Coronavirus: Impact on Stock Prices and Growth Expectations

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Abstract

We use data from the aggregate equity market and dividend futures to quantify how investors' expectations about economic growth across horizons evolve in response to the coronavirus outbreak and subsequent policy responses. Dividend futures, which are claims to dividends on the aggregate stock market in a particular year, can be used to directly compute a lower bound on growth expectations across maturities or to estimate expected growth using a simple forecasting model. We show how the actual forecast and the bound evolve over time. As of March 18, our forecast of annual growth in dividends is down 28% in the US and 25% in the EU, and our forecast of GDP growth is down by 2.6% both in the US and in the EU. The lower bound on the change in expected dividends is -43% in the US and -50% in the EU on the 3-year horizon. The lower bound is model free and completely forward looking. There are signs of catch-up growth from year 4 to year 10. News about economic relief programs on March 13 appear to have increased stock prices by lowering risk aversion and lift long-term growth expectations, but did little to improve expectations about short-term growth. The events on March 16 and March 18 reflect a deterioration of expected growth in the US and predict a deepening of the economic downturn. We also show how data on dividend futures can be used to understand why stock markets fell so sharply, well beyond changes in growth expectations.

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1 Introduction

The outbreak of the new coronavirus has caused a pandemic of respiratory disease (COVID-19) for which vaccines and targeted therapeutics for treatment are unavailable (Wang et al. (2020)). The outbreak has caused major concerns about public health around the world. At the same time, there are growing concerns about the economic consequences as households are required to stay home to slow the spread of the virus. The impact that "pausing" the economy may have on supply chains, households' demand, and the financial stability of firms, the financial sector, and households is largely unknown. As a result, policymakers, businesses, and market participants are trying to revise growth expectations in the short-, medium, and long-run.

As the current situation is unprecedented, and developing rapidly, models that use macro-economic fundamentals may miss some of the key forces and may be too slow to update given the frequency with which macro-economic data become available. It has long been recognized that asset prices may be particularly useful as they reflect investors' expectations about future payoffs. A natural starting point may be equity markets, bond markets (Harvey (1989)), and credit markets (Gilchrist and Zakrajsek (2012)). Indeed, much of the media commentary has evolved around these markets. In particular the movements in the stock market have received a lot of attention. In this paper, we provide a perspective on how to interpret movements in the stock market and what it tells us about growth expectations by combining it with asset pricing data from other markets.[1]

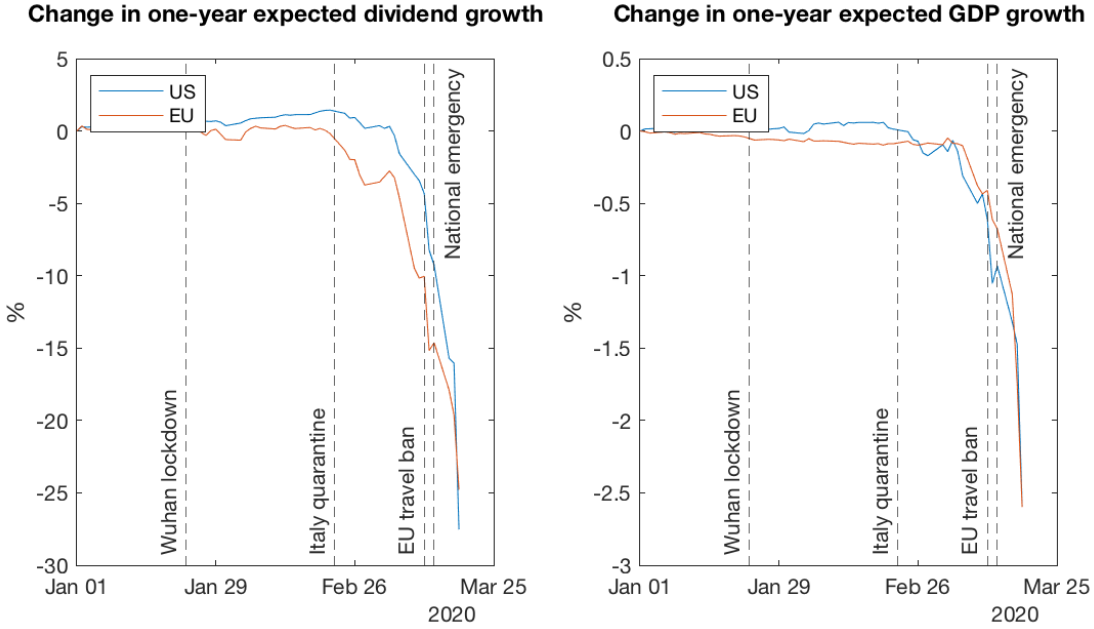
Equity markets in the EU and US dropped by as much as 30%. This is an extraordinary amount. To interpret this decline, it is useful to recall that the value of the stock market, S_t, is equal to the discounted value of all future dividends

$$S_t = \sum_{n=1}^{\infty} \exp\left(-\mu_t^{(n)}\right) \mathbb{E}_t \left[D_{t+n}\right], \tag{1}$$

where $\mathbb{E}_t D_{t+n}$ is the expected dividend in n years from today and $\mu_t^{(n)}$ the cumulative discount rate for that cash flow. If the stock market falls, then either expected future dividends fall

