COVID-19 and the Macroeconomy

Supplement to *Macroeconomics, 5th edition*

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The pandemic associated with COVID-19 is yet another "once in a lifetime" shock to the macroeconomy, following just a decade after the global financial crisis. This brief note explores the macroeconomic implications of the pandemic using the models from my textbook, *Macroeconomics*.

The note is divided into three main parts. First, we explore international data on COVID-19 mortality and GDP. Second, we discuss how to think about COVID-19 using our various models. Finally, we examine data on GDP, employment, and inflation over time to help us evaluate what we learn from the models.

1. An Overview of the COVID-19 Pandemic and Economics

The COVID-19 pandemic has been an economic and humanitarian disaster. As of this writing, well over 2 million people worldwide have died, including roughly one out of every 750 people in the United States, Mexico, and parts of Europe. These costs are not spread uniformly throughout the population, focusing disproportionately on the elderly, people in poor health, minorities, and essential workers.

The Environmental Protection Agency in the United States uses a value of around $10 million to value the lives of middle-aged Americans when judging the economic trade-offs associated with life-and-death decisions such as how to set highway speed limits and safety regulations.[1] Using this number, recent research estimates that the COVID-19 pandemic in the United States reduced economic well-being in a way that is equivalent to reducing everyone's consumption by 11 percent. But the costs are not uniform by racial and ethnic groups. For example, for Black Americans, researchers estimate the costs equal 14 percent and for Latinx Americans, the costs are equal to a 21 percent reduction in consumption. These differences are reflected

[1] See "Mortality Risk Valuation," at https://www.epa.gov/environmental-economics/mortality-risk-valuation.

in life expectancies: during the first year of the pandemic, deaths from COVID-19 reduced life expectancy by 1.1 years for White non-Latinx Americans, by 2.1 years for Black non-Latinx Americans, and by 3.1 years for Latinx Americans.[2]

Other forms of economic loss may be even larger in the long run. For example, research suggests that the lost education associated with the closing of schools and online education may *permanently* reduce the annual consumption of the affected cohorts by 1 percent. In contrast to the one-time losses documented in the previous paragraph, these are losses that persist for a child's entire lifetime.[3]

Countries throughout the world have sought to mitigate the losses from COVID-19 in various ways. Lockdowns, travel restrictions, school closings, social distancing, and mask wearing are some of the responses that have been adopted, typically through some combination of governmental order and voluntary changes in individual behavior. These responses have reduced deaths from COVID-19 while also reducing GDP and economic activity.

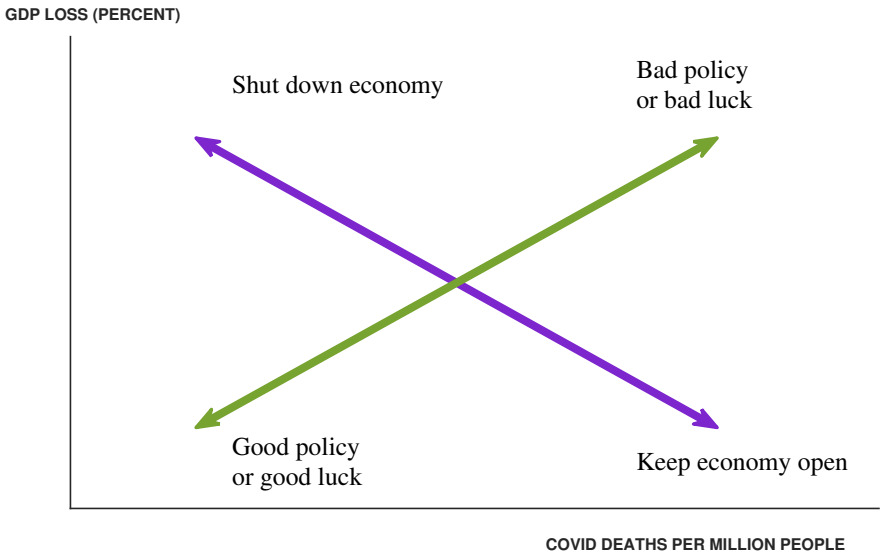
Figure 1 shows a stylized way to think about the economic effects of these responses, in a graph with COVID-19 deaths on the horizontal axis and GDP loss on the vertical axis. Notice that points further away from the origin on this graph are worse, as both COVID-19 deaths and GDP losses are a "bad" rather than a "good." The purple line in the graph captures a short-term trade-off between economic activity and COVID-19 deaths. For example, stay-at-home orders may reduce deaths from COVID-19 but result in a loss of economic activity as people reduce their consumption of many goods and some find it hard to carry on their work from home. This trade-off is a natural way that people think about the macroeconomic effects of COVID-19.

