Chapter

20

It is not the virus that circulates, but people.

Professor Didier Pittet

Nobody is safe until everybody is safe.

Popular saying

Economics of Covid-19

Chapter Contents

Introduction

The Covid-19 pandemic is one of those historic events that change the world. It has affected every human being, killed more than a million at the time of writing and disorganized everyday life in every country. The pandemic also provoked a deep economic crisis nearly everywhere. This crisis is unlike anything we have seen. Yet, it is not difficult to understand it with the usual tools of economic analysis, which is what this chapter aims to explain.

It starts with a brief and simple presentation of epidemiological principles. We then look at the macroeconomic impact of the pandemic and provide an interpretation of the observed momentous effects. Then we examine the labour market and the impact on firms across industries. The last section provides an overview of the specificities of vaccine development and the challenges of vaccination.

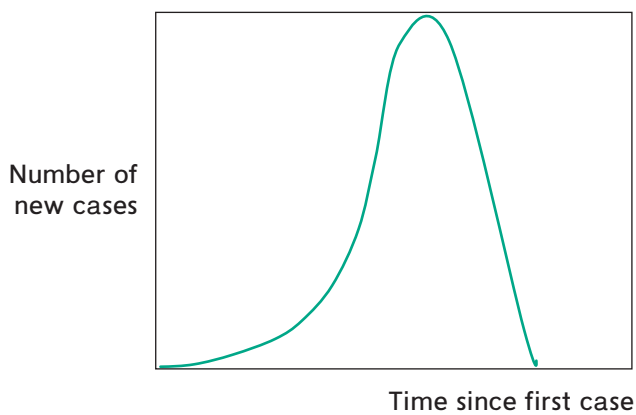
20.1 A brief primer on epidemiology

20.1.1 How pandemics work

A key characteristic of a pandemic is the speed at which it spreads. If every sick person infects two persons, these two persons next infect four others, who go on infecting eight, and so on. Epidemiologists denote the multiplicative factor, here 2, R (for reproduction). This process is known to be exponential, in this example it is doubling at every step. What is special about an exponential process is that it starts affecting very few people, so it may go unnoticed for a while. It becomes noticed when many people are affected and, at that stage, it goes extremely fast. If it takes, say, one week for a sick person to infect two others, then the number of sick people doubles every week. When thousands of people are sick, the weekly additions become overwhelming. With $R = 2$, only 512 people become sick 10 weeks later, but after 20 weeks we talk about a quarter of a million of newly infected people. and a million after 30 weeks.

If the pandemic is left unchecked, no matter how large, eventually the whole population will be infected. It is just a question of time. This is where the (relative) good news comes. The virus needs new hosts to survive because an infected person either becomes immune or dies. As the number of immune survivors grows, contacts between infected and not-yet infected people become less frequent and R declines. Eventually, R becomes less than one, and fewer people are infected every week. We now have exponential decay. It is estimated that when a large fraction of the total population has been infected and is immune, say 60 to 80 per cent, we don't know for sure, the pandemic stops. Epidemiologists call this effect herd immunity. The pattern of infections is described by the epidemiological curve depicted in Figure 20.1.

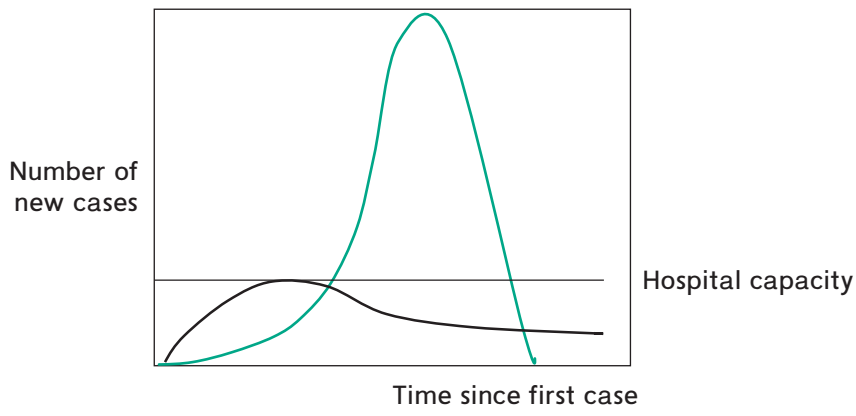
Figure 20.1 The epidemiological curve



The existence of herd immunity is not entirely good news, though. First, when the pandemic is lethal, a number of people will die along the way. Second, while a number of infected people may not feel

sick – these are called asymptomatic cases – others will need to be hospitalized, but hospitals can only take care of so many people. Once the pandemic spreads fast, hospitals stand to be unable to admit all the sick patients who show up, which will raise the number of casualties. This has happened in a number of countries, especially those that were affected early on (China, Italy). For both reasons, it becomes essential to flatten the epidemiological curve, as shown in Figure 20.2. This calls for drastic social distancing measures, including the infamous lockdowns. But herd immunity can be reached otherwise. Section 20.4 presents the alternative: vaccination.

