

A Tale of Two Crises: The 2008 Mortgage Meltdown and the 2020 COVID-19 Crisis

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The causes and consequences of the 2008 mortgage meltdown and 2020 COVID-19 crisis are quite different: the 2008 mortgage meltdown reflected infection of the financial system due to excess leverage and poor-quality mortgage loans, and the recent crisis reflects a substantial global economic shock to contain the viral outbreak of the coronavirus. Yet the financial and medical systems share many elements, such as opacity and interconnectedness as well as adequate buffers and reserves. We examine these themes as well as asset pricing, moral hazard (though it was at the root of the crisis only in the Great Recession), the consequences for government as a systemic actor, economic concentration, and capital market regulation in the two crises. In both crises, interventions in financial markets and disruptions in the housing market played important, but differing, roles. The recent crisis elucidates open questions about the foundation of financial economics and risk sharing. (*JEL* G1, G2, G3, E4, E5, B2)

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Since the onset of the COVID-19 crisis, many commenters have highlighted substantial economic and financial differences compared to the mortgage meltdown (Great Recession). At its core, the mortgage meltdown involved opacity with respect to payments, whereas the COVID-19 crisis concerns opacity with respect to health status. Of course, though there are differences, crucially there also are important similarities and much to learn by highlighting these and considering the two crises together. In effect, the two examples can lead to more insight than a single one by helping to focus on broader and common perspectives and differences. Many open questions are raised by the similarities and the contrasts between the two crises, and, of course, much can be learned from the most recent and ongoing crisis. Furthermore, the breadth

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and magnitude of the recent shocks point to fundamental open questions in financial economics. We try to highlight many of these issues and challenges.

At a high level, the causes and stresses underlying the two crises were dramatically different, as broadly recognized and appreciated. During the mortgage meltdown (2007–2009), the financial system became infected as overleveraged financial institutions often held excessive exposure to mortgage-related instruments that had declined substantially in value. In contrast, at the onset of the COVID-19 crisis the financial system had been strong. While the financial system’s vulnerability to large economic shocks and the potential for significant default quickly emerged in 2020, infection of the financial system was not the underlying problem. Instead, medical infections from the coronavirus caused the adverse economic shock. Of course, these infiltrated the financial system and had adverse implications for financial balance sheets and availability of funding, despite financial intermediaries in the United States beginning the recent crisis with a relatively strong capital base.¹ However, provision for loan losses increased at the end of the first quarter of 2020 and more substantially at the end of the second quarter (incremental provision for loan losses then of \$28 billion by the three largest lending institutions).

Economic principles point to some basic similarities between the two crises. At its root the COVID-19 crisis was medical and the various “stay-at-home” and quarantine orders were intended to “slow the spread” of the coronavirus or “flatten the curve”—but with a strong effect on economic activity as well as contagion. It is helpful to reflect on the medical aspects from the lens of economics as well as the financial aspects to help shed light on the parallel between the COVID-19 crisis and the Great Recession. In the two crises interventions in financial markets and disruptions in the housing market played important, but differing, roles.

The COVID-19 context provides an especially attractive opportunity to revisit, both theoretically and empirically, many of the most basic questions in financial economics, especially in light of the “exogenous” nature of the underlying shock. The shock itself heightens appreciation of the range and types of uncertainty in the economy and consequently, the value of flexibility and real and financial optionality and the potential importance of capital reallocation due to the substantial equilibrium repricing of projects and assets. This emphasizes the importance of liquidity and cash as well as a range of physical (as well as financial) buffers.² At the same time, the government’s dramatic policy response of fiscal and liquidity injections has included substantial support to debt markets from the Federal Reserve. This has led to

¹ Over the past decade, European financial institutions had not built their financial strength to a similar degree, but since the COVID-19 shocks are global, these organizations certainly face significant challenges too.

² For example, this may help suggest an explanation for the large-scale cash holdings prepandemic attributed to some firms, such as Apple.

substantial increases in the use and issuance of debt (despite debt's limited flexibility) and a range of aspects of moral hazard (e.g., because of less risk-sensitive pricing and potential debt overhang in the future), which suggests revisiting traditional theories of capital structure as well as the role of government in the capital markets. Strikingly, much of the impact of the intervention of the Federal Reserve arose from its inherent credibility without actually needing to undertake substantial amounts of trading or lending. The financial and monetary injections together with greater precautionary savings and reduced investment demand also have led to dramatically lower interest rates (even at long horizons) and even negative real rates in the United States and in much of the world, which reflect a substantial change in the structure of financial equilibrium pricing. Government policy interventions also highlight the importance of risk sharing and redistribution, including the prevalence of incomplete contracting (to a degree the fiscal interventions were an ex post response to the economic dislocations that emerged rather than an ex ante design). Finally, the crisis reveals important challenges inherent in our system of financial intermediation, particularly the fragility of various product designs (including money market and other mutual funds) and the potential mismatch between assets and liabilities.³

Table 1 provides some broad summary perspectives and observations on the crises.

1. Large Shocks, Uncertainty, and Valuation: The Nature of Risk and Asset Pricing

A striking aspect of economic crises is the dramatic impact on market valuation. This reflects shocks to both the structure of cash flows of projects and to the market pricing operator from changes in the structure of marginal utility of the cash flows that would be consistent with market clearing. In this spirit, dramatic changes in valuation occurred in both the 2008 and 2020 market crises, influencing both cash flows and pricing (such as low interest rates and increases in risk premiums). In the more recent crisis, the impact on the long-run viability of many activities and enterprises has been substantial.

At a broad level, the two crises (and others) highlight a number of similar features about the nature of risk and asset pricing. Crises highlight that for many market participants that the central risk is aggregate or systematic risk, which would be borne even after forming a diversified portfolio and priced through expected return. Cross-sectional variation in returns highlights the presence as well of idiosyncratic risk, which financial theory demonstrates is diversifiable and so does not contribute to expected return or to downside exposure of the investor's wealth. In both 2008 and 2020, the capital markets

³ In contrast, the mechanism underlying ETFs is priced directly in the market (unlike mutual funds), using an arbitrage mechanism involving trading by a limited set of "authorized participants" and the ability to create additional ETF shares or redeem shares.

Table 1.

Broad financial perspectives on two crises: The 2008 Great Recession and the 2020 COVID-19 crisis

| | |
|-------------------------------|--|
| Foundational issues | <p>Exogenous shock of uncertain magnitude and duration Real volatility and value of flexibility/optionality Effects of negative real and nominal interest rates across currencies Importance of capital reallocation due to equilibrium repricing Value of liquidity and cash Changes to capital structure framework given shocks & Fed interventions Liquidity versus solvency Financial product design & fragility: Money market funds, mutual funds, & ETFs Did policy lessons from 2008 work in 2020? Were they allowed to work?</p> |
| Federal Reserve interventions | <p>Liquidity Interventions (repo, etc.) Low short-term interest rates Forward guidance on interest rates and other policies Assets purchases: Corporate bonds, municipals, ETFs, fallen angels Direct lending programs</p> |
| Fed policy questions | <p>Why could the Fed have a large impact on asset prices with few trades? What are the costs of Fed efforts to influence asset prices? Why was implementing exit strategies challenging post-2008? What are the right exit strategies going forward? What are the goals of specific programs? Which loans to make/purchase?</p> |
| Cause of the crisis | <p>Mortgage valuation opacity, adverse selection, and leverage (2008) Medical contagion and opacity (2020)</p> |
| Features in many crises | <p>Precrisis economy as a biased benchmark (meaning of “crisis”) Unanticipated scenario, so challenging to capture in stress testing Many alternative possible causes to crises and dimensions for tail events Inadequate reserves Government as systemic actor</p> |
| Crisis management | <p>Equity capital (2008) as robust reserves; liquidity Optimal buffers and reserves: Ex ante and ex post Optimal testing design (2020) What is “essential work”? What are its consequences for concentration?</p> |
| Moral hazard | <p><u>2008</u> Leverage by homeowners and leverage by financial institutions leading to bailouts Management compensation incentives <u>2020</u> New debt issuance and debt overhang Implicit bailout of owners of risky debt Fed purchases of weak credits: Reduced risk-sensitive pricing Unemployment insurance with replacement income in excess of 100% Structure of PPP and airline loans: Risk sharing versus moral hazard Forbearance for foreclosure and eviction: Risk sharing versus moral hazard</p> |
| Risk sharing | <p>Structure of mortgage servicing contracts and first loss to originators Social risk sharing as a function of income and industry/losses Unemployment insurance and bonuses Insurable risks and contracting</p> |
| Capital market regulation | <p>Incomplete contracting: Ex post vs. ex ante risk sharing Short-selling restrictions Money market, mutual funds, and “runs” Speculative trading activities and manipulations</p> |
| Types of data | <p>Mobility, payroll, expenditures, Small Business Administration, corporate issuances, balance sheets</p> |

experienced declines (strongly correlated across assets) of 35% to 50% (relative to peak). Furthermore, in light of the decrease in interest rates during these crises (due to central bank actions, reduced investment demand and greater precautionary savings) the declines in asset values (which reflect the present value of future cash flows) understate the decline in the size of the consumption stream or an annuity that could be purchased or consumed. At the same time, it also is helpful to recognize that credit spreads (e.g., for corporate bonds) and risk premiums widen substantially in the event of a crisis. In some instances, the systematic sources of risk described also reflect risk to the financial system and lead to systemic risk. Crises in both 2008 and 2020 exemplify the importance of such system risks and protecting against both conditional and ex ante shocks to our financial system. This highlights the important question of how did the various reforms after the 2008 crisis (such as the Dodd-Frank Act, higher capital standards on banks, and global regulatory changes) perform in 2020. To what extent did various reforms protect the economy and to what extent did subsequent actions prevent a full assessment of the earlier reforms?