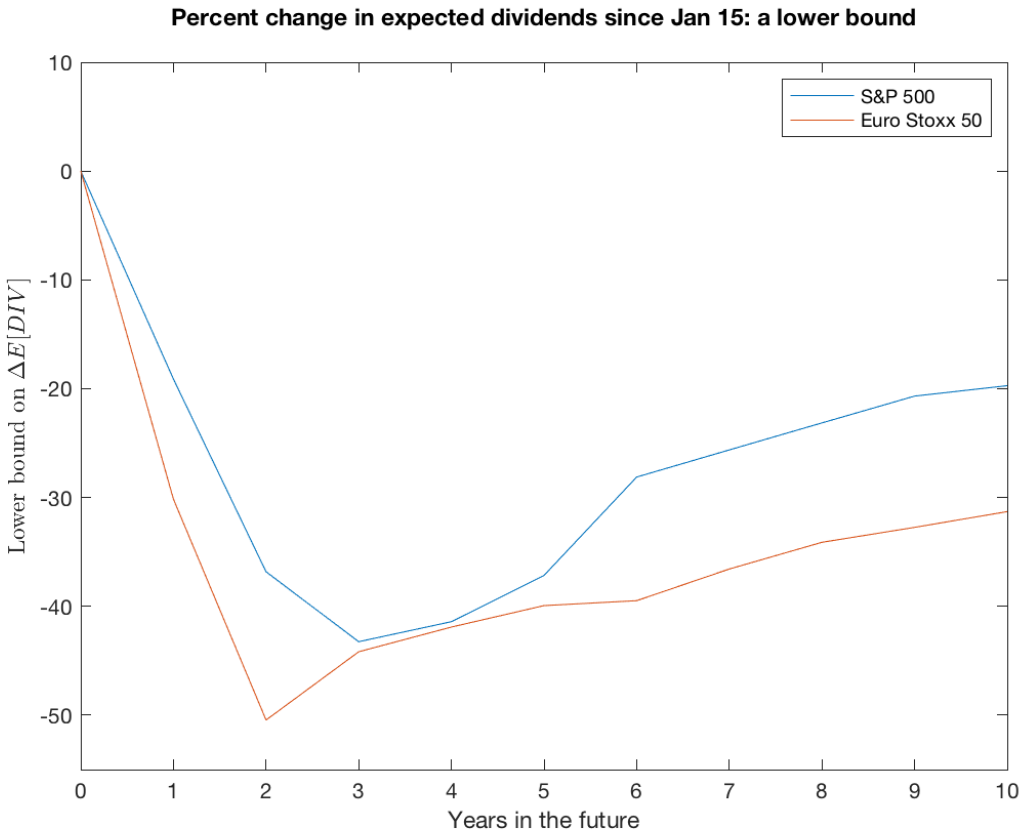
[1] Ramelli and Wagner (2020) look at the cross-section of stock price reactions to COVID-19 events to understand the factors that impacted investors' demand during the onset of the crisis.

Figure 1: Expected Dividend and GDP Growth from Dividend Futures



This figure shows the change in expected dividend and GDP growth relative to expected value at January 1st 2020. The figure shows expected growth in US in blue and the EU in red. Key events are highlighted on dotted lines. The expected dividend growth is revised slowly in response to the outbreak, particularly in the US where at March 11, it was only revised down by less than 5%. By March 18, expected dividend growth is down by 28% in the US and 25% in the EU. Expected growth over the next year is down by 2.6% both in the US and the EU. We emphasize that these numbers are based on historical relations between growth and asset prices and come with substantial uncertainty. Details of the estimation are in Section 5.2.

Figure 2: Lower bound on revisions in expected growth at the 2-year horizon



This figure shows a lower bound on revision in expected dividends at different horizons. The revisions are measured relative to expectations on January 15. The figure shows the bound for the S&P 500 in blue and the bound for Euro Stoxx 50 in red. The lower bound bottoms out around 2- to 3-years into the future, with expected dividends being revised down by as much as 43% in the US and 50% in Europe. The lower bound increases from year 4 to 10, which is consistent with investors expecting rebound growth after the recession. We emphasize that the estimates represent lower bounds and that expected growth could be higher.

or investors discount future dividends at a higher rate, that is, $\mu_{t,n}$ rises.

For the stock market to decline by 30% only due to revised growth expectations, the shock to future dividends needs to be large and highly persistent. To see this, we can sum the dividend prices over the first 10 years and find that this accounts for about 20% of the value of the stock market. This implies that if discount rates do not move and the economic impact on dividends lasts no more than 10 years, a 30% decline in the stock market would mean that firms pay no dividends in the next 10 years - seemingly a rather extreme scenario. However, this is typically not the right way to interpret movements in the stock market. The seminal work by Shiller (1981) and Campbell and Shiller (1988) shows that most of the variation in the value of the stock market is due to changes in expected returns, $\mu_{t,n}$, not revisions in expected future growth rates. This insight brings good and bad news. The good news is that investors' expectations did not decline as dramatically as in the earlier calculation. The bad news, however, is that we learn little about growth expectations by taking cues from the stock market. Instead, we learn about investors' changes in discount rates that may be driven by shifts in risk aversion, sentiment, or uncertainty about long-run growth.

Our main point is that data from a related market, namely dividend futures, is useful to obtain estimates of growth expectations *by maturity*. Dividend futures are contracts that only pay the dividends of the aggregate stock market in a given year.[2] We can convert these prices to directly observe each of the components of (1)

$$P_t^{(n)} = \exp\left(-\mu_t^{(n)}\right) \mathbb{E}_t D_{t+n}. \tag{2}$$

We refer to $P_t^{(n)}$ as the price of the dividend strip. If we sum all dividend strip prices, they add to the market, $S_t = \sum_{n=1}^{\infty} P_t^{(n)}$. There are two important reasons that data on dividend strip prices are informative. First, van Binsbergen et al. (2013) show that prices of dividend strips are good forecasters of dividend growth, GDP growth, and consumption growth. Second, and particularly relevant during this period, dividend strips are differentiated by maturity, just like nominal and real bonds. We use this feature of the data to provide an estimate of

[2]See van Binsbergen et al. (2012), van Binsbergen et al. (2013), van Binsbergen and Koijen (2017), and Gormsen (2020) for earlier work on the properties of dividend futures.

expected growth over the next year and to obtain a lower bound on the term structure of growth expectations by maturity.

Figure 1 shows the dynamics of expected dividend and GDP growth expectations in the EU and in the US until March 18. Growth expectations did not respond much to the Wuhan lockdown. Following the lockdown in Italy, growth expectations start to deteriorate. The travel restrictions on the visitors to the US from EU leads to a sharp deterioration of growth expectations and once again following the declaration of the national emergency and the subsequent actions by the Federal Reserve on March 15. As of March 18 dividend growth over the next year is down by 28% in the for S&P 500 and 25% for the Euro Stoxx 50. The estimate of GDP growth over the next year is down by 2.6% in both the US and the EU.[3]As a word of caution, we emphasize that these estimates are based on a forecasting model estimated using historical data. In turbulent and unprecedented times, there is a risk that the historical relation between growth and asset prices breaks down, meaning these estimates come with uncertainty.