The green line in the graph goes in the other direction, however. In particular, the green line may capture "good policies" and "good luck." For example, if

[2] See Jean-Felix Brouillette, Charles I. Jones, and Peter J. Klenow, "Race and Economic Well-Being in the United States," Stanford University manuscript, 2021. To match up the numbers at the end of the paragraph, note that the EPA's value of life means that each year of life is valued at approximately 6 to 7 percent of annual consumption per person.

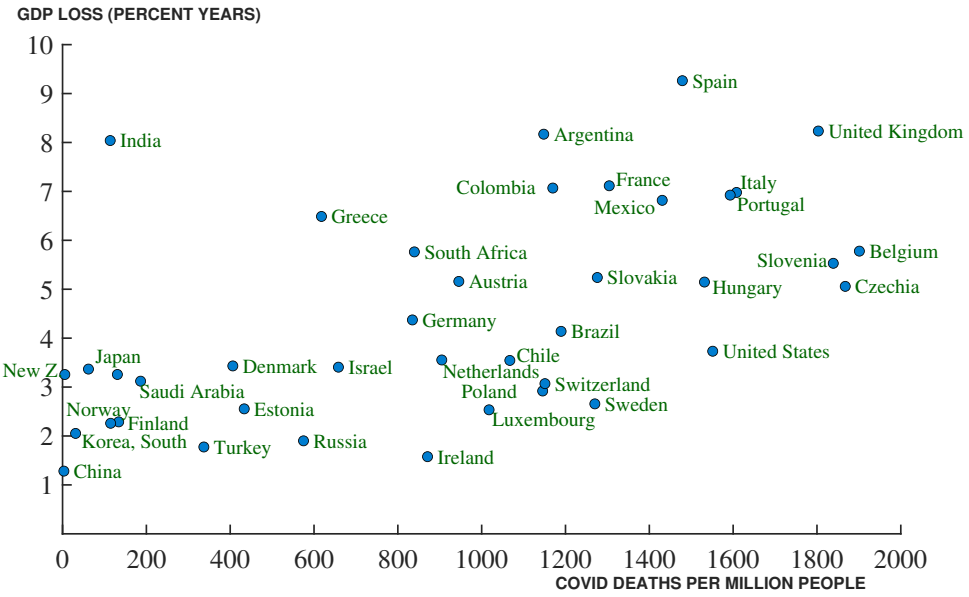
[3] Nicola Fuchs-Sch undeln, Dirk Krueger, Alexander Ludwig, and Irina Popova, "The Long-Term Distributional and Welfare Effects of Covid-19 School Closures," CEPR Discussion Paper DP15227, August 2020.

Figure 1: Economic Activity, COVID-19 Deaths, Health Policy, and Luck



Note: The purple line captures a basic short-term trade-off between economic activity and deaths from COVID-19. The green lines recognizes that this short-term trade-off can shift in or out, depending on health policy (such as mask use and social distancing) as well as luck.

Figure 2: International COVID-19 Deaths and Lost GDP



Note: "GDP Loss" is the *cumulative* loss in GDP since the start of 2020 and is annualized. For example, a value of 6 means that the loss since the start of 2020 is as if the economy lost six percent of its annual GDP. GDP data are through 2020Q3 and COVID-19 deaths are as of February 26, 2021.

economies are fortunate in some way and avoid exposure to cases early on, they may be able to continue their economic activity without seeing a substantial rise in COVID-19 cases, at least for a while. Or areas that adopt good policies, such as universal masking, may be able to safely continue operating schools and many businesses at a higher level of activity. Good policies and good luck may shift the purple trade-off line "in" toward the origin, resulting in fewer deaths and smaller losses in GDP.

Which of these forces is more dominant in the data? Or are they both important so that when we look at the evidence, we will see a cloud of data points with no clear correlation?

The answer for countries around the world is shown in Figure 2. The perhaps surprising message of this graph is that the correlation is positive rather than negative. Rather than being dominated by a trade-off between COVID-19 deaths and GDP losses, the data suggest that the two have moved together, at least over the

long course of the pandemic. That is, some countries like China, South Korea, Norway, New Zealand, and Japan have had very good performance on both dimensions, while others—including the United Kingdom, Italy, Spain, Mexico, and Argentina—have had poor performance on both dimensions.

The magnitudes of these differences are also remarkable. South Korea, Japan, and Norway have experienced between 25 and 100 deaths for every million people in their populations and lost a cumulative total of between 2 and 3 percent of GDP. The United Kingdom, in contrast, has around a 20-fold higher death rate of more than 1,700 per million and has lost more than 8 percent of a year's GDP. And of course there are many countries in between. The United States, for example, has suffered 1,500 deaths per million people and lost about 3.5 percent of a year's GDP.