Relatedly, what has been the role and influence of Federal Reserve policies with respect to interest rates, quantitative easing and liquidity provision in the two crises? In both crises, short-term interest rates declined to near zero, and, in the COVID-19 crisis, more serious considerations have arisen about negative interest rates.⁴ Negative interest rates have played a much greater role in the global environment in recent years, both on a nominal and especially on a real basis. Negative rates are not simply a short-term phenomenon in 2020; they are fundamental to both real and nominal term structures. Discounting has been central to valuation theory and even to the finance discipline, but, to date, the move away from discounting the future has received only relatively modest academic attention (e.g., Spatt [2020] discusses the consequences for investing of low and even negative interest rates). While various policy discussions of nominal rates focus on the “zero interest-rate bound,” the significance of the bound (which has been broadly recognized since the Great Recession) for understanding interest rate dynamics and volatility is worth ongoing attention.

The difficulty in withdrawing liquidity provision that resulted from quantitative easing in the aftermath of the 2008–2009 crisis points to a basic aspect of Fed intervention in the markets to shore up liquidity in crises. An important aspect of the COVID-19 liquidity interventions of the Federal Reserve has been the lack of clear articulation of “an exit strategy,” which seems closely related to both the difficulty in withdrawing liquidity since 2013

⁴ Statements by the leadership of the Federal Reserve in 2020 seem somewhat more open to negative interest rates than during the prior crisis. Rogoff (2020) highlights the potential case for negative interest rates in the COVID-19 setting, whereas Goodfriend (2016) emphasizes both the implementation of negative interest rates and the ongoing rigidity of the zero interest-rate bound as compared to earlier rigidities associated with fixed exchange rates and a fixed price of gold.

(starting with the “taper tantrum” then) and the dislocations in repo that began in September 2019, after relatively modest shrinkage of the Federal Reserve’s balance sheet. Some of the challenges may reflect the demand for collateral in the aftermath of the Dodd-Frank reforms. These are important issues ripe for further study.

The systematic and systemic aspects of risk highlight an important facet related to the nature of insurable risk. Insurance companies are typically not in a position to insure broad societal risks if too large, though (a) sometimes offering to do so despite not possessing the necessary resources and (b) sometimes challenged to do so. For example, it was striking that some casualty companies insured municipal bonds prior to the Great Recession (see [Nanda and Singh 2004](#)). The defaults of municipal bonds likely would have been strongly correlated, questioning whether that would have reflected an insurable risk. In light of the lack of claims, these “monoline” insurers (such as Ambac and MBIA) extended their efforts to also insure the mortgage sector, along with AIG, which issued credit default swaps to insure huge amounts of mortgage exposure held by investment banking firms. As is well known, the insurance companies essentially collapsed from providing this mortgage coverage during the Great Recession, unlike the prior insurance of municipal bonds. For example, AIG’s downgrade on September 15, 2008, triggered collateral requirements in its swap contracts that AIG was unable to satisfy, effectively requiring Federal Reserve support to avoid a bankruptcy filing. An interesting insurance twist in the COVID-19 crisis is that business interruption insurance typically (though not always) includes exclusions for pandemics (sometimes explicitly identifying disease, virus, and/or bacteria). This point reflects the inherent difficulty in insuring systemic risk. Often these policies require a physical loss of property rather than just a property loss. Such examples reflect a more proactive approach in the COVID-19 context by insurers to avoid systemic risk. Understanding the nature of insurable risk and the structure of insurance contracts (e.g., what products arise and what contractual restrictions are important) is worthy of further attention by financial economists. Both crises (and others) highlight the importance of systemic and uninsurable risk in crises. This raises an interesting conceptual issue about designing contingent (conditional) insurance that is inversely related to aggregate or systemic realizations, given the limited ability of insurance companies to insure aggregate exposure. To the extent that there are existing examples of contingent insurance based on pandemic and other aggregate exclusions or insurance with a ceiling on aggregate societal claims, these would be interesting to understand empirically and from a risk-sharing perspective.

In light of the magnitude of the coronavirus shock in 2020 and the range of its likely effects on the organization of real activities over the long term, it seems particularly interesting to explore the impact on valuation and valuation theory. The events of 2020 emphasize the potential importance of very

large discrete shocks, as created by the pandemic, and far out-of-the-money states of the economy, including ones that are well beyond our historical experience or for which we have little experience (the “peso problem”).⁵ Of course, aspects of these lessons were highlighted by the extraordinary financial market shock in 1987 (that was quickly reversed) and the subsequent changes to the structure of risk-neutral tail probabilities and out-of-the-money options pricing (e.g., see [Rubinstein 1994](#)). The coronavirus shock had huge impacts on relative asset pricing in 2020 (as illustrated by the much greater returns experienced by high-market value vs. lower-market value companies, technology vs. hospitality companies, etc.), emphasizing the importance of both idiosyncratic risk and diversification. The extraordinary stock market reaction to the 2020 pandemic (e.g., compared to earlier pandemics) is documented by [Baker et al. \(2020a\)](#). The cross-sectional structure of returns and information as the crisis was emerging for internationally oriented firms is described by [Ramelli and Wagner \(2020\)](#). [Baker et al. \(2020b\)](#) show how the COVID-19 pandemic influenced the structure of spending across groups in the economy as well as how social distancing led to reduction in spending among various sectors of the economy.

An important tangible example of changes in relative valuation in the aftermath of COVID-19 is illustrated by real estate. For example, [Ling, Wang, and Zhou \(forthcoming\)](#) use the geographical structure of real estate investment trust holdings to show the negative response of daily stock returns to COVID-19 growth and that the sensitivity of this response is reduced by announcement of policy interventions to limit the virus’s spread. While immediate effects are associated with the ability of tenants to pay rent and utilize property effectively, long-term valuation challenges are also predicted for the post-pandemic period. The post-pandemic period will likely witness homeowners placing greater emphasis on future pandemic possibilities and other large shocks along such dimensions as the value of particular homes (to the extent that home offices are more important and houses are used more intensively) and the value of different kinds of property at various locations. For example, concentration of work in the central city in the current pandemic leads to complications with respect to density, including mass transit and elevators, and potential shifts (due to the ability to work at-home) to more distant location patterns and reductions in commuting times (see the quantitative model of Los Angeles analyzed by [Delventhal, Kwon, and Parkhomenko 2020](#)). The generic impact on the demand for office space is ambiguous in the immediate aftermath of COVID-19 due to the lower intensity of uses of offices (“stay at home”), but the need for greater space by individuals when at those offices. More fundamentally, COVID-19 highlights the value of flexibility and optionality in design and location in the future and

⁵ For example, [Rietz \(1988\)](#) and [Barro \(2006\)](#) highlight the potential of rare events to resolve the equity premium puzzle.

offers an interesting lens into it. For example, the analysis of the term structure of lease provisions with various lease cancellation options would be affected substantially by such anticipated changes in (real) volatility, building on the analysis of the term structure of lease provisions in [Grenadier \(1995\)](#) and arbitrage treatment of embedded options in fixed-income contracts in [Dunn and Spatt \(1999\)](#).

2. Interconnectedness and Opacity

A basic aspect of COVID-19 is the incredible ease of spread to those nearby, especially for extended periods. Interconnectedness not only is often desirable economically,⁶ but also is a basic cause of contagion. In effect, one's presence leads to an "externality." Externalities are central to such basic aspects of economic activity as the liquidity externality in trading (liquidity attracts liquidity) and the externality of a well-functioning payment system.

A second crucial aspect of COVID-19 is opacity (lack of transparency) about who are carriers of the coronavirus. This reflects several important underlying factors, such as the serious potential for asymptomatic spread of the coronavirus (i.e., transmission by someone lacking symptoms, but who is nevertheless contagious) and the limited availability of timely testing. While some tests provide results almost immediately (e.g., within 5 to 25 minutes), others have had delays of almost a week (or even longer), which limit greatly their usefulness (though such stale results provide partial information about who is or has been contagious and are at least helpful in documenting earlier spread of the virus). As the demand and increase in testing grew in June and July 2020, the delays in reporting due to congestion seemed to exacerbate the underlying degree of opacity.

