

COVID-19 and Its Impact on Financial Markets and the Real Economy

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The COVID-19 pandemic severely disrupted financial markets and the real economy worldwide. These extraordinary events prompted large monetary and fiscal policy interventions. Recognizing the unusual nature of the shock, the academic community has produced an impressive amount of research during the last year. Macro-finance models have been extended to analyze the impact of epidemics. Empirical papers study the origins and consequences of the disruptions and the impact of policy interventions. New research evaluates the ongoing financial fragility and its relation to previous episodes and regulations. This special issue contains early contributions to this important and rapidly developing literature.¹

Ten years after the end of the Global Financial Crisis (GFC) and the Great Recession, the COVID-19 pandemic caught the world by surprise. While the GFC can be, at least in hindsight, understood as the consequence of developments in the housing, mortgage, and financial markets that had been building up over several years, the COVID-19 crisis was truly unexpected.

Many scientists have warned about the potential risks of pandemics, as part of a long list of possible rare disasters; however, governments, firms, and households appear to have been caught off guard by the coronavirus. At its roots, the COVID-19 crisis is not a financial or economic crisis; it is a health crisis that has adversely affected the lives of millions around the globe. However, through its effects on supply and demand conditions, and likely also on productivity,

¹This Introduction has been written for a special issue of the *Review of Financial Studies* focused on research on the COVID-19 crisis.

the COVID-19 crisis quickly turned into a large-scale financial and economic crisis.

Firms and households. For many firms, production requires face-to-face interactions between workers. As a result, the supply of many goods and services has been disrupted or even halted. Likewise, the provision of many goods and services requires face-to-face interactions with customers. Again, for those goods and services, demand has dropped sharply for fear of exposure to the virus. In many cases, government restrictions on various activities, as part of an effort to mitigate the effects of the virus, have likely led to economic contractions beyond the direct effect resulting from peoples' fear of exposure. Given these contractions in supply and demand, U.S. gross domestic product (GDP) declined by 3.5% in 2020, the first annual decline since the Great Recession, and the biggest annual drop since the end of World War II. Millions of workers have lost their jobs. In the United States, the unemployment rate soared to 14.7% in April 2020, from 3.5% in February. More than a year later, in June 2021, it remained elevated at 5.9%, higher than in any of the five years prior to the crisis. As we are writing this editorial, in July 2021, the U.S. economy is still hurting. Many countries around the world have undergone similar developments. And, despite the impressive vaccination progress, significant uncertainty remains about the evolution of the virus in terms of variants, global vaccine inequity, etc., in the months and years ahead of us.

Financial markets. The effects of the COVID-19 crisis on firms and households, and the associated uncertainty, caused disruptions in many financial markets. Even the U.S. Treasury market showed signs of stress in March 2020. Corporate bond markets and money market funds experienced acute stress as well. Crucially, financial markets rebounded quickly. While the S&P 500 Index lost one-third of its value during the COVID-19 crash of February and March 2020, it gained all of it back by August 2020, and it has been rising ever since. Similarly, U.S. corporate bond yields (relative to 10-year Treasury yields) rose sharply during February and March 2020, but have rebounded quickly and returned to precrisis averages within the same year. The quick recovery of financial markets in the United States can be, at least in part, attributed to the Federal Reserve, which took swift actions to avert a full-fledged financial crisis. Still, these patterns led many to wonder about a possible disconnect between financial markets and the real economy and the relevance of financial market indicators for economic recovery.

Fiscal and monetary policy. Congress acted swiftly. In March 2020, it passed the \$2.3 trillion Coronavirus Aid, Relief, and Economic Security (CARES) Act, which included extended unemployment benefits and forgivable loans to small businesses, among other things. Additional stimulus packages

followed, both in 2020 and in 2021. The Federal Reserve, too, acted right away. In March 2020, in an extraordinary FOMC meeting, the Federal Reserve lowered the target range for the Federal funds rate to near zero. Additionally, it initiated large-scale asset purchase and backstop funding programs to a wide variety of markets, including the corporate bond market. In taking all these actions, the Federal Reserve benefited from the playbook it had developed during the GFC and took additional actions, such as announcing the purchase of corporate bonds, an unprecedented move in the United States. The goal of the backstop funding programs was to make sure trading would continue in those markets, thus preventing market freezes of the sort witnessed during the GFC.

