Explaining the Covid-19 Market Collapse and Resurgence

Thesis Submitted in Partial Fulfillment
of the Requirements
of the Jay and Jeanie Schottenstein Honors Program

Yeshiva College
Yeshiva University
May 2022

C Judah Aronovitz

Mentor: Professor James A. Kahn, Economics

The Covid-19 pandemic sent ripples through the stock market, with the S&P 500 plunging 35 percent in the spring of 2020. But in the last week of March the index jumped 18 percent. By early June it was within 5 percent of its February peak and surpassed it in August. Clearly some combination of monetary-fiscal policy, federal relief programs, changes in beliefs (related to the pandemic's effect on earnings and dividends) and speculation amongst investors led to an unprecedentedly speedy recovery.

The goal of this paper is to explain the market's V-shaped trajectory, with the goal of pinpointing the precise cause of the wild market movements, with specific focus on the cause of the initial market collapse and its recovery. In other words, to what extent did the aforementioned factors play a role in determining the market's fluctuations? This paper will focus on determining the market reaction to changes in information regarding the pandemic, monetary-fiscal policy (i.e., reduced interest rates), federal relief programs, economic fundamentals and corporate earnings. As demonstrated by Cox, Greenwald and Ludvigson (2020), comparing the timing of market fluctuations to the timing of these factors is crucial to determine the underlying causes of the market's V-shaped trajectory. Inability to explain the market's trajectory might indicate that it is best explained by changes in investor sentiment or risk aversion. Another potential explanation would look at the idea of changes in the perceived probability of a "disaster," as in Barro and Ursua (2012). Additionally, specific focus on how different sectors were affected by the pandemic, monetary-fiscal policy and other factors will help shed light on this question.

Alternative Explanations in the Literature

Some have suggested that government restrictions on business activity and voluntary social distancing were the main drivers of the stock market plunge. Baker, Bloom, Davis, Kost, Sammon

and Viratyosin (2020) argue that such actions can have a significant effect in today's world economy that is highly consumer focused, with a significant amount of face-to-face interaction, and has a high level of international travel for business and tourism. The abrupt uptake of business restrictions and voluntary social distancing had a massive effect on businesses, especially in the consumer, travel and hospitality sectors. It reduced the "flow of customers" to businesses, resulting in revenue loss. This had a profound impact on the stock market.

Moreover, such restrictions resulted in labor shortages. Baldwin (2020)[1] put it well: "COVID-19 and the containment policies have directly and massively reduced the flow of labor to businesses. The result has been a sudden and massive reduction in the output of goods and services." Thus, such restrictions impacted business operations and sales, and created a labor shortage.

They argue, based on the timing of fluctuations, that reasons that "stress the lethality and adverse health effects" of the virus are inaccurate; if they were correct, one would expect downward market fluctuations to occur after new news of the pandemic's lethality, which they claim did not occur.[2]

Research done by Badar Nadeem Ashraf (2020) provides empirical support for this assertion. He shows that the stock markets of several countries responded negatively to increases in Covid-19 cases; there is a negative correlation between the number of confirmed cases in a country and the stock market returns. He calculated the average daily stock market returns of several countries from the day of the first confirmed case and observed that the returns are negative in the first 20 days, then are positive or even for the next 20 days, and then are negative from day 40-60. To explain this relationship between confirmed cases and market returns, he asserts that it

[1] Baker et al., 11
[2] Ibid., 734

takes time for a smattering of cases to result in a widespread outbreak. The market (of a particular country) was not overly concerned with a small outbreak of Covid-19 in that country, and that is reflected by the market's upswing between days 20 and 40. But the later reaction (between day 40 and 60) shows that "markets again react with negative sentiments to the large number of confirmed cases." In other words, the markets reacted to the possibility of a widespread outbreak. Their data is "consistent with the outbreaks in China, Italy, Iran and Spain which reached their peaks around 30-60 days from initial confirmed cases."[3] This matches the dip between days 40 and 60. Interestingly, he finds that the markets only reacted to the number of confirmed cases, but not (in a statistically significant way) when confirmed cases later died.

One takeaway from this is that the fact that the market did not react to news of deaths resulting from Covid-19, but rather to widespread outbreaks of Covid-19, shows that the market's V-shaped trajectory should not be explained by reasons that stress the lethality of the virus. If anything, it stresses the market's reaction to the contagiousness of the virus. This fits with the theory of Bloom et al.: the concern was that a widespread outbreak would impel the government to issue restrictions and for people to voluntarily social distance, which would negatively impact businesses. Alternatively, with enough confirmed cases, actual business activity started to decline.