Given the extraordinary economic harm induced by this opacity, a vigorous testing strategy with timely tests and an appropriate scale of testing would appear important to the restoration of economic health given its importance for encouraging economic actors to more willingly engage with one another.⁷ One illustration is that rapid response testing is a valuable alternative to costly 2-week quarantines, unless the probability of a positive result is extremely high. More specifically, Nobel Laureate Paul [Romer \(2020\)](#) called for approximately 25 million tests daily. Rather than suggesting that these be

⁶ The move toward globalization over the past few decades reflects the traditional perceived desirability of interconnectedness (e.g., facilitating the development of markets for a country's products) and the focus on comparative advantage, which led to reductions in the cost of various imports. Most educational and work environments have utilized interconnectedness to a considerable degree, but part of the response to the pandemic has been to limit interconnectedness, when not essential. On the one hand, this degree of interconnectedness in educational and production settings was perhaps not fully appreciated, but significant portions of that could be obtained even in the presence of remote education and work.

⁷ The continuing shock to economic activity reflects in part significant changes in behavior by economic actors. Much greater transparency and isolation of those sick at a point in time would help restore economic activity near the prior levels.

deployed in a uniform fashion (which itself could be extremely useful), Romer proposed deploying the tests based on the central importance of protecting both individuals and the economy/society. For example, under Romer's plan testing would be especially frequent for frontline health care workers (because of the importance of their coronavirus status as a result of their role and extent of interactions) and various essential workers, among others. Contact tracing also would be used to identify potential subjects for testing or isolation. The dynamic nature of the opacity, which emerges because one's COVID-19 status can change so rapidly, highlights the importance of the frequency of testing. In a sense testing (when medically and economically viable) offers a solution to opacity that would have been difficult in the Great Recession (2007–2009), where the presence of adverse selection (private information by the seller of the securitization or mortgage) would have been relatively more important.⁸ On the other hand, one challenge in the COVID-19 context is that the information state changes so rapidly. This highlights the importance of both testing over time and identifying the central role of differential test frequencies, because the disease state changes with differing frequency among people and the societal costs of disease vary among individuals.⁹ This reflects the differential extent of contacts and the medical vulnerability of individuals, who directly or indirectly are exposed to the spread of the virus. An important source of opacity even with testing is the incubation period before an infected individual would obtain a positive test result.

Another approach that addresses the potential benefits to mass testing is suggested by [Kotlikoff and Mina \(2020\)](#), who point to a simple test that can be done at home at a very low nominal cost (e.g., a few dollars) and provide rapid results (but at the cost of being somewhat insensitive), which can be supplemented for positive responses with a more accurate subsequent test. This highlights that some of the key elements in developing a testing strategy are the costs, time lag and accuracy of the tests and that to a degree resolving at least a portion of the opacity is an economic decision. An interesting economic question is whether sufficient private incentives (e.g., from employers) would be available to cover a significant portion or even all of the costs of testing, at least if the costs are sufficiently low. A different way to reduce the costs of testing would be economizing on the number of tests required by undertaking pooled (joint) tests of a number of individuals. For example, if samples from four individuals were jointly tested, then a positive result would lead to individual tests of the four, while a negative result would apply to all

⁸ This raises an interesting issue: to what degree is adverse selection important during the COVID-19 crisis? While it was generally recognized to be crucial in the mortgage meltdown as the mortgage seller would have considerable private information relative to the buyer, the question also arises whether a person has private information about his health status. As suggested in the insurance literature (e.g., [Rothschild and Stiglitz 1976](#)) adverse selection arises in the health context, even though only to a modest degree in the context of COVID-19.

⁹ This emphasizes that the *cumulative* number of tests in a jurisdiction itself is not especially significant.

four individuals. Under this approach the optimal number of individuals to jointly test would be influenced by the probability of positive outcomes. Such an approach would be especially effective if the frequency of positive outcomes was very low (in which case a relatively small number of tests could be used to establish the status of many individuals). Of course, the optimal testing strategy also would be strongly influenced by the cost of a test (if testing were free . . .), the costs of delayed outcomes (depending on the specific test available), and the frequency of false positives and false negatives.

An alternative approach to address opacity that also is sensitive to the potential costs of testing is undertaking modest numbers of randomized tests to establish via statistical methods the frequency of disease in various subpopulations using information from questionnaires (see [Kaplow 2020](#)) in order to facilitate decision-makers making informed decisions with respect to relevant subpopulations. The advantage of this sampling approach is that it does not rely on frequent testing of the overall population, which would impose substantial resource challenges on the testing front. Nevertheless, this approach could facilitate thoughtful decision-making because it would offer informative estimates of the prevalence of COVID-19. In contrast, standard estimates of the proportion of test takers with a COVID-19 diagnosis are not very useful or comparable to one another because of the tremendous selectivity in who is allowed or willing to be tested.¹⁰ For a long time, only the sickest individuals were tested; ironically for those individuals the test results may not have been particularly important because they required intense care anyway due to symptoms (and would continue to do so, even if their test outcomes were negative). In an environment in which the test became more widely available over time, but only those who are relatively sickest or perceived likely to be sick are tested, then one would expect that the frequency of positive outcomes over time would decline even without a decline in the incidence of disease. Yet some government guidelines incorrectly view a declining fraction of positive tests over time as an important indicator of progress.¹¹

While the discussion above focuses on opacity and testing for the presence of current infection, another important aspect of opacity is the lack of information about who might have had a past infection, that is, who has antibodies to the virus and may be protected from getting a subsequent infection from the virus. Those who are immune may be better positioned to take on activities or responsibilities with greater risk of exposure (whether in travel or work in a hospital emergency room or as supermarket cashiers, etc.), could donate plasma to fight the disease, or could be a low priority for a vaccine.

¹⁰ Differences in the availability of testing across jurisdictions make it especially difficult to interpret the difference in positive test rates across jurisdictions.

¹¹ On the other hand, in the presence of increasing testing (and therefore, less selection of the test takers) an increasing fraction of positive tests would point to an increasing prevalence of disease.

While antibody tests are available, they are considered less reliable than testing for the disease, which could limit the usefulness of these tests in the applications suggested above. Furthermore, it is unknown how quickly the extent of protection afforded by antibodies declines over time.

Both interconnectedness and opacity played important roles in the Great Recession as well. During the mortgage meltdown the extent of problematic holdings and which holdings were substantially overvalued were not clear, but there was concern that sellers understood their own situation better than buyers (the classic [Akerlof \[1970\]](#) “lemons” problem), which led to dramatic declines in the valuation of mortgage-backed securities being traded. In effect, this resulted from the considerable opacity (e.g., investors and counterparties didn’t know which holdings were problematic) in conjunction with adverse selection. More broadly, there was considerable adverse selection about the financial status of various firms and their need for funding. This induced counterparty risk that manifested in various ways (e.g., in 2007–2008 AIG provided considerable insurance of the mortgage sector, but its precarious financial situation was not fully appreciated). Interconnectedness and opacity are central to counterparty risk experienced during the Great Recession, but adverse selection played a much more prominent role than in COVID-19, where there is little indication of adverse selection.¹²

3. Reserves, Buffers, and Stress Testing

An important feature facing the medical system in 2020 is the adequacy of reserves and buffers. This applied to many different types of equipment, such as ventilators, PPE (personal protective equipment), and masks, as well as hospital space and beds. The issue is about having a flexible enough (or even just-in-time) supply system, but to a degree also about having adequate reserves in place in advance (e.g., “just-in-time” vs. “just-in-case”). Of course, stocking such reserves would be costly, especially if the items in question have a very low likelihood of usage. This is part of the *ex ante* challenge associated with preparing for a pandemic of unknown intensity and unknown form. To a degree, the counterpart of this during the mortgage meltdown was whether financial firms had adequate reserves through robust financial capital, that is, equity. Requiring more robust financial capital later certainly was an important policy prescription to emerge in the aftermath of the 2008 crisis.