Is the COVID-19 crisis just “another” large-scale shock? We think not. Its origin as a health shock, an unprecedented global pandemic, makes it fundamentally different from previous financial and economic crises, including the GFC and the Great Recession. A deadly virus attacked not only the health of individuals but also that of the entire economy, creating stress in financial markets not seen since the GFC. While both Congress and the Federal Reserve stepped in right away to apply lessons learned from the GFC, the U.S. economy has not fully recovered more than a year later. Hence, putting the origin of the shock aside, the magnitude and scope of the intervention are surely unprecedented and will affect economics and finance research for years to come.

The articles contained in this special issue offer unique insights into the various challenges faced by economic agents during this historical crisis episode. Some of the articles focus on disruptions in financial markets, while others explore how shocks to the real economy may cause financial markets stress, affecting risk premiums and asset prices, and how policy intervention can help alleviate the stress. Some of the articles lay the foundation for new theories aimed to integrate epidemiology and economics, while others provide new data and empirical analyses to shed light on the implications for markets and the economy. Collectively, the articles in this special issue allow us to better understand the impact of the COVID-19 crisis on financial markets and the economy as a whole. In addition, as the GFC resulted in many changes to the regulatory landscape, the COVID-19 crisis also provides a real-life stress test to study which regulations have been successful and which parts of the financial sector will require (ongoing) attention.

This special issue includes 10 articles, described in more detail in Section 1. Some of the papers were submitted via the regular submission process; others were solicited by the editors. All of them provide unique insights into the nature of this pandemic shock, its effect on financial markets and the economy, and the ensuing policy interventions. As developments of this pandemic and its aftermath are still ongoing, and new insights and data about the past events continue to emerge, we expect more research to follow in the future. We

very much welcome key contributions to the literature on COVID-19 and its long-term consequences in the *Review of Financial Studies*. With this in mind, we conclude in Section 2 with a discussion of potential directions for future research.

1. What Is Included in This Special Issue?

This special issue contains 10 papers. The first group of papers, discussed in Section 1.1, connects the spread of the virus and mitigation policies to economic decisions and asset price valuations. These papers present new directions by applying insights from epidemiology and understanding the implications for finance and economics. The papers in Section 1.2 study disruptions in financial markets that occurred as a result of the pandemic shock, and the role of monetary policy in alleviating them. These papers connect to prior literature on financial fragility and regulation and analyze what has changed during this episode, providing new insights for future regulations.

1.1 Macroeconomic models featuring pandemics

Eichenbaum, Rebelo, and Trabandt (2021) make a seminal contribution to the literature by embedding the canonical SIR (susceptible, infected, and recovered) model (Kermack and McKendrick 1927) into a macroeconomic model. They do so to understand the interaction between economic decisions and epidemics. In the model, people can become infected while shopping, working, or interacting with others in scenarios unrelated to either consuming or working. Susceptible people understand they are less likely to become infected if they consume and work less. While this cautionary behavior mitigates the severity of the epidemic, it amplifies the severity of the economic downturn via demand (reduced consumption) and supply (reduced labor supply) effects. The model also allows for the possibility that the health care system becomes overwhelmed, and, in that case, people more aggressively cut back on consumption and work.

The competitive equilibrium is not Pareto optimal due to an externality that infected and susceptible people do not internalize the effect of their decisions on the spread of the virus. Eichenbaum, Rebelo, and Trabandt (2021) explore the value of government interventions and in particular containment policies. In the calibrated version of the model, they find that aggressive containment policies, and strengthening such measures as the fraction of infected people rises, would save roughly half a million lives in the United States. Their model features capacity constraints on the health care system and the possibility of vaccines and treatments being developed. While such policies mitigate the human cost of the virus, the economic costs are large, as consumption falls by 22% in the first year as opposed to 7% without containment policies.