A more plausible explanation would be that investors' general confidence in the economy declined (albeit in a short time frame). Individual investors had different views on the pandemic, based on personal risk aversion and sentiment regarding the future state of the economy and business environment. Such attitudes about business activity were certainly influenced by business closures and social distancing; they helped solidify the widespread belief of long-term economic decline.

---

[3] Ibid., 5

Such an explanation is proposed by Cox, Greenwald and Ludvigson (2020). They used the estimated asset pricing model of Greenwald, Lettau, and Ludvigson (2019) (GLL) (using updated estimates of the model), to "decompose the market's changes into distinct component sources attributable to fluctuations in aggregate economic fundamentals, interest rates, corporate earnings shares, and/or discount rate fluctuations driven by the pricing of stock market risk." They show that "it is difficult if not impossible to explain the market's V-shaped trajectory during the COVID-19 crisis with plausible fluctuations in aggregate economic activity, corporate profit shares, or short-term interest rates." They conclude that "the estimates point toward wild volatility in the pricing of stock market risk, driven by fluctuations in risk aversion or beliefs/sentiment."[4]

They also determined whether the Federal Reserve played a role, if any, in improving the market. They studied the market movements immediately before and after a policy announcement to determine the effect of the announcement on the markets, and found that "conventional policy announcements" regarding lowering interest rates did not play a role in the market rebound, but "unconventional policy announcements" regarding the issuing of loans to businesses did. For example, the 30-minute windows bracketing five of these announcements are associated with gains of approximately 8% in the S&P 500 stock market index and 12% in the Russell 2000 index. They further argue that as of July 31 of 2020, only a small percentage of the credit had been extended, and the markets had not receded, suggesting that the announcement itself is what boosted the markets as opposed to the actual money flow into the economy.

They conclude, "... this evidence suggests that Federal Reserve communications during the early weeks of the coronavirus pandemic influenced markets mainly by altering risk tolerance, reinforcing the model-based conclusion that market movements during COVID-19 have been more

[4] Ibid., 2

reflective of sentiment than substance."[5] Put simply, the prospect that the government would help prop up businesses that were suffering alleviated much of the risk sentiment amongst investors, allowing the markets to improve.

Giglio, Maggiori, Stroebel and Utkus (2021) conducted a study on investor sentiment before, during and after the market crash. What they found is that those who were optimistic about equities before the crash moved out of equities and those who were pessimistic didn't. Trading decisions reflected a change in sentiment amongst investors who were initially optimistic, bolstering the point made by Cox et al. that the pandemic altered investor confidence. They found that investors believed with higher certainty that there would be further extreme stock market declines and significant declines in short-run economic activity, also showing that the pandemic affected investor sentiment.

According to this analysis, what Baker et al. seem to have been missing in their analysis is that actual decline in business activity due to government restrictions and voluntary social distancing is not what caused the market downturn. The market didn't react to actual declines in profitability, sales, or other such metrics. The markets first experienced volatility at the initial news of a pandemic before the economy went into decline. It was rather investor sentiment about the future state of the economy that caused the market downturn. They did not conduct a rigorous analysis, so while their explanation is plausible, it does not hold up against the data. In fact, they admit to the "broad-brush character" of their analysis.[6]

Declines in hospitality, travel and consumer discretionary (and retail) sectors would support the analysis of Baker et al. but could also be explained in a way that fits in with Cox et al.

[5] Ibid., 3
[6] Ibid., 13

Namely, that investors believed that these sectors would suffer more than other sectors. This was a very reasonable assumption to make based on the economic environment.

Yet, there are several difficulties with this approach. First, if the only explanation of the market's V-shaped trajectory is changes in investor sentiment and risk aversion, it is difficult to understand how Fed announcements led to such a speedy market recovery and new market highs. Liquidity can only help businesses for so long. What convinced investors that the pandemic wouldn't wreak havoc for years to come? The extent of the market recovery does not seem to make sense according to this approach.