2. COVID-19 in Our Macro Models

I find it helpful to think about COVID-19 as shocking *two* of the parameters in our macroeconomic models. On the one hand, it is like a tax on consumption and therefore shows up in our short-run model as a decline in $\bar{a}_c$ and therefore a decline in $\bar{a}$. On the other hand, it is also like a tax on employment in the long-run growth model based on Solow and Romer, thereby reducing $\bar{Y}$. From a pedagogical standpoint, this is an excellent example of how real-world shocks can show up in sophisticated ways in our models, affecting more than one parameter and requiring us to consider both the short-run model and the long-run model. We discuss and analyze these shocks in turn.

2.1 COVID-19 as an Aggregate Demand Shock

In part, COVID-19 can be thought of as a "tax" on consumption: if you go out of the house to buy groceries, see a concert, or go to a restaurant, there is some chance you will catch the coronavirus and get sick. As a result, consumption falls sharply and this reduces aggregate demand in the economy. That is, COVID-19 shows up as a decline in $\bar{a}_c$ and therefore a decline in $\bar{a}$ in the short-run model, causing a

recession.

As many observers have noted, it is conceptually possible for the economy to bounce back quickly from a shock like this. After all, production in many economies falls sharply on Saturday and Sunday relative to the rest of the week. Similarly, many firms in some European economies shut down for the entire month of August for vacation and then bounce back to normal in September. If the pandemic were to magically disappear immediately, somehow, then it is possible that macroeconomies around the world could boomerang back to normal in short order.

If both the pandemic and the low level of macroeconomic activity persist for a while, the dynamics of the short-run model raise an interesting question. The Phillips curve suggests that a weak economy should lead inflation to decline. The macroeconomy is clearly very weak. Does this mean we should expect a large decline in inflation? Perhaps. However, there are two possible reasons why that might not be the case.

The first is already familiar from the Great Recession. The macroeconomy was very weak there as well, with GDP falling 6 percent below potential for a substantial period of time. Yet inflation remained remarkably stable at close to 2 percent. One of the main reasons for this appears to be the credibility of central banks in managing inflation expectations, maintaining them at 2 percent.

But in this case, there is another reason, which brings us to the second way of thinking about COVID-19.

2.2 COVID-19 as a Shock to $\bar{Y}$

COVID-19 can also be thought of as a "tax" on working: if you go to work, there is some chance you will catch the coronavirus and get sick. As a result, people stop going to work. Employment declines sharply, and this reduces the *supply of goods* to the economy via the production function in the long-run growth model. That is, it reduces $\bar{Y}$. But by reducing the incomes of people in the economy, this decline in employment also reduces the *demand for goods* in the economy.

This insight leads to an important point: *A decline in* $\bar{Y}$ *in our short-run model*

causes a similar decline in Y (because $C = \bar{a}_c\bar{Y}$, and so forth.) and leaves short-run output $\tilde{Y}$ unchanged. The way to think about this statement is that if a bunch of people are not working, that reduces GDP. But it also means that incomes in the economy are reduced and this reduces consumption (and investment and government purchases, and so forth.) in the economy as well. In our short-run model, these effects exactly offset so that short-run output, $\tilde{Y}$, is left unchanged. Since $\tilde{Y}$ does not change, there is no pressure on inflation from the Phillips curve and no reason for inflation to decline.

Thinking about the supply side of the economy raises other issues about the extent to which the macroeconomic effects of the pandemic could be drawn out. On the one hand, as we noted earlier, it is possible for the economy to bounce back sharply from these "taxes" once the taxes are gone. Other the other hand, the Solow model explains how shocks to the economy can have longer-lasting effects. For example, to the extent that the investment rate falls or the capital stock depreciates without being replaced, output could fall below its steady state and take a while to return.

While this is possible for physical capital, one might broaden the notion of capital to include "relationship capital" to extend the metaphor. The supply side of the economy is built upon many relationships—between businesses and their suppliers, between firms and their workers, and between businesses and their banks. To the extent that a long-lasting pandemic causes some of these relationships to break down—for example because of bankruptcies, lost jobs, or business failures—rebuilding this relationship capital may take time.

At a casual level, one can think of $\tilde{Y}$ as capturing the demand side of the macroeconomy and $\bar{Y}$ (and the long-run model) as capturing the supply side as well as any demand effects that result from changes in supply. COVID-19 affects both. The $\bar{Y}$ effects would not be expected to change inflation, so that the economy could experience a large decline in actual GDP Y without any subsequent pressure on inflation.

[Through an unfortunate oversight, a "TFP shock" example that I meant to include in the 5th edition did not make it into print. I'm attaching this text to the end

of this note. Similar to the COVID-19 example, it shows how the long-run model and the short-run model can interact.]