Jones, Philippon, and Venkateswaran (2021) develop a related model to understand the inter-action between epidemics and economic activity. As before, the risk of infection increases when shopping and working. To mitigate the risk of becoming infected, people can work from home, except with lower productivity. A key feature of the model is that it allows for learning-by-doing, and productivity losses decline as people become more experienced in working from home. This aspect of the model enriches the dynamic implications and allows for testable predictions across sectors.

When analyzing externalities, Jones, Philippon, and Venkateswaran (2021) highlight a “fatalism effect”: people rationally anticipate early on in an epidemic the likelihood that they will be infected at some point in the future. This realization in turn weakens their incentives to be careful and to avoid becoming infected today. Government policy can be designed to offset this effect. In this model, the economic impact of mitigation policies is less severe because of peoples’ ability to work from home. In an extension, Jones, Philippon, and Venkateswaran (2021) consider a model with multiple sectors that each differ in their epidemiological parameters and ability to work from home. They calibrate the model using data on various sectors and show that the model’s predictions align with data on health and economic outcomes.

Hong, Wang, and Yang (2021) extend this literature by allowing for aggregate shocks to the transmission rates in the epidemic model. The second source of aggregate risk is the possibility of developing a vaccine. Instead of focusing on economic decisions in terms of consumption and labor supply, as in Eichenbaum, Rebelo, and Trabandt (2021) and Jones, Philippon, and Venkateswaran (2021), the authors focus on the impact of the epidemic, and the related mitigation measures, on corporate earnings and firm valuation. Firms can take costly measures to mitigate the spread of infection. While taking such measures is costly today, doing so raises future expected earnings; therefore, mitigation measures may increase firm value.

Hong, Wang, and Yang (2021) estimate an epidemic model using data from 16 countries. This approach helps to improve the precision of the estimates. They first show that deterministic models, which are widely used in the literature, are worse at approximating the stochastic model at longer horizons, that is, when the development of the vaccine is further out. Second, the optimal mitigation strategy is affected by uncertainty in transmission rates, as there is an option value of waiting when there is a possibility that infections will die out. Also, as infection rates cannot be perfectly controlled, mitigation measures fluctuate with infection rates.

In terms of asset prices, the price-to-earnings ratio may actually increase during the onset of the pandemic. After all, while earnings drop sharply, in part because of mitigation costs, prices reflect the temporary nature of the shock and the recovery of earnings once a vaccine is discovered. Using their model, Hong, Wang, and Yang (2021) estimate that asset prices would fall by 15% in the absence of any mitigation measures.

The previous three papers provide evidence to support some of the key predictions of the models in connecting the spread of the virus to fluctuations in real and financial markets. But, this evidence is at a fairly aggregated level. Ultimately, more granular data are needed to understand the various effects of the pandemic and its interaction with the economy. Spiegel and Tookes (2021) make an important step in this direction. They collect comprehensive data on business closures and other restrictions across counties in the United States over time as the pandemic has evolved. With these data, they explore how the different policies are related to fatality rates in the respective counties in the following weeks. If decisions about mitigation policies should be based on a cost-benefit analysis, balancing the economic costs against the health benefits, these estimates can be essential.

The authors provide a rich set of results. Mask policies, which presumably have low economic costs, are generally found to be associated with lower future fatality rates. Other policy measures that entail more significant economic costs, such as restaurant, bar, and gym closures, are also found to be associated with lower fatalities. Yet, additional measures, such as the closure of low- to medium-risk businesses, may have been counterproductive. When interpreting the results in the paper, one must think carefully about causality versus correlation. To facilitate a causal interpretation, the authors conduct various tests, such as looking at the effects of statewide policies on small counties or comparing counties near state borders.

1.2 Financial market disruptions and the impact of policy interventions

With a shock to the real economy of a magnitude, such as the COVID-19 shock, one would expect financial turmoil to follow. The evolution of the shock, and the areas of the financial system affected by the shock, however, came as a surprise. The epicenter of the financial turmoil was to a large extent the corporate bond market. Haddad, Moreira, and Muir (2021) study this market during the height of the COVID-19 crisis in March and April of 2020. The stress exhibited in this market was manifested by an increase in spreads and a decrease in liquidity. What is most unique about this episode is that the greatest stress was seen for assets on the safer end of the spectrum. Also, the increase in spread of these corporate bonds was not accompanied by a similar increase in spreads of credit default swaps (CDS), so a large part of it must have been driven by sources other than an increase in credit risk that could have resulted from the real shock.