Another question yet to be answered, as Mazur, Dang and Vega (2020) point out, is why stocks in relative positions of strength experienced stock price declines. They propose the "theory of economic relationships between linked firms" to answer this question. The idea is that a shock to one firm affects all of the firms that they are linked with (e.g., their customers and suppliers). Therefore, "even for unrelated industries, a revenue shock to one firm may have a negative revenue effect on all economically related firms, precipitating a cascade of price declines in the stock market."[7]

The Disaster Model

It might be helpful to consider another explanation for the stock market's V-shaped trajectory. Many have proposed the "disaster model", which incorporates rare disasters of uncertain timing and magnitude in asset pricing models. The idea would be that the initial uncertainty about the threat of the virus as well as widespread shutdowns increased the probability

[7] Ibid., 4

of a catastrophe (i.e., a Great Depression-style event), which the Federal Reserve's actions helped to alleviate.

Rietz (1988) first proposed the "disaster model." He himself rejected this, but Barro (2006) insisted it was correct. He extended the model of Lucas (1978), Mehra and Prescott (1985) and Rietz (1988) and calibrated it with a more accurate probability distribution for rare disasters in the 20th century. Many have since extended, calibrated or rejected the model.

If the model holds up, which many assume it does, it might answer the "equity premium puzzle." The equity premium is the return of a diversified portfolio of U.S. equities above the return of a risk-free asset, such as a 10-year U.S. treasury bond. It represents the compensation awarded to investors for taking on extra risk and owning equities rather than bonds. The premium ranges between 5-8%, depending on the risk associated with equities. The "equity premium puzzle", which was first brought to light by Mehra and Prescott (1985), refers to the commonly held assumption that 5-8% is too high of a difference between the return of equities and bonds; it is incompatible with assumptions in finance and macroeconomics about the rational level of risk aversion of investors.

The way it solves the "equity premium problem" is as follows: if people expect a disaster to occur, and it never occurs, the equity premium will appear high; they were heavily compensated for taking on risk that never materialized. But according to this approach, the equity premium is not too high; equity investors are more exposed to disasters than bondholders are.

The "disaster model" approach addresses both difficulties that were raised above. The unprecedented speed and extent of the market recovery makes sense; the Fed, by providing liquidity, helped alleviate the risk that the pandemic would cause a disaster event, like the Great

Depression. That is, even with the virus, businesses would be able to stay afloat and the U.S. wouldn't plummet into a severe recession. Once the market realized this, it recovered quickly.

Moreover, the model explains why stocks in relative positions of strength experienced stock price declines. This is because the model incorporates the risk of disaster for all assets, not only for specific sectors. The probability of a disaster is built into the prices of all assets. In fact, Seo and Wachter (2016) reconcile option prices with macroeconomic data on disasters. Thus, even if, for instance, the pandemic would have a greater impact on the airline and hospitality industries than the banking industry, one would expect declines (albeit smaller ones) in the latter as well. Therefore, one would expect that the only sectors that did not experience declines would be those that the pandemic helped. Examples of these could be the consumer staples and health care sectors.

Along these lines, an inescapable implication of the disaster model is that all else being equal, assets that do worse during a disaster should have higher expected returns; investors are rewarded for taking on the additional risk of a disaster. Berkman, Jacobson and Lee (2011) affirmed these assumptions in their research: they found that "industries that are more crisis risk sensitive yield a higher return, on average."[8] These are also the industries that plummet most in the event of a rare disaster.

The Gordon growth model can be used to justify the disaster model's ability to explain the market movements. According to the model, S&P 500 index = expected dividends (February 2020)/(r-g), with r being the rate of return of the market and g being the dividend growth rate. Figure 2 shows the history of dividend growth from 1980-2022. Markets had already experienced a near-disaster just a decade earlier. The model is used here to replicate the market returns before, during and after the market recession. I use 10% for r, as it is the historical nominal return, and 6%

[8] Ibid., 326

for g, which, according to S&P Global, is the mean historical S&P 500 dividend growth. The value of the index at a given time is known.

The value of the index on February 20, 2020—immediately before the pandemic—was 3380.05. According to the Gordon growth model, the expected dividends was 135.2 (which amounts to a dividend yield of 4%). This is the expected dividends when there is no disaster, as it was before the pandemic.