2.3 Putting the Two Shocks Together

Putting these two shocks together leads to several key conclusions:

- To the extent that COVID-19 is like a "tax on consumption," which leads to a decline in aggregate demand, one would expect some downward pressure on inflation.
- To the extent that COVID-19 is like a "tax on working" in the LR model, the economy could experience large declines in GDP without any downward pressure on inflation.
- In either case, once the pandemic is over, these shocks may disappear and it is possible for the economy to bounce back quickly, as it does every week after a weekend and every summer in Europe after a long vacation.
- If the pandemic destroys "relationship capital"—say between firms and banks or firms and their suppliers or firms and workers—the economic recovery following the pandemic could be more drawn out.

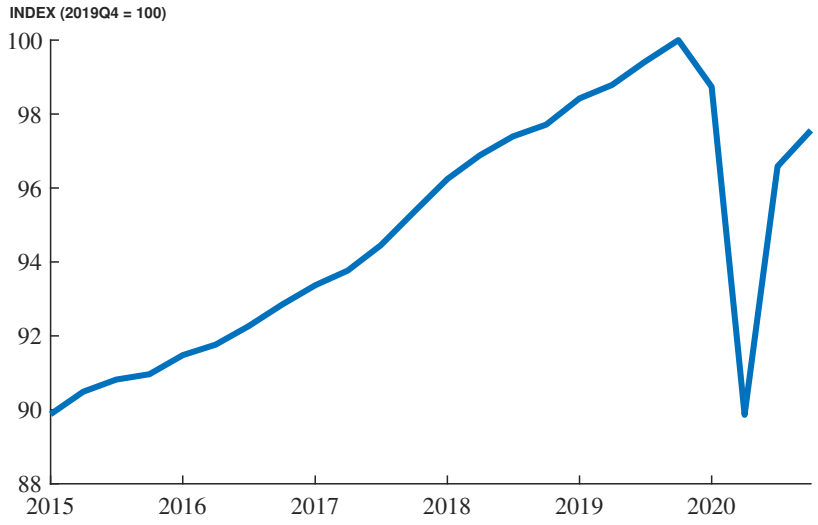
In the next section, we explore the empirical evidence to date to help us evaluate these conclusions.

3. Macroeconomic Activity and the Pandemic

Here we walk through some of the data on macroeconomic activity during the pandemic. Figure 3 begins by showing real GDP for the United States since 2015. The value in the fourth quarter of 2019—that is, right before the pandemic—is normalized to 100 so that the size of the decline in activity is easy to interpret.

Two things stand out from the data on U.S. GDP. The first is the very sharp contraction that occurred in 2020Q2, with GDP falling to 10 percent below the peak. The

Figure 3: U.S. GDP



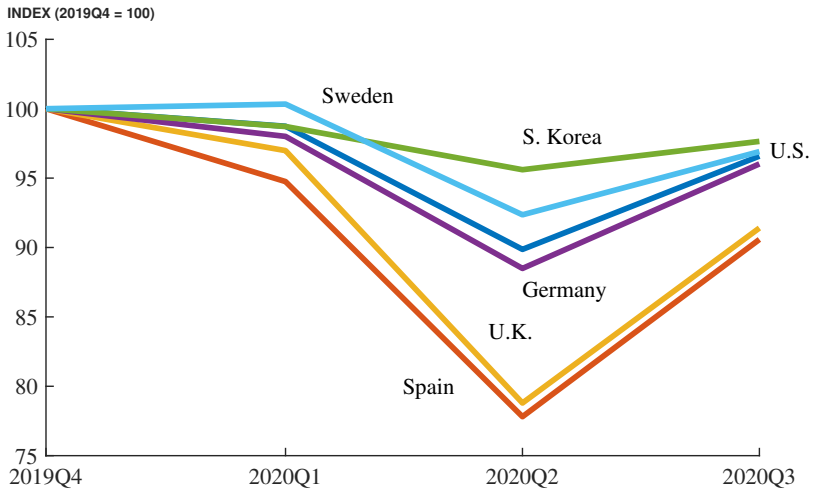
Source: Federal Reserve Economic Data (FRED).

second is the very sharp recovery that occurred in 2020Q3. This is a great example of a V-shaped recovery: people stopped working and consuming for a quarter and then started to return once things seemed safer. Even by 2020Q4, however, GDP remained about 3 percent below the peak from a year earlier, and the cumulative loss in GDP throughout 2020 was around 3.5 percent of GDP.

Figure 4 shows a similar figure for select OECD countries. The United Kingdom and Spain experienced much sharper declines in GDP than the United States, while the declines in South Korea and Sweden were more modest.