The authors explain these patterns as a result of liquidity shortages in the corporate bond market. Demand for cash by various institutions, such as mutual funds, accompanied by the constraints faced by financial intermediaries—which are both phenomena studied in other papers—contributed to extreme liquidity pressure, pushing down the prices of assets well beyond what the increase in credit risk would imply. Hence, the paper provides important evidence of the fault lines in the financial system exposed by this crisis. The authors also analyze what led to the quick stabilization of, and recovery

in, this market, and attribute it to a large extent to the intervention by the Federal Reserve, and in particular the unprecedented announcement that it would purchase corporate bonds.

Kargar et al. (2021) also focus on the corporate bond market at the height of the COVID-19 crisis and its aftermath. To gain a better understanding of the changes in liquidity in this market, they follow pre-COVID-19-crisis literature and distinguish between risky-principal trades, where dealers offer immediacy by purchasing the asset and holding it until finding a buyer, and agency trades, where the seller retains the asset until the dealer finds a buyer. They show that the cost of risky-principal trades increased dramatically in the height of the crisis, leading customers to switch to the less-preferred agency trade. Hence, the way liquidity was compromised is reflected not only in larger costs but also in slower speed.

They then build a model featuring demand for the different types of liquidity by different investors and an intermediary sector that provides the different liquidity services at some costs. Estimating the model based on COVID-19-crisis data, they argue that the patterns seen in the market can be explained as a combination of increased demand for immediacy and an increase in the cost that dealers have to bear to provide liquidity in the risky-principal route. They estimate that the demand for immediacy rose sharply by about 200 bps per dollar of transaction, but that it receded quickly and fully following the announced interventions by the Federal Reserve. On the other hand, the increase in cost of providing liquidity reversed only partially, due to balance sheet constraints that continued to be binding. Since regulations that were put in place after the 2008 crisis increased constraints on dealers, they might have contributed to the fragility in the corporate bond market in 2020, a market that was not at the center of attention during the GFC.

Another episode of stress in financial markets following COVID-19 developments materialized in prime money market funds. Li et al. 2021 study this episode. In two weeks in March 2020, institutional prime money market funds lost about 30% of their assets under management. This episode was particularly interesting, because money market funds experienced runs in the crisis of 2008 and were since then at the center of regulatory attention with different reforms introduced to maintain their stability. A natural question is whether these reforms were of any help, and why runs still occurred.

According to the paper, a key reform enacted following the 2008 crisis was actually a primary source for the current episode of fragility. This reform allows money market funds to impose redemption gates and liquidity fees on investors if a measure of liquidity, the weekly liquid assets (WLAs), falls below 30%. While the intention of the reform was to curb runs as they start to intensify, it may actually have the opposite effect, as the impending suspension of liquidity may cause investors to rush to redeem as long as they can. In a sense, the expected intervention may amplify the strategic complementarities behind a run. Indeed, the authors show that funds that approached the threshold in the COVID-19

crisis saw increased redemptions. Such sensitivity of outflows to funds' WLAs was not seen in normal times, or in times of stress before the reform, such as the 2008 financial crisis. Also, a similar sensitivity is not observed in the COVID-19 crisis with respect to another key measure of liquidity, which is not used by the regulation to determine the eligibility for imposing gates. Finally, like in the case of the corporate bond market, the paper finds that emergency intervention by the Federal Reserve was instrumental for stopping the outflows eventually.

While corporate bond markets and money market funds experienced turmoil following the outbreak of COVID-19, banks exhibited significant resilience. Large inflows of deposits allowed them to provide credit to the real economy. This partly reflects the stronger financial positions banks held leading up to this crisis, following large reforms in the aftermath of the GFC, in which banks' fragilities were exposed. But, what are some of the other factors that contributed to depositors' flows in 2020, and how related were they to the pandemic? Using detailed branch-level deposits and county-level COVID-19 infections data, Levine et al. (2021) study these questions.