Equity provides a buffer that debt does not offer; equity capital, unlike debt, limits the financial obligation of a firm in the event of financial stress and does not create obligations that can lead to bankruptcy and the potential reorganization or liquidation of the firm. Yet much of the immediate

¹² Adverse selection would be present somewhat in the medical context too, as individuals know more than others about their past contacts and current symptoms, but still adverse selection does not appear to be a major issue in the COVID-19 setting. For example, individuals often don’t know how they contracted coronavirus or in many cases that they even have or did.

financial policy response (e.g., by the Federal Reserve) in the COVID-19 context has been to encourage and support greater debt financing. The financial restructuring after COVID-19 suggests the importance of assessing this and the Fed's policy response through the lens of capital structure theory.¹³ Increases in required equity capital were an important part of the response in the aftermath of the Great Recession and in that sense have been helpful in mitigating some of the economic shock from COVID-19. Such increases were mandated by both federal authorities and international regulators in the Basel Process. The additional required equity provided greater reserves. The nature of the incremental costs of equity relative to debt have been subject to considerable debate. For example, [Admati and Hellwig \(2013\)](#) argue from a Modigliani-Miller perspective that equity is not more costly than debt from a social viewpoint, though would be from a private perspective due to the protection against bankruptcy afforded debt by too-big-to-fail. However, bankers argue that the cost of equity is substantially higher than the cost of debt. In contrast, in the case of medical equipment, it is unambiguous that real costs are associated with reserves, especially equipment that is unlikely to be utilized for a long time.

An interesting example is the case of ventilators—which one could consider from both an *ex ante* and (somewhat) *ex post* perspective. Contrary to a study's recommendation about its preparedness in 2015, New York did not purchase ventilators for its reserve, but as its situation deteriorated in March 2020 requested 40,000 ventilators from the federal stockpile (far in excess of the total federal stockpile). The federal government suggested that the request was unnecessarily large, but provided sufficient number that met the realized "need." With hindsight, we even learned that ventilators were not a very effective treatment. Many facets of this suggest interesting dimensions for defining the level of necessary reserves; one additional opportunity with national reserves is that they are ostensibly trying to meet the (correlated) demands from various portions of the country.¹⁴ The choice of optimal reserves depends on the demand of the various recipients (including hedging multiple users), the nature of lead times (to what degree can flexible production be a substitute?) and the uncertainty about model parameters. Unquestionably, reserves are costly, and maintaining reserves sufficient for the largest shocks would not be practical. Still, this leaves open the question of optimal reserves.

Reserves and buffers were important in the Great Recession as much of the financial system was inadequately capitalized. This was a central dimension during the financial crisis and the degree of leverage was undoubtedly a cause.

¹³ Interestingly, while equity markets did not freeze, very little of the new corporate funding in the aftermath of COVID-19 was equity finance (investors desired more senior claims), but after the Fed intervention equity market activity started to recover (see [Halling, Yu, and Zechner 2020](#)).

¹⁴ The complications with correlated sources of demand for the reserves are somewhat reduced when the allocation of the national reserves are loans that can be recalled and redeployed.

Still, the issue of reserves and buffers may have been less challenging then due to the fungibility of alternative funding, as opposed to the diverse medical equipment and supplies needed to fight pandemics of alternative forms.

What conclusions can we draw about the governance of reserves? The governance of reserves in the case of banks is relatively straightforward: the Federal Reserve is the key regulator with respect to supervision of the largest banks and financial stability. Yet the lack of adequate buffers and reserves arose recently in the medical system, so that would need to be reviewed and evaluated in a different manner. It also highlights a broader aspect of the economy; while states have some degree of oversight over hospitals, many aspects of our economy do not have much oversight and so are dependent on the decentralized decisions of those who run the various organizations. Another twist on this theme is to observe that much of “Main Street” lacks substantial reserves—indeed, the bias in the marketplace is to encourage the distribution of “free cash flow” (Jensen 1986). In fact, many businesses operate on tight margins—one can cast that as operating “month-to-month.” This phenomenon of operating on tight margins with limited savings is a characteristic of many small businesses as well as employees living on limited incomes. There are not obvious mechanisms to require the availability of greater reserves throughout the economy, especially in light of the limited overall supervisory opportunities.

Tail events can arise across many dimensions. The extreme circumstances of our pandemic, the mortgage meltdown of 2008 and the terrorist attacks of September 11, 2001, all illustrate the diversity in the types of such shocks that might arise (and obviously, such a list is far from exhaustive). In effect, the basic point is that the label of “one in 100-year event” is misleading in many ways. For example, it does not account for the joint probability of an extreme event on one of several dimensions. Furthermore, it is biased about events that have not occurred by focusing only on events that we have observed. In economic policy and asset pricing, this is often referred to as a peso problem and can help explain basic asset pricing puzzles (e.g., Rietz 1988; Barro 2006), in that traditional analyses don’t directly account for risks that were not experienced within sample. A fundamental implication is that extremely adverse shocks can occur with meaningful probability. This highlights that during booms the government fiscal policy or perhaps even by extension monetary policy, should consider reducing the debt/gross domestic product (GDP) ratio to create scope for addressing the future challenges of substantial adverse shocks. That’s an important sense in which society had not set up adequate financial buffers in advance of the COVID-19 crisis. While the United States does not have the highest debt/GDP ratio among countries, its debt/GDP ratio now exceeds 100%. One caveat is that the burden of the debt may be limited at present due to very low interest rates, especially if government chooses to lock in such funding costs over time by using long-

term debt financing (however, with a positively sloped yield curve the temptation may be to use shorter-term funding).

Of course, another dimension about the potential inadequacy of governmental reserves is to consider the inadequacy at the state and local government level, despite balanced budget provisions. These entities do have debt, not all of which reflects true investments, as well as massive sizes of state and local government pension underfunding. The COVID-19 crisis led to both large budgetary holes for state and local governments (the House of Representatives recently passed legislation providing for \$1 trillion to attempt to plug such holes) and dramatic changes in the underfunding of state and local pension plans. For example, one published report suggested that the extent of underfunding in the government's Illinois plan almost doubled and increased by more \$100 billion as a result of COVID-19 and another pointed out that Illinois borrowed \$1.2 billion from the Federal Reserve for 1 year at 3.82% (when 1-year Treasuries were yielding less than 0.2%), reflecting very high risk and risk premium.¹⁵

Many observers have pointed to the prior economy as a benchmark for the economy's potential recovery. Both 2008 and 2020 examples suggest that this is a flawed perspective.¹⁶ For example, prior to the Great Recession the economy reflected housing and mortgage transactions with easy subprime financing, too much leverage in the financial system and too strong an incentive to add leverage. With hindsight that clearly reflected an inflated or biased benchmark. While the nature of the shock was different in 2020 and the economy was not as obviously overheated, the economy was running \$1 trillion federal government deficits and arguably reflected insufficient recognition of the possibility of adverse shocks (quite apart from whether the economy should have been creating medical reserves that would have been appropriate for the actual shocks). This again suggests an inflated or biased benchmark (this bias could be an underlying feature of crises, since a crisis inherently emerges after a substantial decline). In that sense the growth rate and success of the prior economy is biased as it didn't internalize or reflect the costs of the optimal extent of reserves and flexibility.

Closely related to the issue of reserves and buffers is the notion of stress testing,¹⁷ which became a key tool in the aftermath of the Great Recession. This notion was first implemented by the Federal Reserve in 2009; this initial

¹⁵ Kozlowski (2020) cites a Moody's post-COVID-19 estimate of a recent Illinois adjusted net pension liability of \$241 billion and a June 30, 2019 filing from Illinois that provided an estimate of \$137.3 billion. Gillers and Timiraos (2020) describes the borrowing by Illinois from the Federal Reserve.

¹⁶ This bias may be intrinsic in most crises and extreme events, rather than just those that occurred in 2008 and 2020, because of the inherent conditioning on subsequently experiencing an extreme event.

¹⁷ The initial impetus for the term "stress testing" comes from cardiac stress testing, which involves an evaluation of the heart under stressed conditions. More broadly, one of the themes underlying this article is the close connection between the financial and medical systems and the application of similar concepts to both, particularly in light of the fundamental medical nature of the shocks in 2020.

round of stress tests helped buoy the financial markets because of the relatively modest amount of additional capital identified as needed by the major banks. This provided considerable reassurance, especially since it pointed to only limited capital raising needs suggesting that there would likely be Federal Reserve support later in adverse circumstances. In light of the success of the initial round of stress tests, the Dodd-Frank Act incorporated annual stress tests starting in 2012. One criticism of the implementation of stress testing by the central bank has been its focus on one of two stress scenarios selected by senior regulators. The choice of stress scenario inherently is a difficult and important one, but especially challenging because almost by definition big shocks tend to be surprising and not anticipated by the regulator. An interesting observation is that the stress scenarios had not been based on a pandemic and arguably reflected more modest shocks than the COVID-19 experience. In fact, in the context of COVID-19 the bank supervisors faced an interesting challenge in light of the dramatic stress event facing the real economy—should the bank supervisors move forward for the stress test with the stress scenario that was not based on the pandemic or just focus on the realized stress and observe how financial institutions handled the real challenges from the actual stress? The Federal Reserve decided to move forward with the hypothetical stress scenario, while taking notice of risk management by the major banks in the real economy and incorporating three coronavirus stress scenarios and additionally, reassessing capital planning later in the year;¹⁸ in contrast, the European Central Bank (ECB) decided to focus on the actual economy. It also is worth noting that both Bill Gates (2015), in his remarkable TED Talk, and the President’s Council of Economic Advisers (2019) identified a pandemic as an important *ex ante* challenge. While the causes of the two crises were dramatically different, an interesting common element is that each had serious unheeded warnings (a discussion of a warning of the mortgage meltdown is in Rajan 2005).