We also derive a lower bound on expected dividend growth by horizon, which can be computed directly using observed prices. The lower bound is completely forward looking and requires neither a forecasting model nor historical data, which makes it useful in our setting, and only relies on the assumption that expected excess returns have increased. The lower bound is plotted in Figure 2. The figure has the lower bound on the change in expected dividends on the vertical axis and the horizon on the horizontal axis. As of March 18, the lower bound is lowest on the 2- to 3-year horizon, where dividend growth have been revised down by as much as 43% in the US and 50% in the EU, compared to January 15. There are signs of catch-up growth from year 4 to year 10 as the bound is substantially higher on longer horizons. We study how the bound evolves over the outbreak in response to news and policy initiatives, which gives insights into how financial markets interpreted these events.

As of March 18, the lower bound on dividend growth is as low as what we observed during November of the global financial crisis (GFC) – at least on the short end. On the long end, the lower bound is still not as low as what we observed during the GFC, potentially indicating that investors expect the current crisis to be shorter.

[3]The chief economist of Goldman Sachs, Jan Hatzius, revised his forecast for GDP growth in 2020 down to 0.4%, compared with a prior growth estimate of 1.2% on March 15.

In addition, we show that the lower bound was quite tight during the financial crisis. The lower bound on the change in growth rates was almost 30% on the 2-year horizon, and dividends indeed fell short of the pre-crisis trend by almost 30% after two years. These results suggest that even in a stressed financial system, the dividend futures are closely related to future fundamentals and therefore contain useful information.[4]

We also use the dividend futures to better understand the overall movement in the stock market. The initial drop in the stock market between February 20 and March 5 was substantially larger than the drop in dividend futures. This finding implies that the value of distant-future dividends – dividends paid out more than 10 years from today – must have dropped by more than the value of the near-future dividends. As we find it unlikely that long-run fundamentals, in levels, are hit harder than near-term fundamentals, the drop must come from discount rates. In particular, discount rates must have gone up more on distant- than on near-future dividends. They may have done so because we experience a very persistent increase in discount rates, which accumulates with the horizon and therefore has a larger effect on distant-future dividends. Alternatively, we may experience a large transitory shock to discount rates on distant-future dividends but only a modest shock on near-future dividends. In either case, prices on the market and the futures jointly suggest that discount rates have increased substantially on long-maturity claims such as the market portfolio. We formalize this analysis at the end of the paper.

Our results have implications for asset pricing theories. It is well known that it is oftentimes difficult to identify the economic shocks that caused asset prices to move (Cutler et al. (1989)). The unique feature of the ongoing events is that the nature of the shock is clear, as well as the temporal structure. We discuss this in more detail in Section 8.

[4]A related concern is that dividend futures market may not be as liquid as other equity markets. However, van Binsbergen et al. (2013) show that dividend futures forecast economic growth better than other price-based forecasts such as bond yields. We cannot directly assess the liquidity of the dividend futures market, unfortunately, as much of the trading activity takes place in over-the-counter markets.

2 The Stock and Bond Market Response to COVID-19

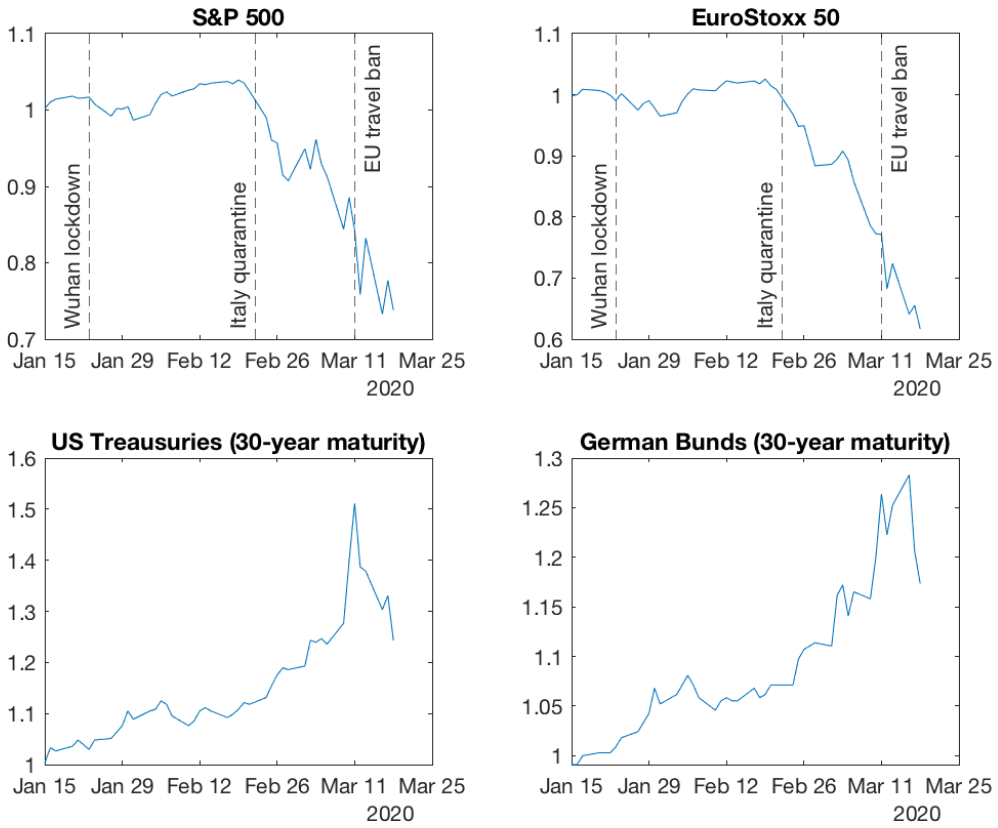
Figure 3 shows the cumulative return on the stock markets in the US and in the EU in the top panels. We use the S&P500 index as the representative stock index in the US and the Euro Stoxx 50 index in the EU. The bottom panels show the cumulative return on 30-year nominal bonds in the US and Germany. Neither of the stock markets responded strongly to the outbreak in China or the lockdown of Wuhan, China, on January 23. However, once it is apparent that the outbreak spread to Italy, South Korea, and Iran, around February 20, stock markets declined sharply.