The evidence they provide points to a channel of precautionary savings. Households in regions with higher infection rates felt more anxious about the developments of the pandemic and put more money in deposits in local branches. As a result of this greater supply of deposits, these banks reduced the rates they pay on deposits. The paper runs a battery of tests to show that this precautionary-savings channel dominated other channels, such as flight to safety or greater demand for deposits by banks, in explaining the patterns of deposit flows across locations and over time during the pandemic. Hence, the paper contributes to a literature on the response of households to this unprecedented crisis.

Turmoil in the financial system is of great concern because of possible spillovers to the real economy. Evidence from the GFC, for example, points clearly to such spillovers, as firms had difficulties raising financing for their investments and operations. An important question in the current episode is whether firms were better prepared to possible financial disruptions. Fahlenbrach, Rageth, and Stulz (2021) document significant heterogeneity in firms' resilience during the COVID-19-driven stock market collapse of February and March 2020. They hypothesize that firms with greater financial flexibility can more easily fund cash shortfalls and therefore should be less affected by the COVID-19 crisis than less financially flexible firms. Indeed, they find that firms which are more financially flexible—based on their cash holdings, short-term debt, and long-term debt at the end of 2019—performed significantly better during the stock market collapse; the stock price of highly flexible firms dropped by 26% less than the stock price of firms with low flexibility. Importantly, the performance gap continues to persist during the subsequent rebound of the stock market, suggesting that the ability to fund cash shortfalls in times of crisis may have long-lasting value implications.

Did financial flexibility this time have a similar value as in previous crisis episodes? The answer is both yes and no. While the value of cash holdings and (having less) long-term debt is quantitatively similar to what it was during the GFC, (having less) short-term debt does not seem to play a significant role for stock returns during the GFC, in contrast to the COVID-19 crisis. Furthermore, Fahlenbrach, Rageth, and Stulz (2021) show that the worst-performing industries during the GFC differ from the worst-performing industries during the COVID-19 crisis, in the sense that the latter industries score much higher on measures of COVID-19 exposure based on the need for social distancing. For these industries, the authors find that the value of cash holdings is especially high during the COVID-19 crisis.

Finally, an important theme emerging from the papers on financial fragility in the COVID-19 crisis is how monetary policy interventions, largely in the form of asset purchases, have helped to stabilize markets. Since this form of intervention is still relatively new and not fully understood, there is scope for more theoretical analysis. Caballero and Simsek (2021) develop a macroeconomic model to analyze the effectiveness of large-scale asset purchases (LSAPs). The model features risk-tolerant (“banks”) and risk-intolerant (“households”) investors. In equilibrium, banks are levered and highly exposed to aggregate shocks, such as the negative supply shock due to COVID-19. In response to such a shock, the effective risk tolerance of the market falls, and the required Sharpe ratio rises. If the shock is small and temporary, a small increase in the Sharpe ratio suffices for financial markets to clear. If the shock is large, however, even if it is temporary, the required increase in the Sharpe ratio is large, and the decline in asset prices and aggregate demand may exceed the decline in supply. The central bank can act by cutting interest rates, but this no longer works if the interest rate is constrained. In this case, if banks’ initial leverage is sufficiently high, multiple equilibria exist, and the feedback between asset prices and risk tolerance can be so strong that banks fail.

Caballero and Simsek (2021) show that, in this case, it is beneficial to move some of the risk to the balance sheet of the government. This reduces the required Sharpe ratio, improves asset prices and aggregate demand, and mitigates the recession. The mechanism explored in the model is more powerful when demand is less elastic, which is consistent with a growing literature on asset demand estimation.

2. Directions for Future Research

The COVID-19 crisis has opened up new directions for future research. Some of them have barely been explored before, while for others, the recent events provide new evidence and insights that will likely affect how they evolve. In this section, we discuss several potential directions of research that we think are ripe for exploration.

2.1 Economics in the shadow of pandemics

Prior to COVID-19, the 1918 influenza pandemic was the most severe pandemic. As people tend to be affected by more recent events, it is thus not surprising that many have not thought of pandemics as a very imminent risk. Some scientists and policy makers have warned against such risk before the current pandemic, but it would be fair to say that it has not been internalized on many levels. As such, pandemics also hardly played a role in modern studies of economics.