Figure 20.2 Flattening the curve



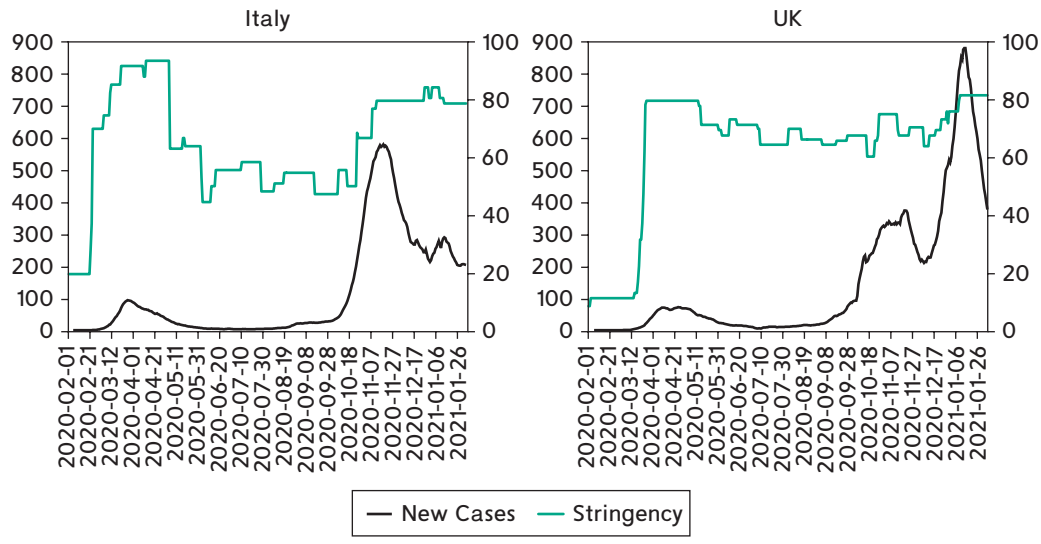
20.1.2 Non-pharmaceutical interventions

In order to flatten curve, we need to reduce *R*, bringing it to below 1 as quickly as possible. Three main factors determine *R*. The first one is inherent to the pandemic: how contagious it is, that is, how often the virus is transmitted when a sick person meets a healthy one. The second factor is how often a sick person comes into contact with a healthy one. The third one is whether it is possible to increase the odds that contact can happen without resulting in transmission. Non-pharmaceutical interventions aim at the last two factors. In order to reduce the frequency of human contacts, governments have ordered lockdowns, restricted large events like sports games, closed down crowded spaces like theatres, schools or shops, encouraged working from home and discouraged the use of public transport. In order to limit contagion in case of contact, people have been told to wear masks, keep distances, wash their hands, and so on. These various measures are called non-pharmaceutical interventions.

These measures have proven to be quite effective but extremely costly and difficult to maintain. Figure 20.3 (overleaf) displays estimates of the epidemiological curves for Italy and the UK, alongside an index designed to measure the stringency of non-pharmaceutical interventions. Keeping in mind that the true number of new cases is likely to be higher than the number shown because many asymptomatic people are not tested, and especially so during the early part of the Covid-19 pandemic, we can observe two waves of infection in Italy and three waves in the UK. The stringency index shows that non-pharmaceutical interventions were taken gradually first, without much success. When they were tightened, it took about a couple of weeks for the epidemiological curve to turn around and decline. Over the Summer of 2020, the measures were partially lifted but the virus was still present, silently embarking on a new exponential growth path. Tougher non-pharmaceutical interventions were then reinstated and the curves were flattened again. The third British wave is believed to be the result of a mutation of the virus that made it more contagious, which required even tougher non-pharmaceutical interventions. At the same time, 'Covid fatigue' seemed to emerge: people became less willing, or even less mentally able, to rigorously follow the measures.

At the time of writing (February 2021), vaccines are being rolled out. The aim is to achieve herd immunity once enough people are immune either because they have been vaccinated or because they have been infected. We will then discover what the threshold is at which herd immunity is achieved.

Figure 20.3 Epidemiological curves for Italy and the UK, 1 January 2020 to 31 January 2021



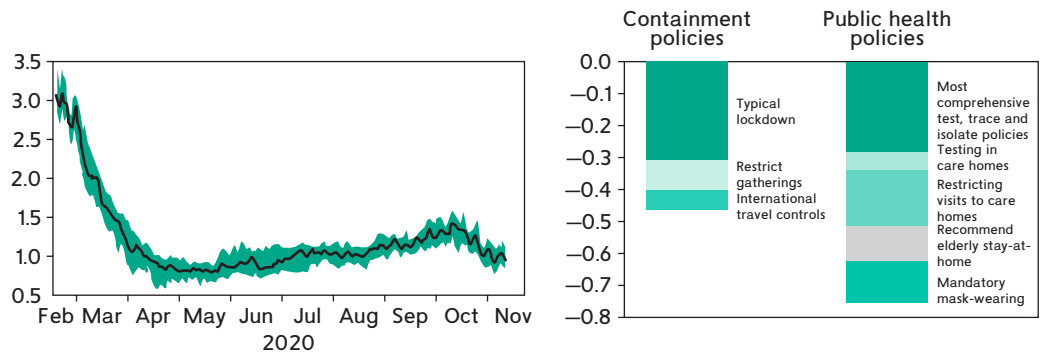
Source: Our World in Data.

This threshold may rise as new, more contagious mutants appear. The fear is that future mutants will be vaccine-resistant, in which case the vaccines will have to be modified, possibly triggering a race between mutations and vaccine adaptation. Mutations are likely to continue until herd immunity is reached around the world, which brings to the front the fact that poorer countries will lag behind the richer countries.

20.1.3 Effects on non-pharmaceutical interventions

The left-hand chart in Figure 20.4 below shows how R declined on average in Europe from very high levels during the early period when the virus was not visible, to below 1 during the Summer of 2020 before rising

Figure 20.4 Estimates of the effects of interventions in Europe



Source: B. Égert, Y. Guillemette, F. Murtin and D. Turner (2021) 'Walking the tightrope: Avoiding a lockdown while containing the virus', *Covid Economics* 64 (January).

again in the autumn. Even if the increase is small, as soon as R goes above 1, exponential growth sets in and the epidemiological curve rises increasingly faster. Many governments were highly reluctant to impose lockdowns again, leading to an even worse second wave.[1]

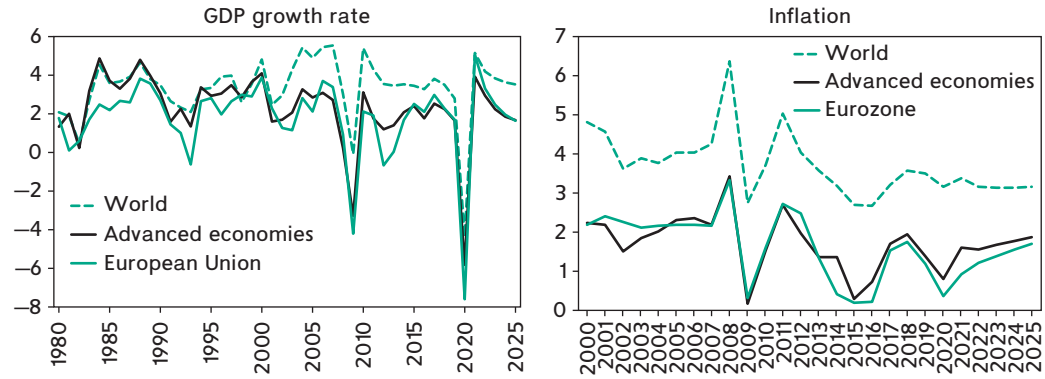
The right-hand chart explains how effective various interventions were. It shows estimates of how much, on average, each one contributes to the reduction of R, distinguishing between containment ('you are not allowed') and health policies. These estimates show that health policies are quite effective; if they are rigorously implemented, it may be possible to avoid the highly unpopular containment measures.