In response to the US decision on March 12 to severely restrict travel from the EU, with the exception of the UK, and decisions by governments in the EU to lockdown to various degrees, stock markets around the world declined by 10% or more. By March 16, stock markets have dropped more than 30% from their peak.

In search of safety, investors' demand for long-term government bonds issued by the US and Germany increased. Over the same period, the yield on 30-year US treasuries decreases by almost a percentage point, driving prices on 30-year bonds up by approximately 30%. We see a similar rally in German Bunds, which are the safe assets in the Euro area.

Stock returns are often measured in excess of the return on bonds. When measured in excess of 30-year bonds, the aggregate equity market falls by almost 60%. This is a lower excess return than observed in any calendar month in modern US history. A central question for policymakers and market participants is how to read this decline in the stock market. That is, what does the decline tell us about the trajectory of future growth expectations or changes in expected excess returns. In the remainder of this paper, we show that we can make progress on this question using data on dividend futures.

Figure 3: The response of the stock and nominal bond markets in the US and EU



This figure shows the cumulative return to the S&P 500, the Euro Stoxx 50 index, 30-year US treasuries, and 30-year German bunds. We depict in dotted vertical lines the following three events: The lockdown of Wuhan, China on January 23, the announcement of quarantine in Italy on February 22, and the announcement by the US government that it would ban travel from the EU on March 11.

3 The Temporal Nature of COVID-19 and Past Pandemics

To interpret the evolution of asset prices, it is useful to place the ongoing pandemic into historical context. The Centers for Disease and Control and Prevention (CDC) provides an overview of past pandemics.[5] The key takeaway is that pandemics tend to be relatively short-lived. For instance, the H1N1 virus spread in 1918 and 1919, the H2N2 virus in 1957 and 1958, the H3N2 virus in 1968, and the H1N1pdm09 virus in 2009. While the pandemic may spread more easily in today's interconnected world, the expectation is that a vaccine can be available within 2 years. So while the economic contraction may be very sharp, and potentially have long-lasting effects, it is reasonable to assume that the economic consequences are most severe in the next one or two years. Indeed, this reasoning has prompted policy proposals to flatten not only the pandemic curve, but also the recession curve (Gourinchas (2020)). We will interpret the dynamics of equity and bond markets through this lens.

4 The Response of Dividend Futures to COVID-19

To better understand the expected impact of COVID-19 on the economy over the next few years, we turn to the term structure of dividend prices. The equity term structure are prices of claims to the dividends of all listed firms in a given year. To interpret the dividend strip price, we can write (2) as

$$P_t^{(n)} = D_t \exp\left(g_t^{(n)} - \mu_t^{(n)}\right)$$

where $g_t^{(n)} = \ln \mathbb{E}_t \left[\frac{D_{t+n}}{D_t}\right]$ is the expected growth rate between t and n. In practice, we do not directly observe the dividend strip price, but instead the dividend futures price, which we denote by $F_t^{(n)}$. The two prices are linked by $F_t^{(n)} = P_t^{(n)} \exp\left(n y_t^{(n)}\right)$, which implies

$$F_t^{(n)} = D_t \exp\left(g_t^{(n)} - \theta_t^{(n)}\right),$$

[5] https://www.cdc.gov/flu/pandemic-resources/basics/past-pandemics.html.

where $y_t^{(n)}$ is the $n-$year risk-free interest rate and $\theta_t^{(n)} = \mu_t^{(n)} - ny_t^{(n)}$, the expected excess returns on $n-$period dividend risk. We directly observe the futures price, $F_t^{(n)}$, which informs us about the market's expectation of the growth rate *by maturity* and the expected excess return, $\theta_t^{(n)}$, again, by maturity. The unique feature is that we can get information about growth expectations by maturity, while the stock market is informative about the growth rates and expected returns across all maturities combined.

The dividend futures are exchange-traded products, traded on the Chicago Mercantile Exchange in the US and on the Eurex Exchange in EU, and also to a large extent on over-the-counter markets. Because the contracts expire in December, the maturity of the available contracts varies over the calendar year, and we therefore interpolate prices across the different contracts to obtain constant maturity prices. We use the mid-quotes at close as pricing data in the US and settlement prices, which is the volume-weighted average price during the day, in the EU.

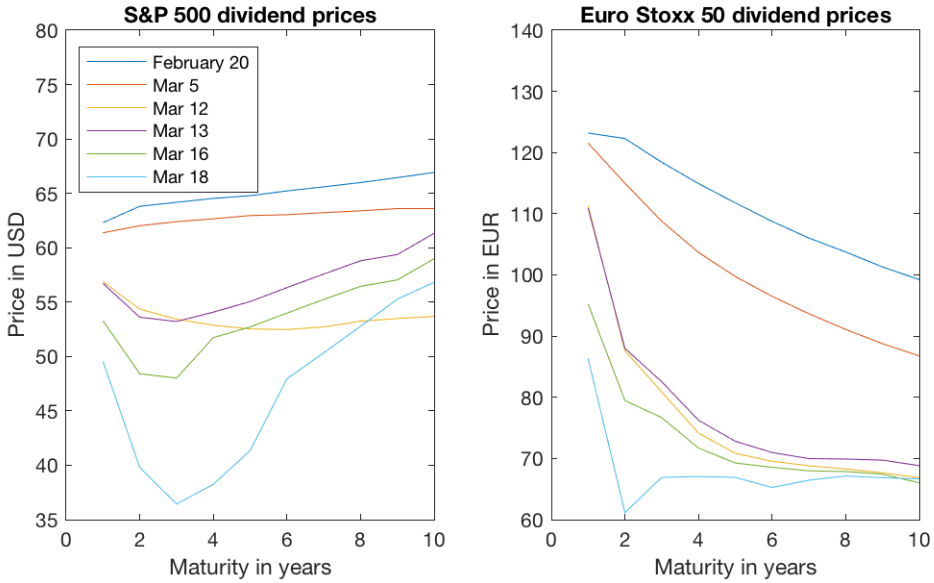
Figure 4 shows the term structure of dividend futures for the S&P 500 and the Euro Stoxx 50. The figure plots the prices on February 20, March 5, March 12, March 13, March 16, and March 18. For the S&P 500, prices hardly move between February 20 and March 5, but they fall substantially from March 5 to March 12. For the Euro Stoxx 50, prices decline in both periods.