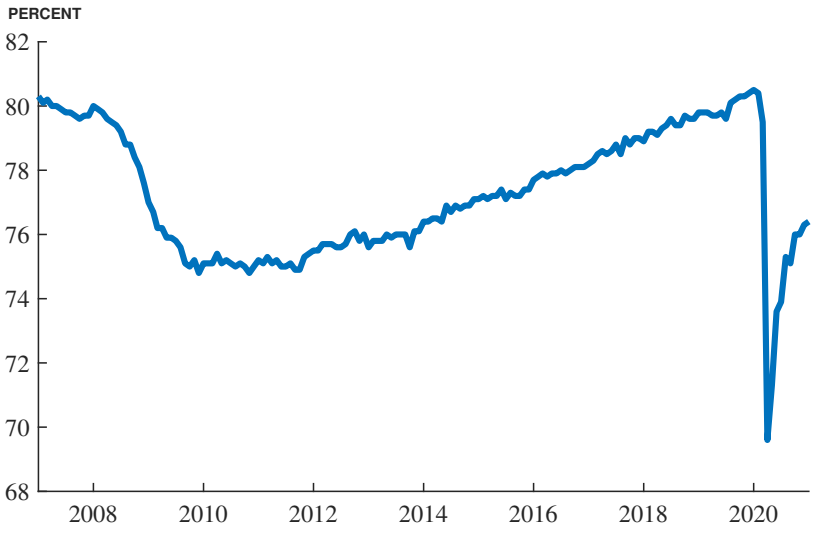
Figure 5 provides a look at the labor market in the United States by plotting the employment-population ratio for prime-aged workers (i.e., workers between the ages of 25 and 54). Right before the pandemic began, this employment ratio had returned to around 80 percent, the level it held just before the 2008 global financial crisis. With the pandemic's arrival, employment fell sharply to below 70 percent. By the end of 2020, the ratio had recovered to around 76 percent—still below the 80 percent pre-pandemic peak but substantially above the minimum reached earlier in the year.

Figure 4: GDP in Select OECD Countries



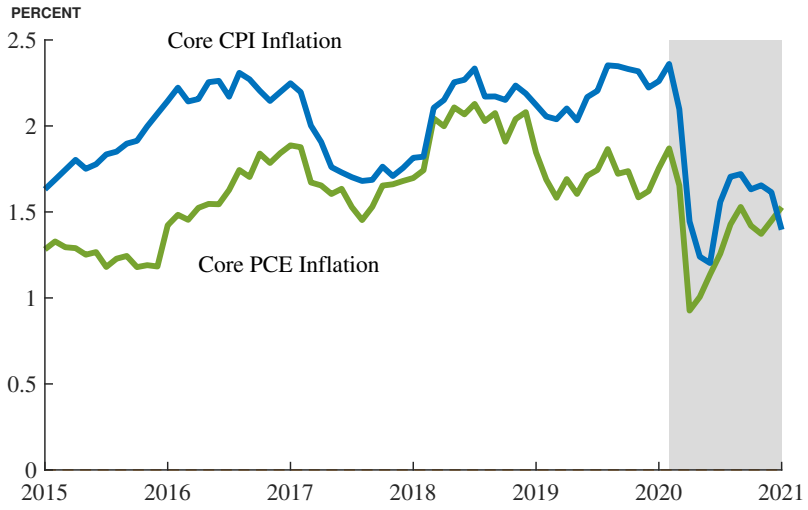
Source: OECD Main Economic Indicators, obtained from Federal Reserve Economic Data (FRED).

Figure 5: U.S. Employment-Population Ratio, Ages 25–54



Source: Federal Reserve Economic Data (FRED).

Figure 6: Core Inflation in the United States



Source: Federal Reserve Economic Data (FRED). These "core" inflation measures exclude food and energy. The inflation measures that include these categories are more volatile but deliver a similar message.