While stress testing has been a focus in the aftermath of the Great Recession, it has not been a major focus in the nonfinancial economy. Though hospitals undertake various preparedness testing and review, it is not obvious that they undertake systemic stress testing with respect to their supplies in a systematic way—and whether there are natural mechanisms throughout the economy to undertake such analyses. Because of the multi-dimensional aspects of stress preparation by hospitals, being prepared with ample buffers and reserves is challenging due to the range of tail events confronting the medical system and the diverse needs that these would imply. Of course, the COVID-19 crisis was an extreme tail event along *some* dimensions, there also are many alternatives for which one should be somewhat prepared. This is not to suggest that one can be fully prepared for all tail events that one could envision. Relatedly, one criticism of the implementation

¹⁸ See Quarles (2020).

of stress testing by the central bank has been its focus on one or two stress scenarios, perhaps limiting the importance of preparedness for a range of extreme scenarios. Actual crises are likely to reflect unanticipated shocks (for which, by definition, preparation would have been minimal) rather than the types of selected stress scenarios that it would have been natural for central bankers to identify.¹⁹

4. Moral Hazard

One of the central features in the Great Recession was the extent of leverage and excesses of financial institutions, particularly in origination and holdings of mortgage-backed securities in various forms, such as considerable sub-prime origination. Yet despite their instrumental role in seeding the crisis, many of these same institutions were protected and viewed as “too big to fail,” receiving special funding or bailouts through the Federal Reserve and U.S. Treasury (e.g., through the Troubled Asset Relief Program, or TARP). Most observers viewed this as producing moral hazard, by encouraging and rewarding excess future risk-taking. In contrast, in the COVID-19 crisis the role of financial leverage and excesses is widely acknowledged to be more muted and not the root cause of the crisis and consequently, the recent policy responses (unlike those in 2008-2009) were not oriented to loss absorption and fixing bank balance sheets by injecting capital or removing problematic assets. But, at the same time, a broad range of moral hazard and incentive challenges are created by the policy response to COVID-19, perhaps more than in the Great Recession. While ultimately an important response to the Great Recession was to require substantially higher bank equity (though after first bailing out or protecting a number of extremely large financial institutions), the Federal Reserve has indicated willingness to support the corporate (and municipal) debt market broadly (including “fallen angels”), encouraging substantial issuance of debt and discouraging risk-sensitive pricing after COVID-19. Furthermore, the extent of issuance of debt would contribute to distortions from debt overhang and various fiscal programs, such as the PPP and the structure of unemployment bonuses, also lead to moral hazard and significant incentive distortions.

An important way in which moral hazard is especially significant in the economic management of the COVID-19 crisis relates to the financial instruments used to provide federal funding. In some respects this is much more of an issue in the recent context of the coronavirus compared to the Great Recession because of the extraordinary extent of the shock and uncertainty about its duration (and overall scale), which leads to solvency challenges for at least some firms needing funding. Much of the federal support during the

¹⁹ This observation is not intended as a criticism of the choice of stress scenarios by central bankers, but a reflection on the surprising nature of actual crises. Of course, to the extent that stress test methodology can incorporate a broader range of outcomes, doing so would be useful.

Great Recession could be provided by the Federal Reserve because of the presence of good collateral and the lack of substantial credit risk in many situations, but in the recent context such collateral was more limited relative to the demand for borrowing, given the extent of uncertainty. Consequently, it was important in the COVID-19 crisis for the Treasury to backstop a portion of the lending in programs with significant potential credit risk (to try to limit the risks to Federal Reserve independence and limit the extent to which the Fed is engaging in fiscal policy).²⁰ In turn, this raises the question of the design of the resultant instruments. [Hanson et al. \(2020\)](#) and [Philippon \(2020\)](#) point to the debt overhang problem that would emerge without structuring the repayment in an efficient manner.²¹ To limit the problem of subsequent overleverage, one would want to structure repayments to limit the severity of the debt obligations and instead (at least in part) use less senior claims, which also could help ensure the viability of future funding. [Hanson et al. \(2020\)](#) also point to a number of additional factors to enhance the design of the financial claims, such as using staged finance to provide credit, in order to facilitate the dynamic re-evaluation of further credit extensions, given the degree of uncertainty of the shock.

The discussion of moral hazard indirectly points to some of the challenges associated with interventions in the capital markets by the Federal Reserve. The speed with which the Fed rolled out some of its initial steps (such as intervention to preclude money market and commercial paper runs) is striking. The Fed was already armed with the Fed and governmental playbook from the financial crisis and had experience dealing with liquidity disruptions in the repo market since fall 2019. Over time, it took further steps more directly oriented to the challenges of the recent crisis, such as expressing a willingness to buy municipal bonds, corporate bond exchange-traded funds (ETFs), and “fallen angels” to deal with new difficulties created by the more recent disruptions.²² One of the related (but very important) concerns is that, to the extent that the Fed is perceived as the buyer “of last resort,” the role of risk-sensitive pricing would be undercut, leading to inefficiency and excessive risk-taking. Though the actual purchases by the Federal Reserve under several programs were relatively modest, this raises a number of important issues to analyze. For example, what is the mechanism by which the Fed programmatic announcements (rather than actual purchases) have such strong

²⁰ A counterpart to this during the Great Recession was funding from the Troubled Asset Relief Program (TARP) that was advanced by the Treasury, but the solvency challenge and credit risk uncertainty was much more modest on an overall basis.

²¹ [Crouzet and Tourre \(2020\)](#) show that the effect of debt overhang in suppressing investment is small in a structural model of investment with credit support, but credit support programs help avoid liquidation when the financial markets would be otherwise closed to the firm.

²² [Donaldson et al. \(2020\)](#) analyze the interaction between bankruptcy and debt restructuring, showing that Federal Reserve lending programs can impede restructuring and because bankruptcy and restructuring are complements can be potentially harmful.

effects,²³ what is the extent of disruption in risk-sensitive pricing (both from the perspective of suggesting that the Fed would “bail out” investors in these instruments in the future and its actual purchases from leveraged hedge funds in the adverse scenario in March 2020), what can we learn about the pricing and underlying risks of municipal and corporate bonds from the interventions and market responses, and can the Federal Reserve plan an effective exit strategy from this role of “buyer of last resort”?

One point to emphasize is the difficulty in distinguishing solvency and liquidity challenges (especially given the uncertain strength and duration of the underlying shock), which was not a central concern of the Federal Reserve during the Great Recession. Concerns about solvency reinforce the apparent lack of liquidity (many observers anticipate a wave of bankruptcies resulting in congestion and inefficient resolutions due to implicit capacity constraints in the bankruptcy process). A natural context to understand the nature of bond liquidity is to use exchange-traded fund data around Federal Reserve interventions, building on the interesting analysis in [Haddad, Moreira, and Muir \(2020\)](#), who show that prior to the Fed intervention ETFs traded at a discount (especially for safer bonds).²⁴ Major steps by the Federal Reserve on March 23rd addressed liquidity dislocations (see discussion in [Haddad, Moreira, and Muir \[2020\]](#), who document dramatic adjustment in the pricing of investment-grade cash bonds versus credit-default swaps after severe market dislocations, as well as reductions in bond trading costs then as highlighted in [Kargar et al. 2020](#)).

Additional steps in early April were designed to limit the credit risk premium, including the willingness of the Federal Reserve to purchase bonds by “fallen angels.” As during the early stages of the Great Recession, there was a run to use credit lines in March 2020, which initially was funded through asset sales and the expansion of the Federal Reserve’s balance sheet (see [Li, Strahan, and Zhang 2020](#)), highlighting the significance of cash and liquidity during financial crises and uncertain access to financial markets until the active intervention of the Federal Reserve. In a related spirit [Acharya and Steffen \(2020\)](#) show that at the time of heightened risk (before the Federal Reserve interventions) “cash is king” and interestingly, the precautionary role of cash was relatively stronger for better credit risks. [Halling, Yu, and Zechner \(2020\)](#) provide complementary results, highlighting that stronger credits issue relatively longer maturity debt during the COVID-19 crisis

²³ [Watts \(2020\)](#) suggests that this effect is similar to Mark Twain’s character, Tom Sawyer, persuading others to undertake as fun his punishment of “whitewashing” a fence. The Fed’s announcement of potential purchases similarly stimulated the interest and demand of others. The mechanism by which the Fed intervention is so successful without needing to undertake substantial debt purchases is one of the more fascinating challenges that this crisis highlights.