20.2 Macroeconomics of the Covid-19 pandemic

20.2.1 The impact

The economic toll on the economy has been commensurate with the historical nature of the pandemic. Figure 20.5 shows that the fall in real GDP is by far the largest in decades, often larger than what was seen during the Great Depression of the 1930s. Based on data published in October 2020, the figure is likely to be highly optimistic, both for 2020 and 2021, given the new waves of the pandemic. The V-shape of growth indicates a deep fall, followed by a sharp rebound and then a return to historical growth rates, but these are forecasts, based on assumptions.

Figure 20.5 GDP growth rate and inflation (%)



Source: World Economic Outlook, IMF, online.

The interpretation of the economic collapse of 2020 may seem straightforward, but there is more than meets the eye. The proper framework is the *AD-AS* apparatus. In Figure 20.6 we start from point A, which can be thought of as representing the pre-pandemic year 2019. Two things happen when the pandemic occurs.

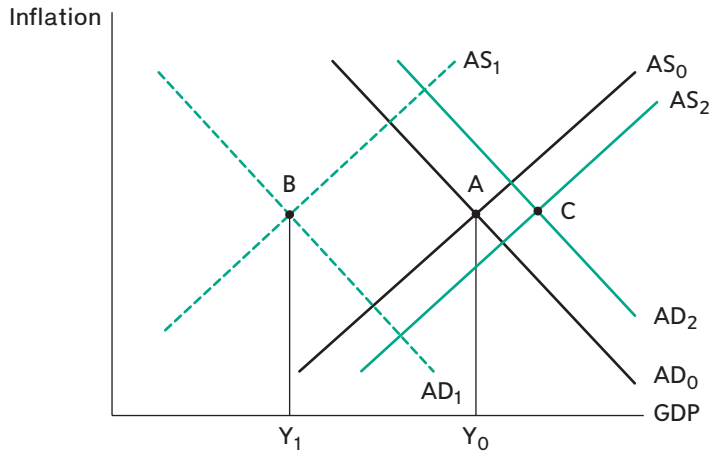
- First, many people reduce their mobility sharply, either because they are concerned about being infected or because they have to (lockdowns or closed shops and workplaces, for example), often both. Consumption falls, which then discourages investment spending by firms. The resulting decline in aggregate demand is represented in Figure 20.6 by a leftward shift of the *AD* schedule from AD_0 to AD_1.
- Second, most non-pharmaceutical interventions impose severe restrictions on firms and their employees. These restrictions range from outright orders to stop all activity to the imposition of sanitary or transport measures that reduce activity. The overall supply declines and the *AS* schedule shifts to the left from AS_0 to AS_1.

[1] By then, new cases were better measured so we must be careful when comparing the first and second waves.

The pandemic turns out to be both a demand and a supply shock, partly because the pandemic leads people to reduce their activities, partly and maybe principally because of the measures taken to flatten the epidemiological curve. The economy moves from *A* to *B*, which captures the decline in activity visible in Figure 20.5.

Which shock is dominant, the demand shock or the supply shock? Inflation provides the answer. If inflation increases, point *A* is above point *B*, which indicates that a reduced demand faces an even more reduced supply, so that *AS* shifts by more than *AD*. Conversely, a larger demand shock would result in point *A* lying below point *B*. Figure 20.6 indicates a small decline in inflation over 2020, which suggests that demand declined a bit more than supply. An additional factor has been a fall in commodity prices, reflecting the global nature of the pandemic.

Figure 20.6 The *AD-AS* interpretation



And next? The forecasts presented in Figure 20.5 anticipate a sharp increase in demand soon accommodated by supply once the pandemic comes to an end. On the demand side, the forecast assumes a strong rebound in consumption. People increased their savings during the pandemic because they sharply cut consumption while their incomes were protected by various public support schemes – explained later. Consumption rebound occurs when people are freed from their fears of being infected and from the much maligned non-pharmaceutical interventions. They are expected to spend their accumulated savings to compensate for pent-up consumption. On the supply side, firms will be keen to return to their previous production levels. They will call back workers who were put on various support schemes, and they will hire more workers if needed to match the consumption rebound. They will also start again to invest in productive investments, which will further strengthen demand. Graphically in Figure 20.6, the economy temporarily moves to point *C* as *AD* bounces back to the right to AD_2, followed by the *AS* shift to AS_2 before returning to their initial positions.

20.2.2 Macroeconomic policy responses

Is there a trade off?

The joint occurrence of demand and supply shocks is unusual. Even more unusual is that these adverse shocks are a deliberate policy decision taken for sanitary reasons. A natural question is whether it makes

sense to trade off the health benefits from non-pharmaceutical interventions against their staggering economic costs, not to mention the social and mental health costs. This question has triggered heated debates in every country around the world, including considerations of basic rights like the right to move freely. Box 20.1 presents a few examples of policy strategies.

The evidence is that there really is no trade-off, for several reasons. First, people spontaneously shop less, travel less and work less anyway out of fear of being infected. Second, if left unchecked, the pandemic will spread exponentially, incapacitating ever more people until herd immunity is reached. Third, seeing the difference with other countries that managed to flatten the curve, most governments will end up taking strong measures. Doing so late will call for stronger and longer-lasting measures, which then inflict even more harm to the economy. In the end, acting early and forcefully eventually pays off, from both health and economic angles.

Box 20.1 Non-pharmaceutical intervention strategies

Different countries chose different strategies. Most countries adopted intermediate approaches between the two polar cases:

- Zero-death strategy. The idea is to 'beat the virus' by immediately adopting the strictest possible measures: complete lockdowns, including school closures. There is no trade-off between health and the economy, health is the only concern.
- Herd immunity strategy. The idea is to 'let the virus run' until enough people have become immune through having been infected or vaccinated. The economy cannot be closed down and individual liberties cannot be curtailed.