The fact that prices did not drop between February 20 and March 5 in the US suggests that investors did not revise down the expected value of short-term profits much, despite the fact that stock markets dropped substantially during this period. The drop in the stock market is thus unlikely to be driven by deteriorating fundamentals, but rather by an increase in discount rates on long-maturity claims (we discuss how these may arise later in Section 8).

On March 13, the US declares a national emergency at 3pm EST, which resulted in a sharp rally in the stock market. The response in the dividend futures market in the US reveals that this announcement did not lead to a change in dividend prices in the first 3 years, but a sharp increase in all future years. This suggests that the announcement primarily lowered discount rates, for instance by reducing investors' risk aversion, or changed investors' expectations about the length of the economic downturn.

On March 16, many states in the US take further actions to limit the spread of the virus.

Figure 4: The Development of the Dividend Term Structure over the COVID-19 Outbreak



This figure shows the term structure of dividend future prices. The dividend futures are claims on the dividend paid out on the index in a given year. We consider the S&P 500 index and the Euro Stoxx 50 index. Maturity measured on the horizontal axis is expressed in years. Consider the S&P 500 in the left figure. The blue line shows the term structure of dividend prices is upward sloping on February 20, 2020. The yellow line shows that the term structure is downward sloping on March 12. It becomes upward sloping again on March 13 and 16. For both indexes, the prices fall by most on the 2- to 3-year horizon.

In addition, during the weekend, the Federal Reserve cuts interest rates to zero and, at the same time, announces a new quantitative easing program. Stock markets fall sharply once again. Dividend prices in the US now decline the most at short to intermediate horizons, consistent with a revision of the expected depth of the recession.

On March 18, dividend futures in both the US and EU drop sharply at the short and intermediate horizons. The long-horizon claims move modestly.

5 What Do Equity Markets Tell About Growth Expectations?

5.1 A Lower Bound on Dividend Growth

We provide a simple lower bound on the expected growth rate in dividends that can directly be computed using market prices. If we consider a change in the price of a future over short period of time from t to t', $t' > t$, we have

$$\Delta f_{t'}^{(n)} = \Delta g_{t'}^{(n)} - \Delta \theta_{t'}^{(n)},$$

where $\Delta x_{t'} = x_{t'} - x_t$ and $f_t^{(n)} = \ln F_t^{(n)}$,the logarithm of the dividend futures price. To obtain a lower bound on the change in growth expectations, we assume that the expected excess return, which for instance reflects investors' risk aversion, did not go down since the outbreak, $\theta_{t'}^n - \theta_t^n \geq 0$. This implies that we can bound the change in expected growth from below by

$$\Delta g_{t'}^{(n)} \geq \Delta f_{t'}^{(n)},$$

which depends only on market prices on the right-hand side that are readily available. Hence, the change expected growth over the next n years, $\Delta g_{t'}^{(n)}$, is bounded from below by $\Delta f_{t'}^{(n)}$.

Figure 5 shows how the lower bound evolved over time. The left panels show the response to individual events and the right panels show the cumulative response from January 15 until a particular date:

- Response to Wuhan outbreak (January 15 - January 31): The outbreak in Wuhan, China did little to move expectations about future dividends, consistent with stock markets in general not responding (see Figure 3).

- Response to global outbreak (January 31 - March 5): Between January 31 and March 5, COVID-19 spreads internationally, with Italy, Iran, and South Korea hit particularly hard. Stock prices both in the EU and in the US fall substantially as shown in Figure 3. In the EU, the lower bound is revised down from close to zero to minus a 6%3 years out. There are signs of catch-up growth afterwards as the lower bound slopes

up in the long end. In the US, the lower bound falls substantially at the long end but not at the short end. Since there is no sign of short-run decreases in growth. A natural interpretation is that the long end drops because of increasing risk premia on long-maturity claims.

- Response to EU travel ban (March 5 - March 12): From March 5 to March 12, COVID-19 continues to spread. Governments in the EU respond with partial lockdowns. The US limits travel from the EU on March 11. On March 12, stock markets experience the largest daily drop since 1987. The lower bound on growth drops substantially both in the US and EU. There are still signs of catch-up growth in EU.

- Response to National Emergency (March 12 - March 13): On March 13, the US declares a national emergency at 3pm EST. Stock prices surge in the last few hours of trading. Interestingly, the lower bound is unchanged for the first 3 years, suggesting investors do not become more optimistic about the near term. But the long term is revised upwards. A natural interpretation of the increase in the long end is that risk premia on long-maturity claims decrease (potentially because of strengthened investor confidence) or that the expected length of the recession shortened. Dividend prices in EU have stopped trading before the declaration of the state of emergency in the US.

- March 16: Stock markets drop by as much as 11% but dividend futures drop by even more. The lower bound on short-term dividends decreases substantially. We experience the biggest downward revision of the bound so far. The drop in the stock market is likely driven by a downward revision in expected growth.

- March 18: Stock markets drop by 5 to 6% but dividend futures drop by 15 to 20% on the 2- to 3-year horizon. The long end of the dividend term structure drops around 5%. We again experience the biggest downward revision of the bound so far. The drop in the stock market is again likely driven by a downward revision in expected growth.

Taken together, the lower bound on dividend expectations is revised down by as much as 43% in the US and 50% in the EU at a 3-year horizon. It is important to keep in mind that the lower bound represents the revision in growth rates relative to previous expectations, not

the actual growth rate. If investors expected a nominal growth rate of 6% annually prior to the outbreak, the expected growth on the 3-year horizon would be more than 18%. Revising growth expectations down by 40% would thus imply a negative growth of only 22% over a 4-year horizon. In addition, the results reflect a lower bound where the drop in dividend prices only reflect a drop in dividends and not an increase in risk premia. We next discuss the methodology that we use to compute a point estimate.

