents the number of researchers per million people, the GDP pro-capita, and the share of the GDP spent on R&D from ourworldindata. The countries with the larger GDP pro-capita also have the larger number of researchers per million people, also because they invest a large portion of their GDP in R&D, that is the reason why their wealth is larger (resource-rich nations are sometimes the exception rather than the norm). Those who spend more in R&D of their GDP are those who may excel in innovation and commercialisation in a free market. The latest (2015) world average is 2.23%. Above-average are the USA 2.79%, Switzerland (2012) 2.97%, Sweden 3.26%, South Korea 4.23%, Japan 3.28%, Israel 4.27%, Germany 2.88%, Finland 2.90%, Denmark 3.01%, Belgium 2.46% or Austria, 3.07%. China is about average at 2.07%, the same as Australia (2013) 2.20%. Because of the critical mass, smaller countries must be involved more deeply into R&D that much larger countries such as China, or the USA, to have their share of the innovation and commercialisation process even in a hypothetical free market that is however not always the case. South Korea, Sweden, Finland, or Israel are good examples of more widespread or niche innovation supremacy of medium or small countries.

This is roughly the situation at the start of the COVID-19, with however to mention the slowing down of the Chinese economy and the growing trading tensions between China and the USA.
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Figure 3  Total confirmed daily COVID-19 deaths per million, (a) all the countries, (b) selected countries of Western Europe (Italy, Switzerland, Austria, Germany, France, Belgium, the UK) plus the USA and South Korea (see online version for colours)

Source: Images reproduced modified from http://ourworldindata.org/grapher/covid-deaths-days-since-per-million, European CDC, credit OurWorldInData.org, CC BY
At present, despite European countries with harsher or more relaxed distancing and lockdown practices have had about same epidemiologic patterns (see Figure 3), with much smaller peak daily death rates per million than the model predictions, and reached much quicker than in the model predictions, the future is uncertain. Adam (2020) and Ferguson et al. (2020) predicted a peak daily death rate per million of 210 for the UK and 170 for the USA after more than two months since the outbreak, while Figure 3 suggests that usually, at the most, the peak daily death rate per million is about 10, with the remarkable exception of Belgium that has the world largest at 28.8. Remarkably, without harsh distancing like neighbouring Belgium, the Netherlands has managed to contain the peak daily death rate per million at below 9. If the measured course of the outbreak has been so far the one depicted in Figure 3, nevertheless return to normality is extremely difficult to be forecasted, for the complex interactions between pure health and political issues. This makes every economic prediction difficult and subjected to continuous revisions. Within this scenario, we will try to forecast the downtrend in R&D, innovation, and commercialisation due to the economic downtrend caused by the prolonged lockdown and distancing measures promoted by corporations in Western Europe and the USA and their ‘philanthropic’ foundations.

2 Concept development

As COVID-19 impacts on the GDP, and the GDP impacts on the R&D spending, then affecting innovation and commercialisation, it is expected that R&D, innovation and commercialisation will suffer considerably for COVID-19 during the year 2020, with effects that will last for many more years. Apart from specific sectors that could receive more funds, for example, health, drugs and vaccines development, surveillance, defence, communications, digital markets, or distant education, investments in every other sector is expected to plunge, and with the reducing investment the opportunity to innovate and commercialise new products, process or methods will certainly reduce.

Among the many regrettable effects of COVID-19, there is an impact on international trade [Bekkers et al., 2020; World Trade Organization (WTO), 2020a, 2020b]. The World Trade Organization (WTO) developed a range of scenarios to simulate the future trends for the GDP. The WTO issued short-term forecasts of trade under three different scenarios, optimistic, neutral, or pessimistic. Trends were computed for the various regions of the world and then for the world average. The outlook for 2020 is miserable, with a decline in trades of 13% to 32%. Some recovery is only expected in 2021. This recovery will be determined by the duration of the outbreak, and the efficacy of the health policies and political responses to restore near-normal conditions and promote the recovery.

The downturn may be even worse than the depicted, as western European countries are still far from any plan of restoring normal conditions. The WTO expects that all the regions will suffer of a significant decline in trade volumes in the year 2020, with the exports from Asia and North America expected to be affected much harder. The sectors expected to fall more are those with complex value chains, services, and trading of merchandise. Because of the slowing economic growth, well evident before the onset of the COVID-19 crisis, and the trade tensions between China and the USA, the value of world exports of merchandise decreased by 3% in 2019, while the value of commercial services exports increased by 2% in 2019.
Economic prediction is extremely difficult, as many complex and interrelated factors are affecting the result. This includes the open question of how long the strict measures for social distancing and border control measures will stay in place (Baldwin and Tomiura, 2020).