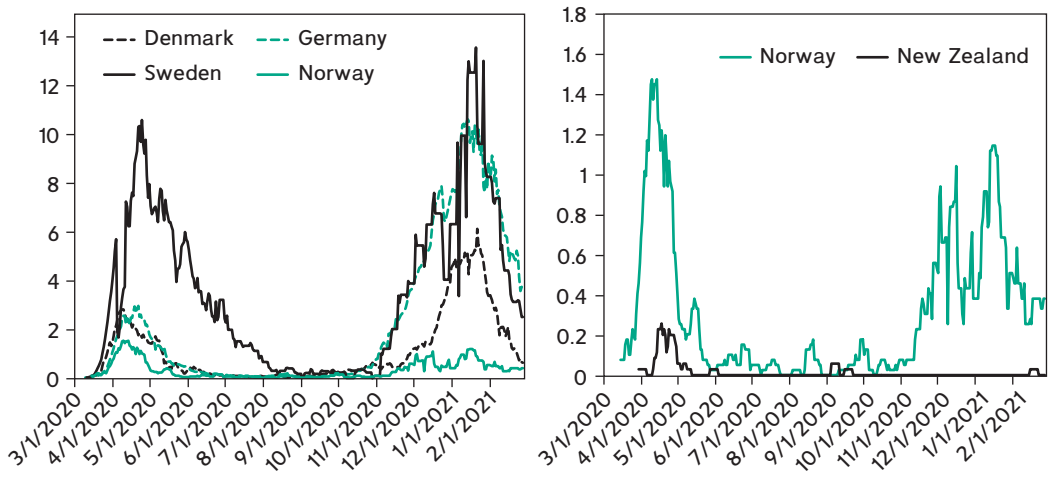
New Zealand is an example of a country that adopted the zero-death strategy. It imposed a complete lockdown in April and May, which resulted in a 12 per cent fall in its GDP. But the economy strongly picked up afterward and the contraction for the whole of 2020 is expected to be of the order of 2 per cent. It suffered so far (by end of February 2021) 26 deaths, out of a population of 4.8 million. Of course, being a small island made it possible to close the borders, a measure still in place. Each time a new case is detected, a new lockdown is imposed.

Sweden is an example of the opposite approach. Up until the end of 2020, constraints to basic individual freedoms (not just lockdowns but making mask-wearing compulsory too) was strictly illegal. The management of the pandemic was in the hands of a health agency, not that of the government. This agency explicitly chose to seek herd immunity, as quickly as possible, possibly even before vaccines would be available. The Netherlands and the UK considered this option for a while but quickly abandoned it.

The left-hand chart in Figure 20.7 (overleaf) shows the number of daily Covid-19 casualties per million citizens for Sweden, Denmark and Norway (three Scandinavian countries that are often compared to one another), and Germany, which chose an intermediate strategy. Germany moved fast to impose a lockdown in March but reimposed a second one quite late in autumn when the second wave hit. The left-hand side chart presents the monthly industrial production index to illustrate the economic impact. Sweden simply did not do better than the others.

Before Christmas, the king of Sweden went on TV and said 'we have failed'. Since then, the Swedish government passed an emergency law that makes it possible to impose measures that may infringe on individual freedom. Such measures were put in force in early January 2021.

Figure 20.7 Deaths and economic activity



Source: Our World in Data.

Main public macroeconomic policies

In the developed countries, nearly all governments adopted similar policies. Accepting that the non-pharmaceutical interventions would lead to a sharp economic decline, they focused on protecting people and firms.

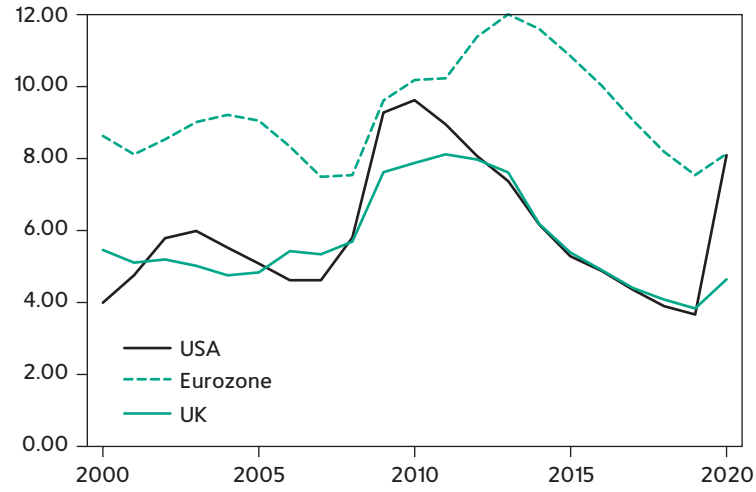
Disallowed to go to work as a result of lockdowns, people still needed income for the following weeks and months. In most of Europe, governments adopted publicly financed part-time arrangements. Inspired by the German *kurz arbeit* scheme used during the Global Financial Crisis after 2008, governments paid firms to not lay off their employees, even if they could not come to work or only for short spells. This policy of avoiding layoffs maintains the work relationship, which helps when the economy restarts, and reduces individual anguish. Governments also compensated firms directly for lost income and/or guaranteed subsidized bank loans. As a result unemployment increased little, especially relative to the depth of the economic crisis. In the United States, instead of subsidizing employment, the Federal government extended state-level unemployment benefits and even sent money directly to every citizen, a less efficient way of keeping the economic afloat since it is not targeted at all. As a result, unemployment rose sharply in the USA with just a small uptick in Europe, as can be seen in Figure 20.8.

In the end, one way or another, in developed countries governments widely opened the taps of public spending to cushion the economic blow of mandatory health measures. As a result, even though economic activity massively declined, actual incomes – measured by GDP – fell much less. In effect, governments borrowed on behalf of their citizens. Public budgets dipped in profound deficits, as can be see in Figure 20.9.

Obviously, no country can run double-digit budget deficits for ever. Sooner or later, they will have to be closed. Even so, public debts are reaching new levels, exceeding 100 per cent of GDP in many countries. In many cases, debt levels are similar to that of Greece before it became caught in its debt crisis, which went on to spread across the European monetary union. Before rushing to conclusions, however, we must think ahead.