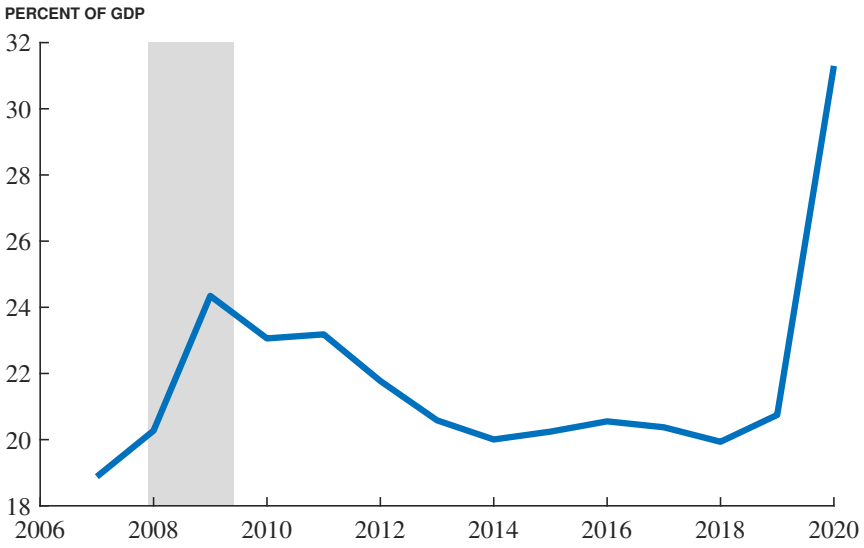
Finally, Figure 6 shows the effect of the pandemic on inflation. Recall the models we discussed earlier: to the extent that the pandemic reduced aggregate demand, one might expect inflation to decline, while to the extent that the pandemic reduced supply, one might see little effect on inflation.

The evidence from core inflation shows that there was some decline, but perhaps not as much as one might expect if the entire decline in GDP were due to an aggregate demand shock. Core inflation declined by about one-half to three-quarters of a percentage point, depending on which measure one looks at. Presumably, both supply and demand forces were at work.

4. Macroeconomic Policy Response

Governments around the world have implemented various macroeconomic policies in response to the disruption in economic activity caused by the pandemic. Figure 7 shows U.S. federal government spending as a share of GDP to illustrate the

Figure 7: U.S. Federal Government Spending

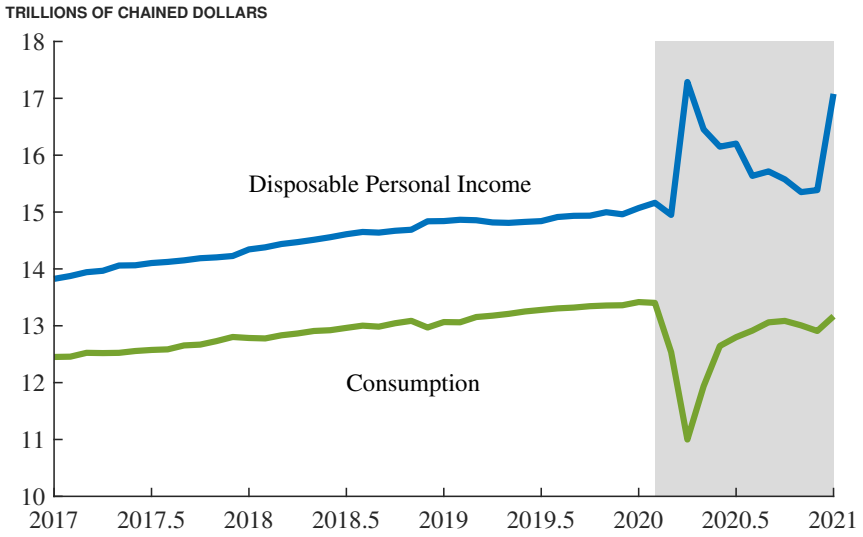


Note: Federal government spending increased from 21 percent of GDP in 2019 to 31 percent in 2020, or by more than $2 trillion.

magnitude of some of these actions. In particular, federal government spending increased from 21 percent of GDP in 2019 to 31 percent in 2020, or by more than $2 trillion. This is an astoundingly large amount, significantly larger than the change during the Great Recession.

Social Insurance: One important role for the government is to provide social insurance, and insuring people against the economic consequences of COVID-19 fits this category well. This insurance took many forms, including extending unemployment insurance in both its duration and in the size of the payments as well as direct payments to medium- and low-income households. Figure 8 illustrates one remarkable consequence of these programs, which is that disposable (i.e., after government transfers and taxes) personal income actually *increased* rather than decreased following the onset of the pandemic. This increase directly reflects the social insurance programs that operated.

Figure 8: Disposable Income and Consumption



Note: Consumption declined sharply during the pandemic. Interesting, disposable personal income, which includes transfers from the government and subtracts of taxes, actually increased substantially, in large part because of various government programs designed to support households.

Business Assistance: The U.S. government also provided several programs to help businesses avoid bankruptcy and the potential "vicious circle" that bankruptcies could create: businesses fail, that causes problems with bank balance sheets, leading banks to reduce lending, which results in a financial crisis and further business failures. The Paycheck Protection Program, for example, supported small businesses by providing them with up to 8 weeks of funding to pay payrolls and benefits, amounting to more than $650 billion.