The next step is to add the probability of disaster into the model. This is represented as:

S&P 500 index = [ED(no disaster)*(1-p) + ED(disaster)*p]/r-[g(no disaster)*(1-p) + g(disaster)*p],

with p = probability of disaster. As per the above non-disaster results, ED(no disaster) = 135.2, r = 10%, and g(no disaster) = 6%. Assuming a probability of disaster of 1% and ED of 135.2 and g of 6% for both states, the implied S&P 500 index value is 3380, .05 points less than the non-disaster index value. Thus, a tiny chance of disaster (1%) with the same dividend growth rate has a non-significant effect on index value.

This result assumes that expected dividends and the dividend growth rate do not change in the disaster state. But if ED(disaster) = 67.6 (this assumes a 2% dividend yield; the ED(non-disaster) implies a 4% yield) and g(disaster) = 3%, the implied index value is 3338.06, 1.2% lower than the pre-pandemic index value of 3380.05. This is close to the index value of 3337.75 one day later on February 21, 2020. The interpretation of this is that when investors perceived the possibility of a pandemic, they were not overly worried, but did perceive some risk.

What is more significant is a 10% disaster probability, with r = 10%, g(non-disaster) = 6%, g(disaster) = 3%, ED(non-disaster) = 135.2 and ED(disaster) = 67.6. In this case, the implied index value is 2986.98, 11.6% lower than the non-disaster index value of 3380.05. This is close to the S&P index value of 2985.93 on March 6, 2022 (it was the day's high), around two weeks after the market started declining in reaction to the initial news of the pandemic. The explanation of this is that the initial uncertainty about the threat of the virus as well as widespread shutdowns increased the probability of a catastrophe (i.e., a Great Depression-style event). The market kept declining and hit its trough of 2290.71 on March 23, 2022. The implied probability of disaster in this case (solving for p) is 31.9%. This makes sense; at that point, there was significant risk for a Great Depression-style event. The Fed stepping in relieved this risk and allowed the markets to recover. The liquidity that they provided for businesses reduced the probability of a disaster and allowed the markets to recover.

Conclusions

Several explanations for the Covid-19 wild market movements have been proposed. Some suggest that government restrictions on business activity and voluntary social distancing caused the market plunge. Others suggest reasons that stress the lethality of the virus. Cox et al. believe that it was the extreme volatility in the pricing of stock market risk, driven by fluctuations in risk aversion or sentiment; they support their assertion by comparing market movements with factors such as aggregate economic activity, corporate profit shares, short-term interest rates, and more. They further argue that Fed's "unconventional policy announcements" regarding the issuing of loans to businesses helped improve the market.

This paper examines the “disaster model,” which emphasizes changes in the perceived probabilities of large negative shocks to the level and growth rate of dividends on stock prices. The initial uncertainty about the threat of the virus as well as widespread shutdowns increased the probability of a catastrophe, which the Fed's actions helped to alleviate. This approach was mathematically justified, using the Gordon growth model to match market movements to the S&P 500 index value.

Figure 1: S&P 500 Index (Daily)