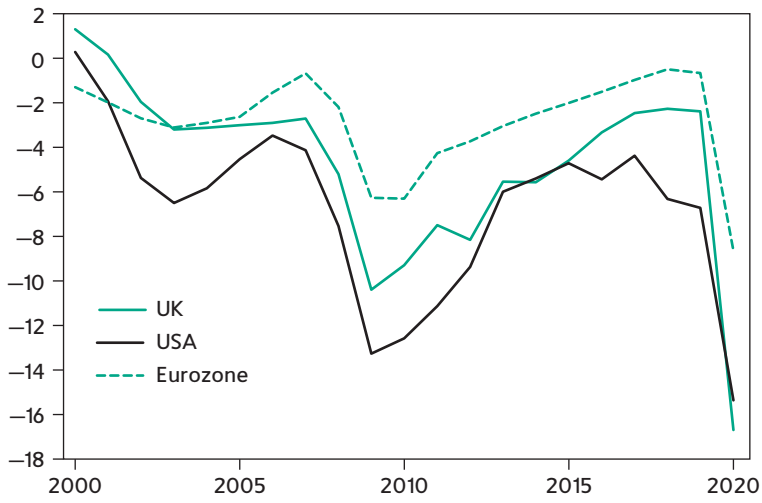
Suppose that, thanks to the vaccines, the pandemic is brought under control by, say, mid to end 2021. This is when the exceptional public support will naturally come to an end. As noted above, relieved

Figure 20.8 Unemployment rate in Europe and the USA



Source: Economic Outlook, OECD.

Figure 20.9 Budget balances in Europe and the USA (% of GDP)



Source: Economic Outlook, OECD.

customers are expected to go on a spending spree and firms will be delighted to satisfy them. At the same time, we will confront the 'zombie firm' problem. During the pandemic, many firms, especially small and medium enterprises, will have taken advantage of cheap state-guaranteed loans only to find out that they cannot reimburse them. Indeed, the number of bankruptcies has dramatically fallen over 2020, but there will be a reckoning when the supports are withdrawn. Firms will fail in larger numbers than usual, leading to steep increases in unemployment. Furthermore, once the savings accumulated during the pandemic have been spent, the initial boost will evaporate. All of this makes it possible that the initial boom will end.

In this scenario, fiscal policy will be needed to prevent a new recession. The question is whether highly indebted governments will be willing to carry on with more large deficits for a year or two, or whether they will feel the urge to run surpluses to start reducing their debts.

Monetary policies

When the pandemic hit, interest rates in many countries were very low, sometimes negative, as in the Eurozone, Denmark, Switzerland and Japan. In these countries and elsewhere, central banks were still busy supporting the recovery from the Great Financial Crisis. Already, during this crisis, the interest rates had been brought to their lower bounds, and many central banks adopted non-standard policies designed to provide financial markets with abundant liquidity, a procedure called quantitative easing (QE). The deep recession brought about by the pandemic has led them to expand the use of these new instruments.

They massively increased their lending to banks to ensure that there would be no shortage of cash anywhere in the financial system. Some central banks provided indirect lending to firms by purchasing private bonds on the markets. They also strongly encouraged banks to generously lend to firms. For example, the ECB has offered loans to banks at –1 per cent, less than the policy rate of –0.5 per cent, on the condition that they use the money to lend to firms. All central banks also committed to keep their very low interest rates unchanged until after the end of the pandemic.

As a result, the stock markets, which initially fell heavily at the onset of the pandemic, recovered and, in most cases, reached levels higher than before. This has come as a surprise: how can markets reach record levels in the midst of the worst recession since, at least, the Great Depression? A number of explanations have been advanced:

- Fiscal supports played a role.
- The central banks' promise of keeping interest rates very low for very long is bound to have a strong impact.
- Some of the savings accumulated as a result of reduced mobility have been invested in the financial markets. A large number of new investors have appeared.

Central banks and public debts

Another important aspect of central bank interventions is that they have acquired from the markets large amounts of public debts. Since the 1970s, a period when inflation rates often reached double-digit levels, most central banks have stopped financing budget deficits. In the Eurozone, for instance, direct financing of governments is strictly forbidden by the Treaties. To be sure, central banks have routinely purchased public debts on the markets, which provided indirect financing to governments. However, these operations were explicitly conducted to provide markets with cash and they were unrelated to the financing needs of governments.

In 2020, as budget deficits skyrocketed, many central banks grew concerned about the risk of public debt crises. Drawing the lessons from the Eurozone debt crisis of 2010, the ECB was keen to ensure that all member governments could borrow to finance the support measures described in the previous section. Indeed, during 2020, the ECB bought an amount of national public debts roughly equal to the newly issued public debts. It even went a step further. Up until then, it was buying national debts in proportion of each country's share of its capital. Starting in March 2020, it has acquired larger amounts of public debts from countries perceived at risk, in particular the Italian debt. In the UK, the Bank of England directly lent large amounts to the Treasury. As intended, these exceptional actions have removed the spectre of public debt crises, at least for now.