²⁴ Examples of the impact of ETFs on liquidity and pricing in earlier contexts include [Dannhauser \(2017\)](#) and [Barbon and Gianinazzi \(2019\)](#). The role of ETFs and before that index inclusion effects, that is, why do stock prices respond so positively when a stock is added to an important index, have been fundamental issues of interest over many decades.

compared to earlier (as markets don't require that they assume as much rollover risk) and bond issuance was particularly pronounced for investment-grade bonds.

The economic lockdown in March 2020 also led to a surprisingly rapid fiscal policy response by Congress. The policy choices were motivated by a variety of goals in managing the "closure" of the economy including (a) restoring aggregate spending power, (b) providing a "safety net" to individuals with limited resources, and (c) facilitating the restoration of incentives in the underlying economy. The resultant underlying policy issues are complex and challenging. Not surprisingly, given the rapidity of enactment, there were various awkward and inefficient aspects to the implemented design. An obvious and visible problem was the provision in the CARES Act which created federal unemployment bonuses of \$600 per week (through July 31, 2020, when under the initial statute the bonus would expire) above the state unemployment payment, which led many unemployed to receive replacement income that substantially exceeded their regular income. In fact, [Ganong, Noel, and Vavra \(2020\)](#) use microdata to show that (a) the median replacement rate was 134%, (b) two-thirds of the eligible workers received unemployment benefits that exceeded their lost earnings, and (c) 20% of those eligible received benefits that were at least double the lost earnings. Obviously, these were very generous relative benefits (for low-compensated workers) and induce a basic moral hazard problem.²⁵

The purpose of unemployment insurance is to provide replacement income to the individuals as part of the system of social insurance, while still trying to incent somewhat individuals to search for employment and to accept suitable offers. A potential rationale for incremental unemployment benefits over the basic unemployment insurance payment (though not in excess of replacement income) during periods of severe economic dislocation would be the difficulty in obtaining new employment given the severity of the aggregate state (this is a simple risk-sharing argument). Given the temporary nature of some of the COVID-19 induced separations, it also is important to encourage laid-off workers to accept offers of re-employment—that's challenging with the observed extraordinary replacement compensation rates. This is a basic incentive argument and leads to moral hazard in its simplest form.²⁶ Advocates of the bonus compensation argued that the workers would lose the

²⁵ Moral hazard and incentive problems are important in various policies implemented in crises and may be challenging to eliminate as illustrated by the political debate over extension of the \$600/week unemployment supplement. Since the federal bonus was fixed in dollar terms and in effect for a limited time, there is considerable variation in the extent of replacement income as highlighted by [Ganong, Noel, and Vavra \(2020\)](#), suggesting exploiting that variation in a difference-in-differences design about unemployment duration.

²⁶ Despite the terminology "moral hazard," this is not criticism of workers who are following economic incentives. The relative attractiveness of unemployment compared to employment is further reinforced by potential health risks with employment due to contagion. One factor that works in the opposite direction is that high unemployment rates and limited overall opportunities encourage acceptance of available employment.

unemployment benefits if they turn down their prior job when reoffered it, but this is difficult to monitor and enforce²⁷ and does not address directly the intensity of the job search undertaken.²⁸ Overall risk-sharing and incentive considerations suggest the optimality of a bonus above the basic unemployment insurance payment that would apply when unemployment is modest, but reflecting a total payment below 100% replacement. This risk-sharing argument suggests a payment contingent on the state of the economy, such as the level of unemployment.

A striking aspect of the Payment Protection Program (PPP) is that funds initially were allocated on a sequential service basis (“first come, first serve”) with a limited pool of funding; ultimately, this shortage led to a second round of funding. The eventual availability of the second round with ample funding mitigated somewhat the queuing aspect to the original allocation, but otherwise it would have been difficult to justify allocation by queue.²⁹ The economic policy response to the COVID-19 crisis also reflected a complex web of eligibility criteria, timing windows, and incentives. Federal support and assistance were targeted to reflect the objective of particular programs, but this can lead to unintended consequences and significant adverse aspects from particular goals. For example, encouraging a firm to retain its full workforce, especially in heavily-hit industries, such as airlines or hospitality, which are likely to need significant downsizing, does not facilitate the adjustment of the economy and the redeployment of talent. Initially, to obtain forgiveness of loans under the PPP program, firms needed to spend the funds within 2 months and no later than June 30, 2020, and at least 75% of funds would need to have been used for payroll expenses. The use of “cliff incentives” and eligibility criteria can create sharp discontinuities in response that are far from the programmatic intent. Indeed, given the restrictive nature of the PPP, Congress later reduced (retroactively) the minimum fraction for payroll to 60% and lengthened the time window for expenditures to 24 weeks.³⁰ These changes help facilitate making the loan forgiveness less closely tied to employment and thereby potentially facilitate the ability of the firm to rebound. Given the design of the PPP it would be useful to undertake a post-mortem as to the extent to which it facilitated the survival of firms (to what extent did the recipients eventually liquidate or file for bankruptcy?) and jobs. In effect, what were the objectives that the PPP advanced and how could the

²⁷ One reason to accept a job offer is that the federal bonus was scheduled to expire at the end of July 2020. Of course, the expiration of (at least a portion of) the federal bonus could be deferred, which workers would recognize too.

²⁸ In the context of the COVID-19 environment job search could be secondary for some individuals, because a portion of the layoffs were temporary, at least at the start of the pandemic.

²⁹ Allocating by queue is suggestive of government selecting “winners and losers.” Additionally, since the banks processed PPP applications, allocation by queue could lead to bias toward bank customers.

³⁰ Under the legislative change, if a firm fell short of the 60% standard, the shortfall would only lead to a proportional decline in loan forgiveness rather than its elimination.

design have been improved in light of that (an important study along these lines is [Granja et al. 2020](#))? These are important and subtle economic questions of broad significance, cutting to the nature of the risk sharing by society and the role of incomplete contracting (ex ante) in a financial crisis.

Another example of the awkwardness of discontinuous policy designs under the CARES Act concerns airline loans. Under the program the Treasury and the airlines agreed that 70% of certain airline loans (billions of dollars) would be converted to grants provided that the airline does not lay off workers or cut wages rates through September 30, 2020 (leaving some discretion to reduce hours and still satisfy eligibility for conversion to a grant³¹). There is a huge discontinuity associated with this design at October 1st, and one would expect many layoffs then (and none earlier if the value of forgiveness of 70% of the loans is sufficient) unless the path of airline demand had risen to an unexpectedly rapid degree. This points to the question as to whether such a cliff design and discontinuous hurdle leads to an economically efficient outcome. A number of the policy responses had cliffs at similar dates (e.g., the \$600 unemployment bonus, eviction loan moratorium, and student loan repayment moratorium all had cliffs positioned at one point near the end of July), which accentuated the problem in policy design. Given the extent of demand destruction for airline travel, retaining the full workforce for the full 6 months would not appear to have been efficient even ex ante—compared to a somewhat more modest combination of unemployment and severance compensation, especially for workers who would find that especially appealing and interested in exploring other possibilities. On the other hand, from a macroeconomic perspective this reflects an early (and incorrect) view that the shock to the airlines was limited to 6 months and perhaps a desire to spread the pain of aggregate unemployment over time (so that the individuals laid off by the airlines would incur their dislocation subsequent to other layoffs).³²

This is illustrative of the deeper and important problem of how to structure economic policy given huge uncertainty about the size and timing of underlying shocks. One approach to more fully understand the market's assessment of such uncertainty would be to use the information in the structure of option prices, which can be linked to Arrow-Debreu contingent claim pricing (e.g., [Ross 1976](#); [Breedon and Litzenberger 1978](#)) and risk-neutral probabilities (e.g., [Jackwerth 2020](#)). [Cheng \(2020\)](#) points to puzzling under reaction in VIX futures as the pandemic emerged in late February and early March 2020. On the timing front, an important recent paper that uses stock prices and dividend futures to decompose expected growth expectations across horizons in the aftermath of COVID-19 in the United States and European Union is [Gormsen and Kojen \(forthcoming\)](#).

³¹ When United Airlines reduced hours of some workers, controversy ensued about whether doing so was consistent with Congressional intent.

³² This could reflect an aggregate risk-sharing motive (smoothing marginal utility).

5. The Challenge of Real Estate and Moral Hazard

Many observers have highlighted the central role of housing finance in the Great Recession, including overleveraging by many borrowers and financial institutions.³³ In significant part the excess risk-taking that this reflected was at the root of the mortgage meltdown and overall crisis in 2008. In contrast, the financing of housing and real estate was not the underlying cause of the economic dislocations in the COVID-19 crisis (of course, the root cause was medical and reinforced by efforts to contain and prevent the spread of the virus, such as social distancing and lockdowns).