Figure 4  Trend for merchandise trade volume, from 2000 to 2022 (index of 2015 = 100)  
(see online version for colours)

Notes: Trends 1990 to 2008 and 2011 to 2018 superimposed to the consolidated data (blue solid line). Forecasted values for optimistic and pessimistic scenarios represented with blue dotted lines.

Source: Credit: WTO. Image reconstructed from http://www.wto.org/english/news_e/pres20_e/pr855_e.htm

As shown by the WTO trend line for the trade of merchandise (Figure 4), before and after the ‘global’ financial crisis of 2008–2009, the prior growing trend never returned. The growth for the trade of merchandise 2009 to 2019 was the result of the growth of China, India plus some liberalisation efforts rather than the complete recovery of Europe and North America.

Figure 5 shows the trade growth, the GDP growth, and the ratio of the two (trade elasticity). In the 1990s the trade elasticity was often more than 2. The average from 1990 to 1999 was 2.28. From 2000 to 2008, the average was 1.73. During the financial crisis, the trade elasticity jumped to 6.3 in 2009. After the financial crisis, the trade elasticity has been on average 1.2 from 2010 to 2019. However, since 2015 it was mostly below 1, with the only exception of 1.5 in 2017, and 1 in 2018. In 2019, before the COVID-19 pandemic, it was already 0. Before the ‘global’ financial crisis of 2008–2009, the factors driving the growth of trade already decelerated. From 2006 to 2008, the GDP growth, as well as the investment growth were declining. Before the COVID-19 financial crisis, similar decelerations were already evident. Investments demonstrated a considerable weakness after the ‘global’ financial crisis of 2008–2009. Similarly, the liberalisation efforts also slowed, while the political uncertainty increased. This novel health, political, and financial crisis, occurred during a more significant slowdown of trade than the one
that occurred 2006 to 2008. From 2017 to 2019, the slowing of trade was evident, as the result of growing political uncertainties and slowing down of the economy, after an incomplete recovery from the ‘global’ financial crisis of 2008–2009.

**Figure 5** (a) Trade growth, and GDP growth (b) Trade elasticity (see online version for colours)

COVID-19 is thus adding significant political instability and significant economic downturn to an everything but an optimistic situation. Forecasting is done based on assumptions about the progression of the disease that are extremely difficult to make, but
more than that assumption about the political changes that are by far even more challenging.

Existing GDP forecasts in 2020 do not reflect yet the effects of the COVID-19 epidemic.

The WTO built three scenarios due to the uncertainty about epidemic evolution and containment measures.

In the WTO optimistic scenario, the containment measures are enforced for a quarter of a year. After these three months, there will be a V-shaped recovery. We know already this supposition that is not right.

In the WTO intermediate scenario, the containment measures are enforced for a half year. After these six months, there will be a U-shaped recovery.

In the WTO pessimistic scenario, that is, however, turning out to be everything but pessimistic, the containment measures are enforced for the whole year. After the 12 months, there will be a L-shaped recovery. In this scenario, the recovery will happen in 2021 and will be only partial.

There is already in between the different opportunities an even worse scenario to consider, as some containment measures are expected to be maintained much longer than the end of this year.

The WTO model depends on the hypothesis for the rise in the costs of trading and decrease of supply of labour and both supply and demand particularly in the segments most influenced by the containment measures. The fall of the GDP is 5% in the V-shaped optimistic scenario. It is 11% in the L-shaped pessimistic scenario. The fall of trade is likewise 8% in the V-shaped optimistic scenario and 20% in the L-shaped pessimistic scenario. We already know it may also be worse than the most pessimistic scenario considered by the WHO. These are the various potential directions for the COVID-19 financial crisis as indicated by the WTO. Likely, the actual developments will be out of this range of opportunities, unlikely on the ‘up’ side, more likely on the ‘down’ side.

3 Closing remark

Predictions are difficult to be made, as the COVID-19 pandemic is also being used for political reasons, and the further evolutions are not only linked to the purely medical developments. The length of the medical emergency and the enforcement of containment measures are still impossible to be predicted.

The WTO has anticipated world trade to fall by something in the range of 13% and 32% in 2020 as the COVID-19 pandemic disturbs normal economic activity and life around the globe. Regarding these predictions proposed only a few weeks ago, likely the impact will be even worse than the worst-case scenario considered. The sharp decline in the GDP will impact the R&D expenditure, as it has always been the case, and therefore innovation and commercialisation. Apart from specific sectors that could receive more funds, for example, health, drugs and vaccines development, surveillance, communications, digital markets, distant education, investments in every other sector is expected to plunge, and with them the opportunity to innovate and commercialise new products. The future for research in 2020 does not look bright at all.
References


Websites

http://ourworldindata.org/grapher/covid-deaths-days-since-per-million.