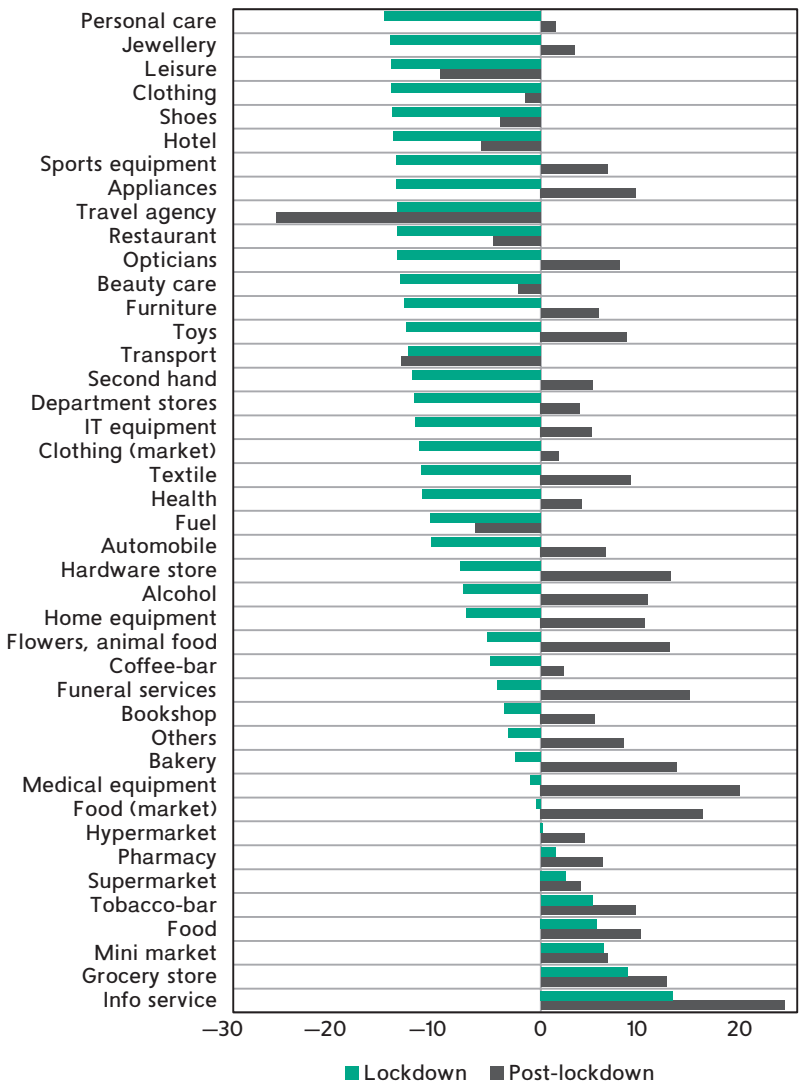
20.3 Microeconomics of the Covid-19 pandemic

The pandemic is also having a major impact on people and firms, which is differentiated according to individual characteristics and industries. Some of these effects are plain to see during the pandemic, others will appear once it is over and some will have long-term effects, over years. This section analyses this potential transformation of the economy.

20.3.1 Sectoral effects

While bars, sport events and theatres were closing, food shopping increased a bit, and online sellers saw their business booming. Figure 20.10 shows how consumption changed in France during the first lockdown in the Spring of 2020 and its aftermath. In some cases, consumption bounced back, in other cases it did not, maybe because people were still worried, maybe because tastes changed for good.

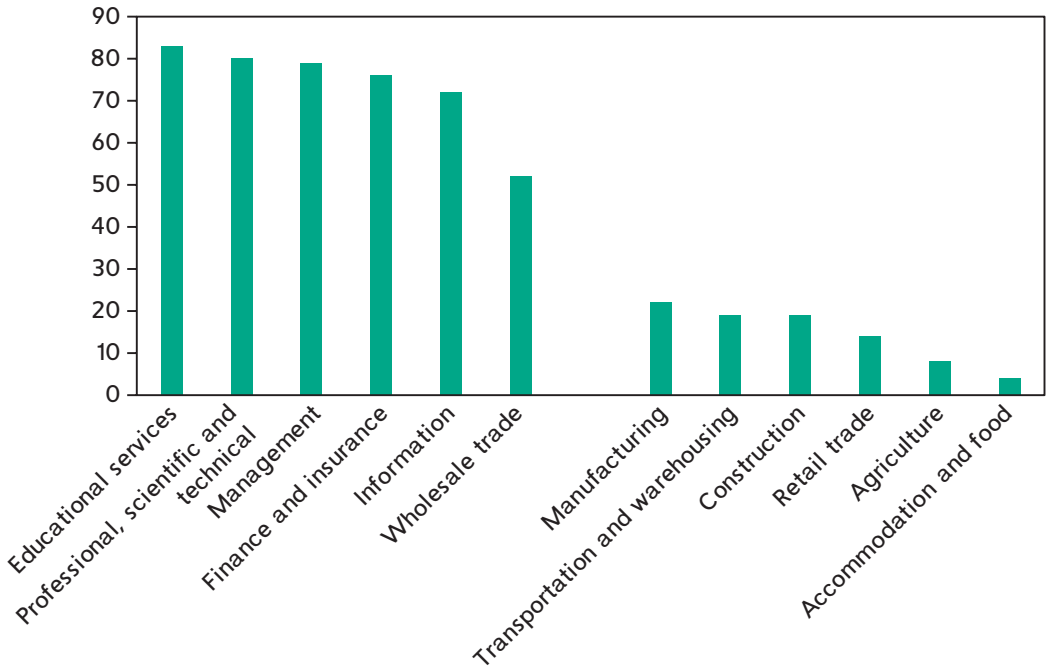
Figure 20.10 Consumption change in France before and after the first lockdown (% change over the 2019 level)



Source: David Bounie, Youssouf Camara, Etienne Fize, John Galbraith, Camille Landais, Chloe Lavest, Tatiana Pazem and Baptiste Savatier (2020) 'Consumption dynamics in the COVID crisis: Real-time insights from French transaction and bank data', *Covid Economics*, 59 (27 November).

This evolution reflects changing consumption demand, but also production. During the lockdown, firms producing 'essential' goods were allowed to operate normally. The others were closed unless they could continue functioning while their employees were working from home. Figure 20.11 displays estimates of the share of jobs that can be done from home for a selection of industries: those where the shares are largest and those where they are lowest. It explains why some production activities had to stop while others continued to operate almost normally.

Figure 20.11 Share of jobs that can be done at home, top six and bottom six (% of industry employment)



Source: Adapted from Jonathan and Brent Neiman (2020) 'How many jobs can be done at home?', *Journal of Public Economics*, 189: 1–18.