5.2 Estimating Dividend Growth Expectations

We also estimate growth expectations directly using out-of-sample forecasting. These estimates are plotted in Figure 1. Here we explain how we estimate these. We first define the equity yields as:

$$e_t^{(n)} = \frac{1}{n} \ln \left(\frac{D_t}{F_t^{(n)}} \right),$$

Using a training sample from 2006 to 2017, we regress annual dividend growth on the ex ante value of the 2- and 5-year yields:

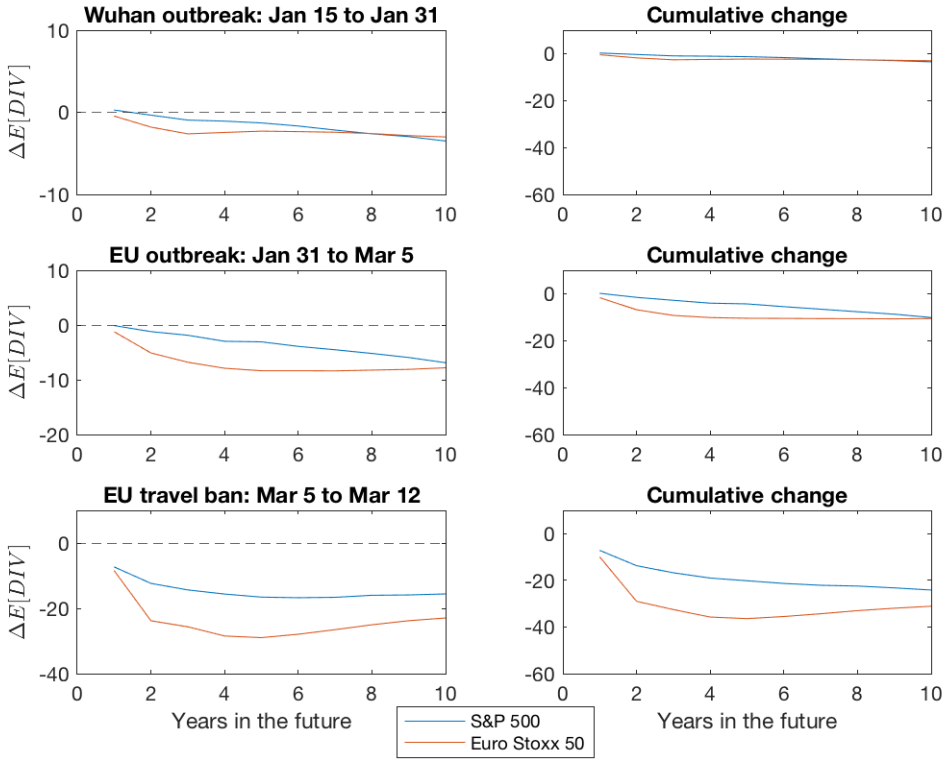
$$\frac{DIV_{t+4} - DIV_t}{DIV_t} = \beta_0^D + \beta_1^D e_t^{(2)} + \beta_2^D e_t^{(5)} + \epsilon_{t+1},$$

where t is measured in quarters and maturity n is measured in years. We then use the parameter estimate in this regression to estimate expected dividend growth at every trading day since January 1 2020.

6 Mapping Dividend Growth to GDP Growth

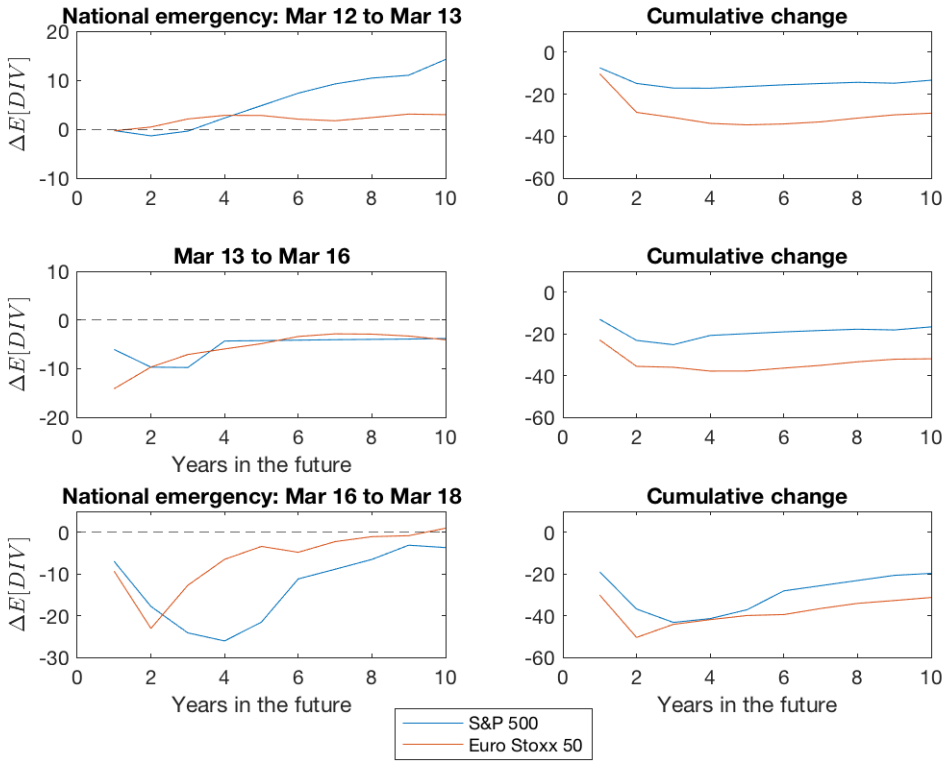
The expected growth in dividends does not map one-for-one to growth in GDP for two reasons. First, dividends are a levered claim on firms' profits. Second, firms' profits are

Figure 5: A lower bound on growth expectations by maturity as implied by dividend markets



This figure shows a lower bound on changes in expected dividends. On the left side, it shows the change over a specific period measured in percent. Each figure shows the lower bound of the change in expected dividends at different horizons, from 1 to 10 years. The right hand side shows the lower bound of cumulative change in expected dividends from January 15. The figure shows that expected dividends may have been revised down by as much as 43% in the US and 50% in the EU. It is revised down the most on the 3-year horizon. This estimate is a lower bound, i.e. the largest possible drop (see text for description).