Recent research suggests that in the absence of these policies, the bankruptcies that would have ensued would have cost the economy an amount equivalent to a 6 percent reduction in consumption. Interestingly, the authors suggest that the plan actually did not on net cost the government money: the lost revenue associated with the bankruptcies would have approximately equaled the fiscal cost of the program.[4]

Quantitative Easing: The Federal Reserve was also heavily involved in supporting the funding of banks and businesses through its asset purchases, known more generally as quantitative easing. As shown in Figure 9, the Fed engaged in around $3.5 trillion of asset purchases in 2020, including treasuries and mortgage-backed securities, but also direct and indirect lending to businesses through financial institutions.[5]

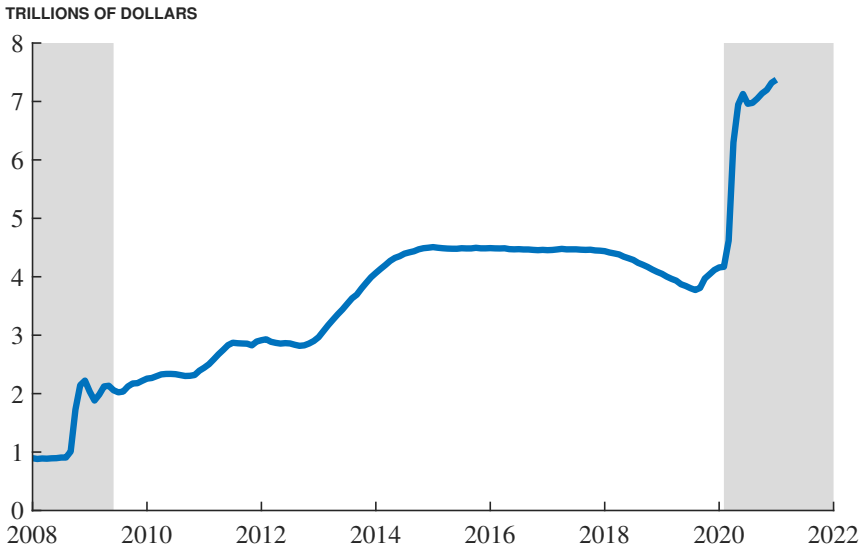
5. Concluding Thoughts

We all certainly hope that the end of the pandemic is near. Macroeconomic activity declined very sharply at the start of the pandemic but has also shown great resilience, bouncing back sharply in the middle of 2020. This suggests some reasons for optimism: once the COVID-19 threat is behind us, it seems very likely that the economy will recover much of its activity quickly. There may be lingering effects, but they seem likely to be small by comparison.

[4]Vadim Elenev, Tim Landvoigt, and Stijn Van Nieuwerburgh, "Can the COVID Bailouts Save the Economy?" The Wharton School manuscript, September 2020.

[5]For more detail, see Jeffrey Cheng, Tyler Powell, Dave Skidmore, and David Wessel, "What's the Fed doing in response to the COVID-19 crisis? What more could it do?" Brookings, January 2021.

Figure 9: Quantitative Easing by the Federal Reserve



Note: The graph shows assets held by the U.S. Federal Reserve. During the pandemic, the Fed engaged in around $3.5 trillion of asset purchases, including treasuries and mortgage-backed securities, but also direct and indirect lending to businesses through financial institutions.

Government policy has clearly played a central role in the response to the pandemic in at least two dimensions. First, policies related to social distancing, mask wearing, and shutdowns directly affect economic welfare through the deaths from the coronavirus. They have both short-term and long-term effects on GDP as well: countries that have kept the deaths from COVID-19 low have tended to have better macroeconomic performance as well. Second, governments and central banks around the world have stepped in to provide "social insurance" to help their citizens and businesses in difficult times. In the United States, these interventions have been large and seem to have played an important role in mitigating the declines in GDP.

[This material was mistakenly omitted from the 5th edition of the textbook.]

Event #4: A Positive TFP Shock (insert at bottom of page 372 of Chapter 13)

The last event we consider in this section is a positive shock to total factor productivity (TFP). Suppose the economy improves its rules and institutions or discovers a new technology. How does this shock show up in our AS/AD framework?

This example pushes us to think about how our long-run model of economic growth meshes with our short-run model of economic fluctuations. To start, recall the AS and AD equations:

$$\text{AS curve:} \quad \pi_t = \pi_{t-1} + \bar{v}\tilde{Y}_t + \bar{o}$$

$$\text{AD curve:} \quad \tilde{Y}_t = \bar{a} - \bar{b}\bar{m}(\pi_t - \bar{\pi}).$$

The key thing to notice is that the TFP parameter, for example $\bar{A}$ from the Solow or Romer models of Chapters 5 and 6, does not appear in either equation.