The macroeconomic analysis of the previous section hides all these sectoral effects. Yet, it is not invalidated. Consider the following decomposition of the economy into two sectors:

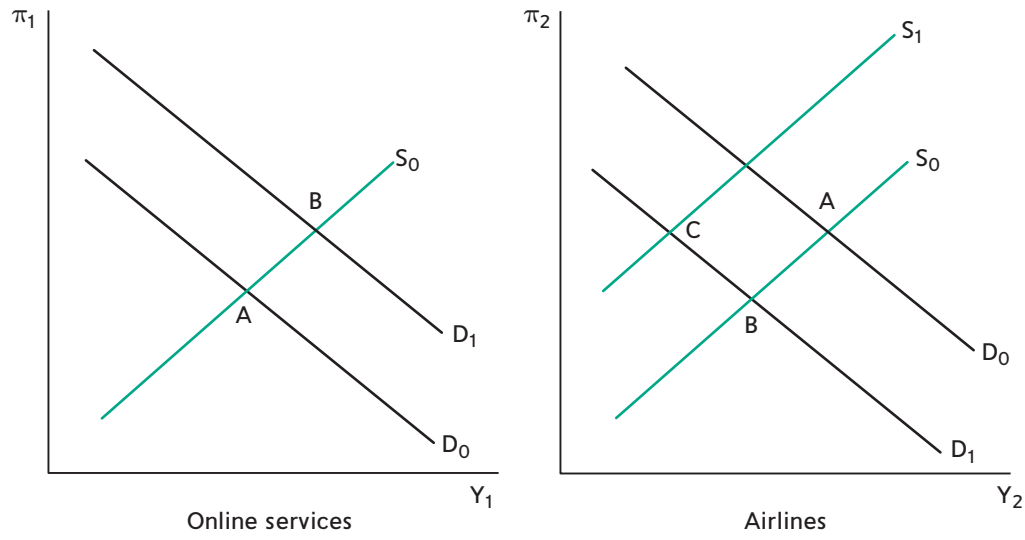
- The first sector, which is benefitting from higher demand and is able to expand its activity. Call it online services.
- The second sector is facing declining demand. Call it airlines.

Figure 20.12 provides an interpretation, looking at the usual demand and supply tool. In both cases the demand curves shift from D_0 to D_1 but in opposite directions. Online services expand as shown from the move from A to B along the supply curve. In the airline sector, sanitary regulations restrict activity, the supply curve shifts from S_0 to S_1 and we move from A to C. The fall in activity is worse than if we had moved to B. The overall, aggregate effect shown in Figure 20.6 combines all sectors. As indicated in Figure 20.10, there are many more sectors like the airlines than like online services so the aggregate effect is a decline in GDP.

Figure 20.12 only considers the initial impact. The online services sector creates more incomes, which could increase demand for airlines and mitigate the recession. However, this is not happening because the decline in demand and supply is caused by the sanitary measures and fears of contagion. On the other hand,

falling incomes in the airlines sector stands to reduce demand for online services. Overall, these second-round effects makes things worse. Stemming these effects is one reason for public support targeted at those who derive their incomes in the airlines and similarly hit sectors.

Figure 20.12 A two-sector example



Source: Eurostat.

This simple analysis calls for looking at the details behind the demand and supply curves. Importantly, the combination of possible changes in consumption tastes, firm closures and employees transitioning to other jobs or to unemployment raises the question of longer-term economic effects of the pandemic. The next sections examine the evolution of labour markets, how firms have reacted to the crisis, international trade linkages and the strong evidence that the crisis has deepened pre-existing inequalities.

20.3.2 Labour markets

Not all workers are equally affected by a pandemic. As explained in the previous section, some industries were badly hit, others benefitted. Even in badly hit industries, some workers could keep their jobs thanks to public support systems, others were laid off and not all of them were eligible to unemployment benefits. In addition, as illustrated in Figure 20.11, the ability to work from home allowed some people to keep working without having to travel to their offices.

Thus, the usual analysis of labour markets has broken down. On the side of the demand for labour, firms that are closed down or operating under strict limits have stopped both hiring and firing. Rapidly growing firms have been hiring, sometimes from the online markets for work-from-home jobs. Regarding the supply of labour, many workers are being paid for not working, or working part-time. In both cases, sharp restrictions on mobility have made labour markets either very local, or global when work can be carried out from home.

Looking forward, the big question is whether work from home will remain an important part of production activity in those industries where it is technically possible. Opinions currently diverge. For a while already, firms in industries ranked high in Figure 20.11 have been adopting work from home, at least for several days per week, as a way of cutting down on increasingly expensive office costs. However, some of these firms worry about informal information, cohesion and corporate culture. Workers, too, are divided.

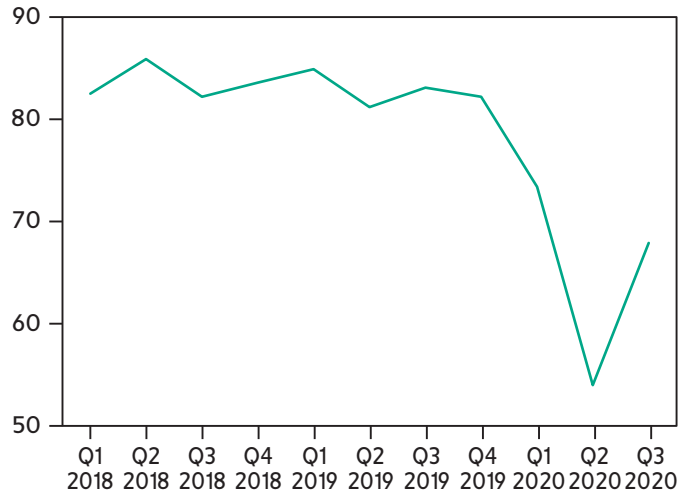
Saving time and expense on commuting is appreciated, but there are costs in terms of socialization and setting up adequate space at home for uninterrupted working time.

20.3.3 Firms

In normal times, each year some 10 per cent of firms disappear and a similar number of firms are created. Of course, bankruptcies are distressing for individual firms and their employees but, for the economy as a whole, this is overall good, a sort of Darwinian process. Called 'creative destruction', this process consists of the least productive firms shutting down to be replaced by potentially more productive ones.

On the one hand, the repetition of lockdowns or similar measures is taking a huge toll on firms. On the other hand, most governments have taken exceptional measures to protect them, combining guarantees and subsidies, including paying for wages (Section 20.2.2). Figure 20.13 shows that these measures did not just prevent an outburst of bankruptcies, they actually brought their numbers below usual levels.

Figure 20.13 Bankruptcies in the European Union (Index: 2015 = 100)



Source: Eurostat.