Figure 6: CONTINUED: A lower bound on growth expectations by maturity as implied by dividend markets



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different from total GDP, which also represents government spending and more. To map the growth in dividends into growth in GDP, we need to make additional assumptions. For the lower bound, we assume the dividend growth is a function of GDP. We first regress dividends on GDP and save the slope coefficient which is around 2 is the US and around 3 in the EU. We then dividend the lower bound on dividends by the slope coefficient to get a lower bound on expected growth in GDP. We note that this rules out the possibility that dividends move for reasons other than changes in GDP, such as changes in payout policy. We show the lower bound on GDP growth in Figure 7.

For our point estimate on GDP growth, the mapping is more straightforward. We run the same predictive regressions as for dividend growth, only now we use GDP on the left hand side. That is, using a training sample from 2006 to 2017, we regress annual GDP growth on the ex ante value of the 2- and 5-year yields:

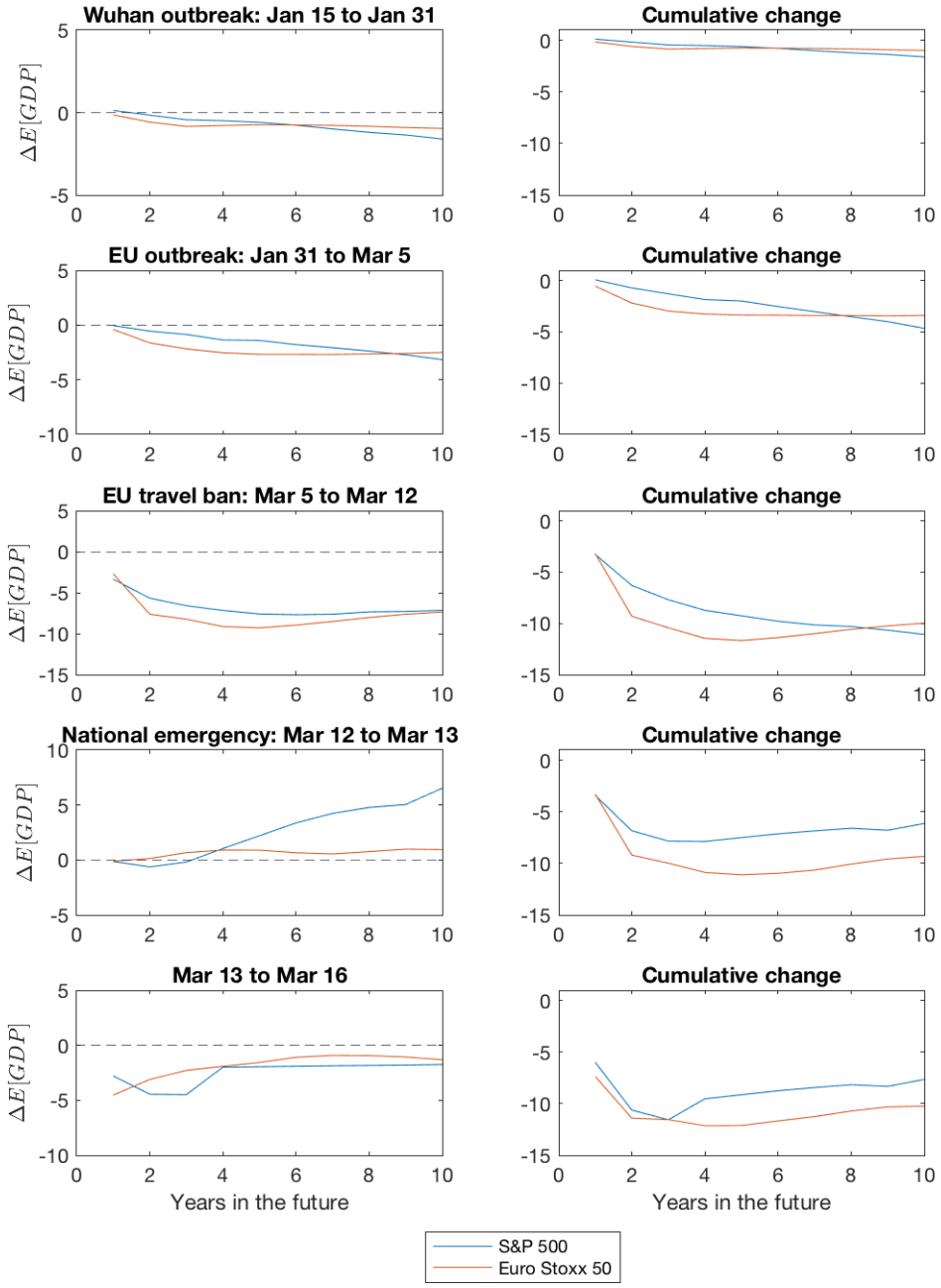
$$\frac{GDP_{t+4} - GDP_t}{GDP_t} = \beta_0^G + \beta_1^G e_t^{(2)} + \beta_2^G e_t^{(5)} + e_{t+1},$$

where t is measured in quarters and maturity n is measured in years. We then use the parameter estimate in this regression to estimate expected GDP growth at every trading day since January 1 2020. We forecast US GDP growth using equity yields on the S&P 500 and we forecast EU GDP growth using dividend yields on Euro Stoxx 50. We measure GDP in real terms.

As mentioned before, as a word of caution, we emphasize once more that these estimates are based on a forecasting model estimated using historical data. In turbulent and unprecedented times, there is a risk that the historical relation between growth and asset prices breaks down, meaning these estimates come with uncertainty.

For comparison, we also show a series of contemporary GDP forecasts in Table 1. We also refer to the CEPR book on "Economics in the Time of COVID-19" for further analysis of the economic effects, and in particular the chapter by Wren-Lewis (2020) who estimates a decline of GDP of around 1% to 2%, and at most 5%.