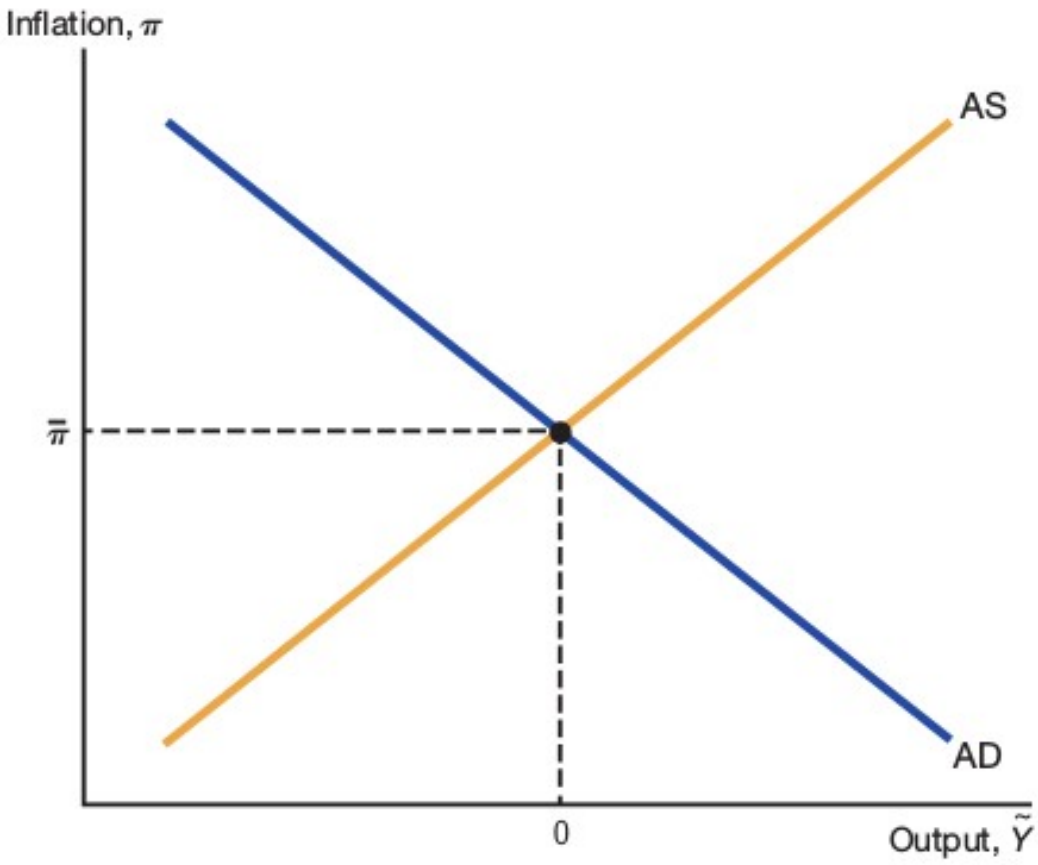
So where is TFP? Recall that short-run output, $\tilde{Y}$, is the percentage gap between actual GDP and potential GDP. An increase in TFP will certainly raise potential GDP—we explained back in Chapter 9 that potential GDP comes from our long-run model. The fact that TFP makes no direct appearance in our short-run model then reveals something important: an implicit assumption of our short-run model is that an increase in TFP raises both potential GDP *and* actual GDP, leaving the gap between the two, $\tilde{Y}$, unchanged. In other words, *a positive shock to TFP has no effect on short-run output or inflation in the AS/AD framework,* as shown in Figure 10.

This is not to say that it does not affect the economy. As we just explained, actual GDP and potential GDP will both increase. So a positive shock to TFP will raise GDP even in the short run, just as it did in the Solow model, for example. But it will not add to any demand-side pressures on inflation that are captured by short-run output—hence, its absence from the short-run model. This example illustrates a very important point: supply-side shocks like an increase in TFP can stimulate GDP in the short run without creating any significant pressure on inflation. Just because the economy is growing rapidly in a given quarter or year does not mean

that inflation is destined to rise.

In other frameworks, a positive shock to TFP can affect inflation, but typically by reducing it rather than increasing it. For example, remember our Quantity Theory of Money from Chapter 8. There, an increase in TFP will increase GDP and put downward pressure on prices—recall Milton Friedman's quip that inflation results from "too much money chasing too few goods." An increase in the supply of goods puts downward pressure on prices. This feature is absent from our baseline AS/AD framework. We will see in Chapter 15, however, that it makes an appearance in richer models of the short run.

Figure 10: An Increase in TFP in the AS/AD Framework



SIDEBAR NOTE: An increase in TFP does not shift either the AS or the AD curve. This shock will raise both actual and potential GDP, but by leaving the gap between the two unchanged, it leaves $\tilde{Y}$ unchanged. A rapidly-growing economy in the short run need not create upward pressure on inflation.