The events surrounding the COVID-19 crisis have uncovered big gaps in knowledge. Pandemics have direct and severe implications for many areas of economics, most prominently, the very pertinent trade-offs between health and the economy that might be part of various decisions made by policy makers in developing mitigation policy. Papers in this issue provide the first steps in understanding such questions, incorporating epidemiological models into macroeconomics and asset pricing, and using detailed data on policies and their consequences.

Regardless of the future path of the current pandemic, we think that these issues will not be easily forgotten and that research on these topics will continue to evolve to incorporate more knowledge from epidemiology into economics and finance. After all, future pandemics might be around the corner, and this knowledge will be important to prepare for them and guide future policies. More detailed data about the current pandemic is also constantly being revealed and analyzed—for example, about people’s activities and movements at various stages of the pandemic—and this will foster a deeper understanding of the connections between the pandemic, policies, and economic activity.

2.2 Technology and social distancing

The pandemic exposed a dimension of risk that was not salient before. This is the risk of communicable diseases spreading as a result of social gatherings and interactions. Firms whose business model heavily depends on gatherings and interactions found themselves in a dire situation. Such firms will face this risk in the future even after the pandemic ends. Other firms found out that they can develop alternative solutions, at least for a period of time. Technology clearly played an important role. If technology was not in place, the path of the pandemic would have been completely different.

Putting the pandemic aside, the use of such technologies opened new questions for the future, as to whether their use will persist and change the way things were done before. Borne out of necessity, the widespread adoption of Zoom and related video-communication technologies is likely to affect how business will be conducted going forward. While many business interactions have been shown to be much less effective in virtual format, for example, conferences, others, such as small-group business meetings, may be conducted remotely more often. Similarly, remote working will likely be more frequent than before, even though offices will continue to play a role.

Whatever the degree of the change will be, if physical proximity is becoming less important, there will likely be implications for the relationships between firms and workers, banks and small-business borrowers, venture capitalists and portfolio companies, plants and headquarters, to name just a few examples. Will we see an increase in physical distance between transacting parties, reminiscent of the “information revolution” in small-business lending in the 1980s and 1990s? Will this expand the availability of credit to marginal firms or individuals? What are the implications for customer-supplier networks, the boundaries of the firm, or corporate governance? Will these developments lead to measurable improvements in productivity? More research and evidence on this issue is needed.

2.3 Functioning of financial markets

Signs of instability cropped up in repo markets in Fall 2019, whereas the events during Spring 2020 highlighted the fragility of Treasury and corporate bond markets more broadly. Given the importance of Treasury securities as safe assets in global financial markets and the relevance of corporate bond markets for the funding of firms, improving the resilience of these markets is essential.

In doing so, it is important to understand the incentives and regulations of various intermediaries, including broker-dealers, money market funds, and open-end mutual funds. How does each one contribute to financial fragility and systemic risk? It is also interesting to rethink the broader architecture of the financial sector and its connection to the Federal Reserve, and which intermediaries, for instance, can access certain facilities.

The connection to the regulations of the post-GFC era, and the test of such regulations in the COVID-19 crisis, is particularly interesting. Regulations have strengthened banks, and indeed banks have been resilient in the current crisis. However, these regulations made the corporate bond and Treasury markets more fragile by shifting activity to open-end funds and by constraining the ability of dealers to intermediate. The crisis thus provides evidence that calls for a re-evaluation of the prior regulation and for an approach that considers the system as a whole rather than specific types of institutions. Another interesting case is that of money market funds, for which previously enacted regulations might have backfired and created unintended fragility. Understanding such unintended consequences and balancing them against the original plans is an important task for future research.

2.4 Implications for fiscal and monetary policy

As short-term interest rates hit zero during the GFC, central banks all over the world actively intervened in financial markets to stimulate economic activity and inflation. Interventions have happened once again during the COVID-19 crisis, this time also to improve liquidity conditions. The COVID-19 interventions have further increased the footprint of central banks in asset

markets. At this point, it seems difficult to think about asset prices without accounting for the role central banks play.