However, in the recent context, important moral hazard issues in real estate relate to both rental and mortgage payments for residential and commercial real estate and the impacts on the mortgage servicing business. In some cases, individuals and commercial renters do not have the available funding to make payments immediately (e.g., because of limited business activity), and, in other situations, commercial renters are observing that they could not use their facility due to state closure orders (e.g., Gap, Inc., suspended rent payments on many stores). This raises interesting legal questions about the enforceability of the leases outside bankruptcy in the event of a government ordered closure and the distinction between a lack of business due to health concerns and government-mandated closures. The nonpayment of rents may be motivated by efforts to negotiate lease concessions, at least for the immediate aftermath of the initial coronavirus shock, reflecting financial distress and the changes in the rental value of leased properties. Nonpayment of rent, in turn, can make it difficult for the landlord to fulfill his loan payment obligation.

Another important facet of moral hazard in real estate finance around the coronavirus has been the structure of servicing arrangements. Loan servicers are often required to continue to pay the investors who own the underlying loan instruments for 4 to 12 months when payments are delinquent. Despite this obligation, nonbank servicers are not supervised as part of the regulatory process (so do not hold significant reserves) and indeed, have resisted oversight. This raises an interesting contractual question as to the efficiency of the assignment of the payment risk to the servicers rather than to the lenders/investors. Most simply, this can be viewed as putting the servicers (who also are often the originators) in the position of bearing first losses, which would cause them to take actions and make decisions that would be efficient (in effect, the structure of imposing this risk on the originator/servicer is an attempt to resolve moral hazard). An interesting conceptual question is whether allocating first losses to the originator increases or diminishes the need for oversight of the originator.

³³ For example, see [Mian and Sufi \(2014\)](#). [Griffin \(2020\)](#) highlights the central role of conflicts of interest, fraud, and misreporting in the mortgage ecosystem in the Great Recession.

The allocation of payment risk raises the question of the role of forbearance (delaying foreclosure and eviction), which encourage payment delays for borrowers in tight financial circumstances. This is motivated in significant part by several themes that emerged in the aftermath of the Great Recession, namely, a recognition of substantial deadweight losses associated with foreclosure (and a desire to avoid those) and the adverse neighborhood spillovers that foreclosures create. Similarly, restrictions on evictions can be motivated in a parallel fashion (as well as from the risk-sharing perspective of creating a safety net under certain conditions). This leaves open the possibility that forbearance or an outright moratorium with respect to foreclosure or eviction can create incremental delayed payment incentives and moral hazard. More specifically, a broad calendar ban on foreclosure or eviction will lead to greater delayed payments and once the calendar restriction ends, the potential for a spurt of foreclosures or evictions. Difference-in-differences analysis of this would be facilitated to the extent that the foreclosure or eviction moratorium ends at distinct calendar times for different properties. Finally, an additional source of dislocation in the mortgage market in the early days of the COVID-19 crisis was the unanticipated disruption in originator hedging of “rate locks” that came about as a by-product of Federal Reserve purchases of mortgage-backed securities. This is illustrative of the subtlety of Federal Reserve intervention in the markets.

6. Government as a Systemic Actor

One of the common messages from the two crises is the extremely important role of government policy and regulatory actions and how these are a major source of systemic risk. Systemic risk refers to risks to the system; it is difficult to identify any large private agent whose actions could pose more risk to the system than those of the government. This is not to say that the optimal government policy is obvious or that a specific government policy is wrong, but that because it is a central player in the system its actions would be at the core of systemic risk broadly defined. Even outside crisis circumstances, financial market participants are extremely focused on government and Fed decisions (e.g., consider the extent to which interest rate decisions are discussed in the financial press, even in normal times). Such policy decisions as bailouts in financial crises and bank equity/capital requirements, which influence risk-taking, have obvious systemic consequences.

While the optimal decision rule may be unknown, it can be helpful to identify situations in which policy decisions appear to be inconsistent over time. Of course, in a crisis as uncertainty or strategic aspects of the context evolve there may be learning, which would influence the optimal decisions. Still, it is important to ask whether decisions are predictable or ad hoc and in the language of economics the extent to which they are time consistent (e.g., [Kydland and Prescott 1977](#)).

Many of the key decisions in the Great Recession would have been difficult to anticipate and involved changing circumstances. These include the differences between Bear Stearns (whose debt was fully protected due to the JP Morgan Chase guarantee) and Lehman Brothers (which went through bankruptcy), between Lehman Brothers and AIG (whose debt was protected), the awarding of bank holding company status to Goldman Sachs and Morgan Stanley, the customized guarantees to Citigroup and Bank of America and the use of the Troubled Asset Relief Program (see [Spatt 2016](#)). Arguably, the merger between Bank of America and Merrill Lynch may have increased future systemic risk.

The systemic concerns about government policy during the COVID-19 crisis in the medical space are illustrated by a range of perspectives, such as (a) inadequate prioritization of testing (see earlier discussion), (b) inadequate prioritization of availability of personal protective equipment, (c) ambiguity about the value of ventilators (early in the COVID-19 crisis there was extraordinary demand, which reflected limited [and perhaps inadequate] reserves, concern about the projected number of cases as well as possible overuse of the device before doctors concluded that it often was counterproductive), (d) inconsistent guidance about the use of masks (which changed dramatically around the start of April 2020), and (e) inconsistency about the lack of adherence to social distancing (a number of public health professionals changed their stance from when the focus was on reopening the economy to when the issue was related to civil protest). In many situations, the idea of “science” has been invoked, often, but not always, in support of a scientifically grounded hypothesis. Of course, the scientific knowledge about certain practices may have changed (e.g., if the prior beliefs were not strong) as there is considerable learning in the COVID-19 context or priorities shifted. The shift in perspectives also may create a new type of challenge by undercutting the credibility of some of the key principles, such as the power of social distancing and the value of masks, in the eyes of some members of the public. Ultimately, the success of such policies is heavily dependent on popular adherence.

7. Economic Concentration

While changes in economic concentration from the crises has not received so much focus, it is useful to address from a long-term perspective how the crises affected concentration and especially how the regulatory system influenced that. Two particularly significant impacts related to COVID-19 and concentration are the new distinction between “essential” and “inessential” firms and activities and the heightened role of technology. During the crisis most states declared many activities as essential and others as not essential, effectively requiring the inessential to close for several months. While some of the distinctions are clear-cut (e.g., grocery stores were essential), other aspects

were far from clear-cut and arguably even arbitrary. Differences in definitions across states or geographic areas that motivate differential exogenous closure patterns could be a useful foundation for empirical identification and causal analysis. The arbitrary nature is illustrated by Walmart being allowed to operate *fully* because it sells groceries, but also many other goods—while states force smaller merchants to close.³⁴ In this sense the a priori decision to sell groceries was a valuable strategic decision for Walmart, for example. This will lead to greater concentration in selling various products. Of course, many tech companies (and especially those that facilitated working at home) performed extremely well. To some degree, these are operating in “winner-take-all” spaces, as many of the underlying business models are essentially natural monopolies. This is illustrated by companies that have benefitted from the pandemic, such as Facebook, Amazon, Apple, Netflix, and Google (the “FAANG” stocks) as well as Zoom and other firms in the video conferencing space, which have reflected a broad transformation in the allocation of time and a focus on “stay-at-home” work. The importance of delivery in the COVID-19 era and selling of goods through Amazon as well as the decisions by states to designate only certain businesses as essential are likely to lead to much greater long-run concentration and market power. While this partially reflects fundamentals, government policies on essential work appears to have substantially contributed to this rise in market power. It could be informative to study these questions using differences in policies about essential work over time, across states, and even internationally, as well as mobility and expenditure data.

Analogously, the Great Recession led to somewhat greater concentration in banking and financial services. First, the “too big to fail” perspective in financial services led to the survival of larger firms (with the exception of Lehman Brothers) as illustrated by the federal support to AIG, Fannie Mae, Freddie Mac, Citigroup, and Bank of America, for example. Furthermore, during the financial crisis regulators encouraged firms to buy smaller players who were struggling, as illustrated by the purchase of Merrill Lynch by Bank of America, the purchase of Bear Stearns by J.P. Morgan Chase and on a smaller scale the acquisition of National City by PNC Bank. All of this has led to greater concentration in financial services in the aftermath of the mortgage meltdown and the Great Recession. Despite the strong differences in the settings, both 2008 and 2020 have in common the greater ability of larger firms to survive the respective shocks. Our discussion highlights that this reflects a mix of factors, including the decisions of regulators. During the Great Recession they wanted to avoid the collapse of “too-big-to fail” financial institutions, providing bailouts or facilitating mergers without much attention to the resultant impact on market power. The artificial (and somewhat varying) definition of essential services (determining which firms

³⁴ It also is not obvious that there is a principled basis for this distinction in terms of limiting the pandemic.

could remain open) during the pandemic of 2020 is likely to play an important role in the future success of these enterprises. These designations could easily enhance market power and help create institutional arrangements that enhance the vulnerability of the economy to future systemic risk. This is a subtle economic parallel between the contexts of the two crises.