This partial freezing of bankruptcies is welcome in the midst of the crisis, the question is, what happens next? One possibility is that the number of bankruptcies bounces back up once governments stop the support measures. This would happen when consumption too bounces back up, but it could moderate the expected spending surge if large numbers of people lose their jobs. Another possibility is that governments continue some support. In that case, the concern is that many 'zombie firms', which would have normally gone bust because they are not productive enough, will survive. This would stop the creative destruction process, eventually slowing down the recovery.

20.3.4 Trade

Trade has fallen, even faster than GDP. One reason is that firms that depend on imports to produce have faced shortages. This has brought to the fore a key development of the last decades: the growing role of supply chains. The disruption of these chains is provoking an intense debate on the merits of globalization.

Indeed, firms have to shut down or to slow down because a far-away country is under lockdown. In the midst of a pandemic, a particularly striking case concerns medicines. It should not be surprising, therefore, that the view that a country's economic and health security is threatened by global value chains has become

popular. In particular, calls for bringing back home the production of essential goods have multiplied. Some corporations are reported to have brought back some activities that they previously outsourced to foreign producers or subsidiaries.

It is too early to know whether this new wave of protectionism will turn the temporary, crisis-related, fall in international trade into a permanent retrenchment from globalization. The Great Financial Crisis of 2008, which also was followed by a trade collapse, already triggered similar calls against globalization. These calls were not heeded by most governments, but that was long ago.

20.3.5 Inequality

A major aspect of the pandemic is that it has exacerbated existing inequalities, both across and within countries. Across countries, the developing countries have less financial resources to provide the kind of support that the advanced countries can afford. Limited health resources and administration capacities constrain the detection of contagion, the ability to treat sick people and large-scale vaccination programmes. It is not even known how many casualties they have suffered. International organizations have tried to help out, as did various non-government organizations (NGOs), but the gap has remained wide.

Within countries, already underprivileged groups have paid a higher toll during the pandemic:

- Lower income people often work in 'essential' activities. While they did not face unemployment, they had to take health risks when travelling to work and while working, sometimes without proper protection.
- Lower income people working in non-essential roles often were those fired first, because they are more dispensable in the sense that they can be more easily rehired once the pandemic is over.
- Lower income people are also often less educated than higher income people. There is evidence that they live in more cramped dwellings and are less ready to adopt social distancing measures.
- Racial discrimination, never absent in good times, is exacerbated during the pandemic.
- Women face more challenging conditions. They disproportionately work in indispensable sectors like food stores or health services. Those who work from home bear a large share of the burden of looking after their children and helping them with online education when schools are closed.

Deepening inequalities are generating political and social reactions. In nearly every developed country, demonstrations have become increasingly frequent. Political preferences have played a role in how people have reacted to public health measures. As a result, governments have become increasingly cautious in mandating lockdowns or closing schools and stores down. Historical accounts indicate that pandemics often have long-run political implications.

20.4 Vaccines

In the absence of effective treatments, vaccinations are the only way to deal with the pandemic. From an epidemiological perspective, vaccination is the way to achieve herd immunity. If the whole world reaches that threshold, Covid-19 would face the same fate as smallpox, rinderpest and, hopefully soon, polio.

20.4.1 Economics of vaccines

It has taken less than one year to develop and start producing effective vaccines – a process that usually takes several years. No doubt, scientific progress made a huge difference but there is also an economic explanation. Developing medicines in general, and vaccines in particular, involves large upfront expenditures (research, testing) with considerable uncertainty about the outcome. The eventual rewards come much later, if and when a product is approved. Pharmaceutical research and development is a huge gamble.

The industry's response is to diversify risks. Thus, very large pharmaceutical companies run wide portfolios of research. Increasingly, though, much research is performed by relatively small companies that specialize in specific technologies and products. They are not diversified but they operate as startups.

They collect money from venture capital investors who diversify risk by investing in many different startups. When and if a startup succeeds, it either sells the rights to a large traditional company or it is simply bought. This is when the venture capital investor is rewarded, often handsomely. In the opposite, and more frequent, case when the startup fails, it disappears and the venture capital investors lose their money. Well inspired and diversified venture capital investors make a few large gains that more than compensate their losses.

In the case of Covid-19, there was a clear public interest in speeding up research. Many governments acted as venture capital investors, like the US Government's Operation Warp Speed. They offered large payments to promising projects. In return, they were guaranteed abundant supplies of vaccine doses in case of success. In many cases, the governments also pre-funded the production of vaccines while they still were at the experimentation stage. This made it possible for deliveries to immediately start flowing upon approval by the relevant authorities. Of course, projects that did not succeed represented a loss for the government, but probably a tiny fraction of the formidable costs of lockdowns and other social distancing measures.

20.4.2 Vaccination hurdles

At the time of writing (in February 2021), vaccination campaigns are picking up steam. They face serious hurdles though.

- Medical hurdles: When new vaccines are rolled out, viruses mutate in a way that undermines vaccine effectiveness. This creates a race between vaccination and mutations.
- Production hurdles: The speed at which vaccines have been developed is astonishing but production is a more traditional activity.
- Political hurdles: In every country, a number of people are opposed to vaccines. The novelty and speed of Covid vaccines reinforce doubts among doubters. As millions and billions of people are vaccinated, some of these doubts may be alleviated.

Early results indicate that vaccination is reducing contagion. We do not know yet the threshold for herd immunity but it appears that the beneficial effects start long before the threshold is reached.

20.4.3 The global challenge

As long as there are some places in the world where herd immunity is not reached, the virus will keep infecting people and mutate along the way. Because borders cannot be tightly closed, the pandemic can surge again if new mutants trump existing vaccines. Thus, beyond the moral issue that all people deserve to be protected, it is in everyone's interest that everyone else be vaccinated.

Vaccines, however, are costly and vaccination requires solid health systems. The poorer countries with insufficient health infrastructure will need international help.

Further reading

Baldwin, Richard and Beatrice Weder di Mauro (eds) (2020) *Economics in the Times of Covid-19*, CEPR, London.

Baldwin, Richard and Beatrice Weder di Mauro (eds) (2020) *Mitigating the Covid Crisis: Act Fast and Do Whatever it Takes*, CEPR, London.

Baldwin, Richard and Simon Evenett (eds) (2020) *Covid 19 and Trade Policy*, CEPR, London.

IMF (2020) *World Economic Outlook*, October, Chapter 2.