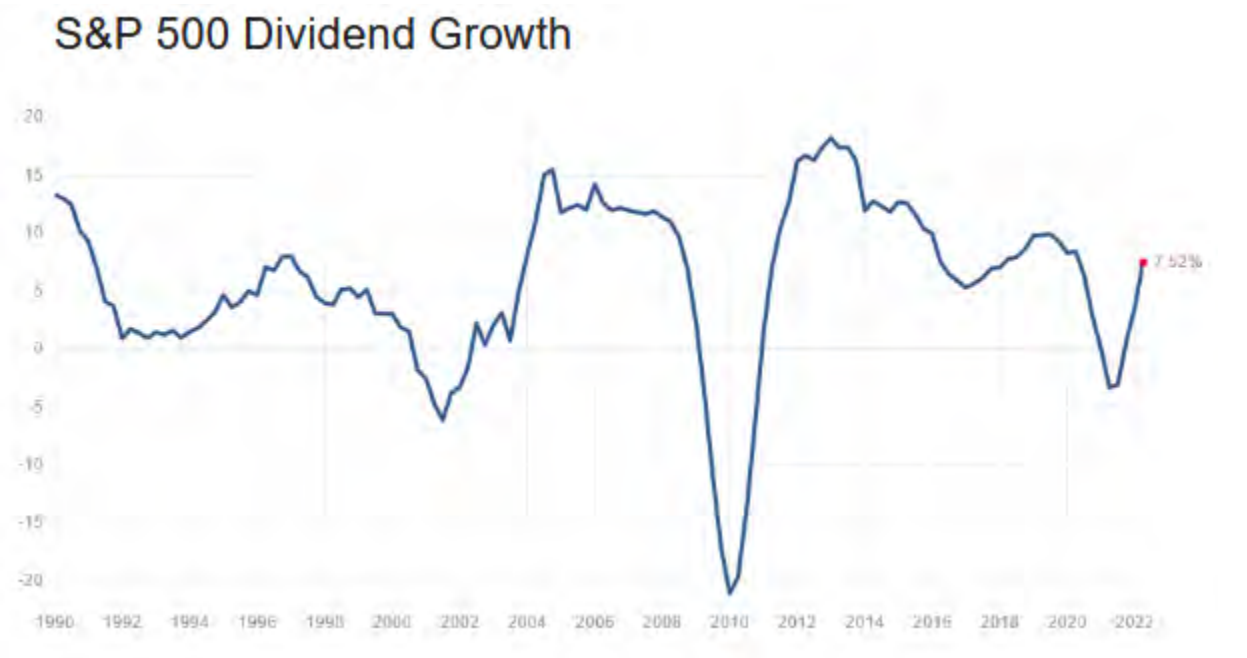

Figure 2: S&P 500 Dividend Growth 1980-2022

References

Ashraf, Badar Nadeem. "Stock Markets' Reaction to COVID-19: Cases or Fatalities?" *Research in International Business and Finance* 54 (December 1, 2020). doi:10.1016/j.ribaf.2020.101249.

Barro, Robert J. "Rare Disasters and Asset Markets in the Twentieth Century." The Quarterly Journal of Economics 121, no. 3 (August 1, 2006): 823–66. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=edsjsr&AN=edsjsr.25098810&site=eds-live&scope=site.

Barro, Robert J., and José F. Ursúa. "Rare Macroeconomic Disasters." *Annual Review of Economics* 4 (January 1, 2012): 83–109. doi:10.2307/42949932.

Berkman, Henk, Ben Jacobsen, and John B. Lee. "Time-Varying Rare Disaster Risk and Stock Returns." *Journal of Financial Economics* 101, no. 2 (January 1, 2011): 313–32. doi:10.1016/j.jfineco.2011.02.019.

Josue Cox, Sydney C. Ludvigson, and Daniel L. Greenwald. "What Explains the COVID-19 Stock Market?," September 8, 2020. doi:10.3386/w27784.

Giglio, Stefano, Matteo Maggiori, Johannes Stroebel, and Stephen Utkus. "The Joint Dynamics of Investor Beliefs and Trading during the COVID-19 Crash." *Proceedings of the National Academy of Sciences of the United States of America* 118, no. 4 (January 26, 2021). doi:10.1073/pnas.2010316118.

Lucas, , Robert E. "Asset Prices in an Exchange Economy." *Econometrica* 46, no. 6 (November 1, 1978): 1429–45. doi:10.2307/1913837.

Marco Sammon, Nicholas Bloom, Steven J. Davis, Kyle Kost, Tasaneeya Viratyosin, and Scott R. Baker. "The Unprecedented Stock Market Reaction to COVID-19." *Review of Asset Pricing Studies*, July 1, 2020. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=edsair&AN=edsair.doi.dedup.....8a422562ad7202f9ad378a4a4aa3cee2&site=eds-live&scope=site.

Mazur, Mieszko, Man Dang, and Miguel Vega. "Covid-19 and the March 2020 Stock Market Crash. Evidence from S&P1500." *Finance Research Letters 38* (January 1, 2021). doi:10.1016/j.frl.2020.101690.

R. Mehra, and E. Prescott. "The Equity Premium: A Puzzle." Accessed May 27, 2022. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=edsair&AN=edsair.doi.dedup.....aec07185fc5260a15c92f68a613bd32b&site=eds-live&scope=site.

Rietz, Thomas A. "The Equity Risk Premium; a Solution." *Journal of Monetary Economics* 22, no. 1 (July 1, 1988): 117. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=edsggo&AN=edsgcl.6673170&site=eds-live&scope=site.

Sang Byung Seo, and Jessica A. Wachter. “Do Rare Events Explain Cdx Tranche Spreads?” *NBER Working Papers*, October 10, 2016, 1–76. https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=edb&AN=118987150&site=eds-live&scope=site.