8. Capital Market Regulation

There are many facets of market regulation with particular significance during the crises (and especially the COVID-19 crisis) in part reflecting the extraordinary levels of price and real volatility (heightening the potential significance of many sources of information including regulatory filings, such as insider trades and corporate disclosures), the special significance of the role of Federal Reserve intervention in the markets, challenges to short selling, runs on money market mutual funds and potential difficulty in the valuation of mutual funds. As an example, the magnitude of shocks from COVID-19 provides an opportunity to explore more deeply regulatory consequences and the importance of information. For example, media reports (e.g., [Gelles and Drucker 2020](#); [Aguirre 2020](#)) have highlighted anecdotally the response of corporate insiders to progress made by their firms with vaccines, such as option grants before announcements, “preplanned” Rule 10b5-1 sales, spontaneous sales immediately after market-moving announcements and misleading announcements.³⁵ Similarly, [Michaels and Francis \(2020\)](#) reported that the SEC began to investigate trading and option grants before the announcement of a major government loan to Kodak to manufacture COVID-19 drugs.³⁶ The COVID-19 crisis also has highlighted issues of investor speculation and the growth of retail accounts and trading, raising the question as to whether such speculative activity by retail investors helps explain some of the cross-sectional volatility patterns.³⁷

Two important issues in the capital markets arena that were first highlighted through the Great Recession were restrictions or bans on short selling and the role of money market funds (see, e.g., [Schmidt, Timmerman, and Wermers 2016](#)). In many countries short-sale bans were imposed during the financial crisis (2008). For example, the United States banned short selling in about 900 financial stocks for several weeks during the debate about the

³⁵ It would be interesting to examine the extent to which these announcements of vaccine progress were misleading and whether the insiders are especially likely to sell prior to price reversals—in effect, whether such announcements were part of a manipulation and whether the announcements exaggerated the firm’s participation in the government’s vaccine program or from selective and opportunistic disclosure in the data made available.

³⁶ This loan was then put on hold pending the outcome of the investigation.

³⁷ Much of this is attributed to “stay-at-home traders,” who focus on speculative trading activities. An interesting example is Hertz (see discussion in [Cohan \[2020\]](#) about Hertz), whose unsecured bonds were trading at about a 60% discount and whose equity traded at a sufficient price in bankruptcy to cause the firm to seriously consider moving forward with an equity offering of a likely worthless security, until pressured by the SEC about the adequacy of the contemplated disclosure.

Troubled Asset Relief Program, leading to greater adverse selection and reduced liquidity and price efficiency (see, e.g., [Boehmer, Jones and Zhang 2013](#); [Dixon 2020](#)). It is striking that in the COVID-19 crisis that different perspectives emerged across countries. While the United States did not impose new restrictions (implicitly reflecting a consensus that the ban in 2008 was a mistake and did not support financial institution pricing), some European countries responded with renewed short-sale bans. The variation in decisions is interesting in its own right (despite the earlier experiences being common knowledge) and helps suggest the potential for interesting cross-country analysis.

The money-market mutual fund valuation issue was one of the more contentious issues in the aftermath of the Great Recession. Ultimately, under pressure from other financial regulators, the SEC limited stable dollar pricing to retail accounts or accounts holding government bonds. This resulted in dramatic substitution away from institutional prime money-market funds³⁸ and subsequently, the closure of many prime money-market funds after COVID-19 (this could be due to a desire to avoid future regulatory risk or as a response to very low short-term interest rates). Despite a variety of regulatory changes, the Federal Reserve felt that it needed to intervene in March 2020 by providing another government insurance program (as the Treasury did in 2008) to avoid a run. This certainly suggests the importance of further analysis of these instruments and the nature of the continuing vulnerability to runs. Were the SEC reforms of the money-market fund regulatory structure poorly designed after the Great Recession? Did the Federal Reserve intervene prematurely in March 2020? This is part of the broader issue of the extent to which financial products can be (re)designed to mitigate asset-liability mismatch and the resultant fragility, while at the same time recognizing that that the intermediation mismatch (along with pooling of risks) is at the heart of the success of financial intermediation in our society. Such concerns are at the core of various aspects of the design of money market mutual funds, mutual funds more generally and ETFs, which have a more explicit direct market pricing process.

9. Concluding Comments

Crises are especially important events in an economy, and much can be learned from them and the ongoing response. In this paper, we highlight and emphasize some of the similarities between the crises of 2008 and 2020, though the events were certainly different in basic respects. We address the question of what we can learn about both crises and the foundations of the discipline by examining open questions suggested by the recent crisis as

³⁸ My personal view is that these distinctions are somewhat arbitrary given the increasing sensitivity of retail investors and the sensitivity of government as well as corporate bonds.

well as by the comparison between the two crises, focusing on various economic principles and aspects of the environment—including the application of these principles to the underlying medical context. Our analysis focuses on such themes as opacity (lack of transparency about risks—whether mortgage or medical), interconnectedness, the adequacy of reserves and buffers across crises, moral hazard (in 2008 it was at the root cause, but in 2020 moral hazard is important in some of the consequential behaviors), the nature of risk-taking, the government as a systemic actor and the importance of the crises for economic concentration.

Of course, the connections between the two crises are also illustrated by the economic ramifications of them. For example, the economic interventions by the Federal Reserve to support the markets and enhance liquidity point to important long-term challenges. Most observers recognize that the Federal Reserve had considerable difficulty in exiting from the dramatic expansion of its balance sheet during the Great Recession and has failed to articulate a clear “exit strategy” with respect to the recent balance sheet expansions. Surprisingly, the balance sheet expansion after the financial crisis did not lead to renewed inflation, but raise important questions about the monetization of debt and the use of and need for expanded collateral in light of other regulatory changes. The more recent interventions may lead to further challenges due to the assumption of credit risk by the Federal Reserve through the purchases of “fallen angels” and municipal bonds. While such purchases are being backstopped by the Treasury (to limit the impact on Fed independence and limit the extent of Fed engagement in fiscal policy), they do raise new challenges because of the potential impact on risk-sensitive pricing and market discipline, which is at the heart of some of the traditional concerns about moral hazard. This raises important broad questions about how to design such interventions and when these would be justified. For example, in supporting markets and restoring liquidity, the intervention by the Federal Reserve at the early stage of the COVID-19 crisis calmed the markets and helped bail out (indirectly) the leveraged bond positions of various hedge funds.³⁹ This points to the broader and deeper question about such interventions, such as do these ex post bailouts promote excessive risk-taking ex ante and undercut market discipline, even assuming that they are not targeted to particular financial institutions? This is a foundational question that the two crises highlight. In some respects, the pandemic of 2020 is an especially interesting one for assessing this question because moral hazard is arising from the policy response, even though there was not direct private behavior causing the crisis (though potentially insufficient caution about risk-taking). Important perspectives can potentially emerge from careful study of the

³⁹ A very interesting analysis of the sources of fragility in bond fund holdings in the COVID-19 crisis is provided by Falato, Goldstein, and Hortacısu (2020), who highlight the role of illiquidity and vulnerability to fire sales in explaining outflows.

various emergency programs, including the challenge of distinguishing insolvency from illiquidity and understanding the mechanism by which particular facilities and trading of the Federal Reserve (including its willingness to purchase bonds and other assets) help support the underlying markets and mitigate run risk.

Moving forward from the COVID-19 crisis, the economy will face new challenges as society sorts out how to adapt from this shock to what we have learned along many dimensions. Some of the ramifications are intermediate-term ones (until society more fully puts COVID-19 behind it through a vaccine or herd immunity) and others are longer-term ones that reflect past under appreciation of the potential for a pandemic as well as heightened value of “stay-at-home” work.

What lessons can we learn from the handling of the COVID-19 crisis? What were the overall impacts of lockdowns, the distinction between essential and inessential work and social distancing? How should we change business models to adapt to changing preferences with respect to social distancing in such sectors as hospitality (restaurants, hotels, airlines, etc.), education, large-scale entertainment (sporting events, theaters, movies, etc.), medicine, mass transit and office space (more remote work vs. more space for workers who remain in the office)? What are the consequences for density, relative property values, the structure of supply chains, and globalization more broadly? How can we improve the structure of overall risk sharing in society to better account for aggregate systemic shocks on an ex ante rather than ex post basis?

To the extent that the recent shocks lead to significant revaluations of assets this highlights both the value of flexibility and the potential solvency challenges associated with illiquidity and are suggestive that much of the illiquidity in the aftermath of COVID-19 had its roots in fears of insolvency. The extraordinary disaggregated data available in the current era on such decisions as mobility, consumer spending, employment, and asset holdings can facilitate the analysis of many fundamental questions using the COVID-19 shocks.

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