This raises a series of important questions. First, as central banks move beyond purchasing government bonds and related securities to corporate bonds and, in some cases, even equities, a key question is how this affects investors' expectations going forward, and how the central banks' actions may distort the pricing of risk. Second, as the ultimate goal is to affect economic activity and inflation, it is unclear whether it is optimal to purchase Treasuries, mortgage-backed securities, or corporate bonds. The ultimate effect will depend on the price impact in the various markets and how changes in associated asset prices affect economic decisions and inflation. Some research on the effect of asset purchases was based on the GFC experience, but the current experience provides new avenues to explore. Third, most of the empirical and theoretical work on large-scale asset purchases focuses on a single country. During the pandemic, most central banks acted in concert, which raises new questions about the impact on global financial markets.

In addition to monetary policy, governments all over the world also took decisive actions to support households and firms in light of the pandemic. Understanding the short- and long-run effectiveness of such fiscal policy interventions, across states and countries, is an important question for future research.

The flipside of such large-scale interventions is a sharp increase in debt-to-GDP levels all over the world. An active literature explores the fiscal capacity of governments and how it depends on the level of interest rates relative to growth rates, wealth inequality, and asset risk premiums. It also raises questions about the coordination between fiscal and monetary policy, as well as central banks' independence.

2.5 The rise of zombie firms

During the onset of the COVID-19 crisis, there was widespread agreement that governments should do whatever it takes to support the economy and limit long-term damage, while fighting the virus. However, as the health situation is improving in first-world countries due to rising vaccination rates, the question arises about how much support is still warranted.

One natural concern is that firms that otherwise would have defaulted, absent the pandemic, are now able to survive. The subsequent low-rate environment and low credit spreads, perhaps in part because of large-scale asset purchases, contribute to such concerns. The potential rise of zombie firms also has implications for the stability of institutions that heavily invest in corporate bonds, such as insurance companies and open-end mutual funds.

In future research, it will be important to develop tools to identify zombie firms, analyze their effect on the macroeconomy and financial cycles, and consider policies to reduce the resulting inefficiency. Some experience in understanding zombie firms comes from past episodes, such as Japan in the

1990s, but a lot still remains unknown. The challenges are dynamic and constantly changing. For example, if fundamental shifts occur because of a greater reliance on remote interactions, this will affect which firms have long-term viability and which are likely to become zombies.

2.6 Household and small-business finance

Households and small businesses were especially affected by the COVID-19 crisis. Evaluating their responses is challenging, however, as the CARES Act of March 2020 was passed shortly after the pandemic began to spread throughout the United States. At the aggregate level, observed outcomes are thus jointly determined by the pandemic and the ensuing policy intervention. However, all of the stimulus packages included in the CARES Act were targeted, creating scope for identification strategies akin to those employed in empirical studies of policies implemented in the wake of the Great Recession to aid households and small businesses.

The first-order questions are evident: Did the \$300 billion in cash payments to individuals and the \$260 billion in unemployment benefits stimulate consumption? Did the \$350 billion paycheck protection program—an additional \$320 billion was added later—protect jobs and small businesses? But important second-order questions also arise: What goods and services were most affected (i.e., did the composition of consumption change)? What regions or industries benefited the most, and why? Finally, besides studying responses to government policy, researchers can exploit a wide range of both geographical and temporal variation in the spreading of the pandemic to study the consumption and employment responses of households and businesses, respectively. The COVID-19 crisis provides a rich laboratory for research that is on par with previous crises, such as the Great Recession.

2.7 Managing and insuring rare and emerging risks

A long list of rare disasters, which typically includes pandemics, has been discussed for years, yet governments, firms, and households seem unprepared. Supply chains turn out to be fragile, including those critical for the development and production of medical devices and drugs. In addition, governments followed very different strategies to fight the virus, yet the lessons learned and best practices have not been widely shared. This raises important questions about the resilience of the global economy to rare disasters, such as, climate change and cyber risk. Also, a large literature is concerned with the determinants of economic growth and how government policies may affect long-run growth. Governments' slow learning about policies that spur growth may have important long-run consequences.

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