Figure 7: A lower bound on GDP growth expectations by maturity as implied by dividend markets



This figure shows a lower bound on changes in expected GDP. On the left side, it shows the change over a specific period. Each figure shows the lower bound of the change in expected GDP at different horizons, from 1 to 10 years. The right hand side shows the lower bound of cumulative change in expected GDP relative to expectations on January 15. The figure shows that expected GDP may have been revised down by as much as 10% in the US and 12% in the EU. It is revised down the most on the 3-year horizon. This estimate is a lower bound, i.e. the largest possible drop (see text for description).

Table 1: GDP growth forecasts

Organization company	**Period**	**Change**	**Level**	**Region**	**Date**
Office for Budget Responsibility	2020	-0.30%		Britain	12-Mar
Rabobank	2020.H1		Below last year's level	EU	12-Mar
EUan Commission	2020	-2.30%		EU	13-Mar
Rabobank	2020	-1%		Eurozone	12-Mar
Rabobank	2020	-0.60%		France	12-Mar
Berenberg Bank	2020.Q1	-0.10%		Germany	19-Feb
Rabobank	2020	-0.90%		Germany	12-Mar
OECD	2020	-0.50%		Global	3-Feb
IMF	2020	-0.10%		Global	22-Feb
IMF	2020		Below last year's level	Global	4-Mar
Goldman Sachs	2020	-1%		Global	6-Mar
Moody's	2020	-0.30%		Global	10-Mar
Rabobank	2020	-1.30%		Global	12-Mar
Rabobank	2020	-1.70%		Italy	12-Mar
Rabobank	2020	-0.60%		Netherlands	12-Mar
Rabobank	2020	-0.50%		Spain	12-Mar
Rabobank	2020	-0.50%		UK	12-Mar
Goldman	2020.Q1	-1.10%		US	2-Mar
OECD	2020.Q2		Below last year's level	US	6-Mar
WSJ Survey among economists	2020	-0.70%		US	12-Mar
Rabobank	2020	-0.50%		US	12-Mar
Capital Economist	2020.Q2	-1%		US	13-Mar
Bank of America	2020	-0.40%		US	14-Mar
Bruce Kasman (JPMorgan)	2020.H1		Below last year's level	US & Global	13-Mar

7 Comparison to the Financial Crisis of 2008

We next compare the market's response to COVID-19 to the financial crisis of 2008. On March 13, the VIX is of similar magnitude as that observed during the financial crisis. Stock prices have also dropped as much as in the fall of 2008, at least when measured in excess of 30-year treasuries. These observations underline the severity of the outbreak of COVID-19.

Figure 8 shows the lower bound during the financial crisis. The blue line plots the lower bound on revisions in expected dividends between July 31 2008 and November 31 2008. The red line plots the subsequent realized dividends measured relative to a pre-crisis trend of around 4% growth.[6] For the S&P 500, the lower bound on changes in expected dividends lines up well with the realized dividends at the short-end. For Euro Stoxx 50, realizations are slightly below the bound at the short end, above the bound in the middle, and around the bound at the long end.[7] It is comforting that even during a period of high financial turbulence, the future prices appear well linked to fundamentals and align well with realizations.

Figure 8 also plots the drop in dividend futures following the outbreak of COVID-19. As of March 18, the drop is as large as observed during the financial crisis, but the curve indicates more catch-up growth.

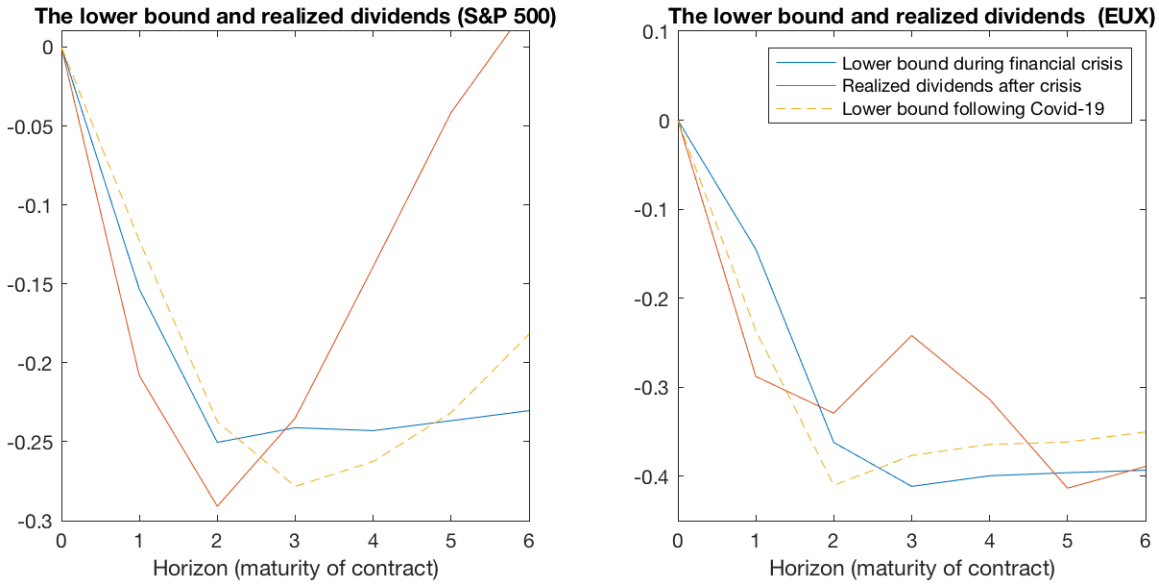
8 Reconciling the Price of the Stock Market with Dividend Strip Prices

Given the modest decline in growth expectations in the first weeks of the outbreak, we can learn something about how expected excess returns changed during this period. To illustrate this, we fit a simple model for dividend prices that we require to simultaneously price the dividend futures as well as the aggregate stock market. Starting from (1), we observe the dividend prices for the first 10 years and we observe S_t. We model the expected growth minus

[6] We measure the growth rates as the real-growth in dividends observed between 1947 and 2007, which is close to 2% plus 2% for expected long-run inflation in 2007.

[7] We note, however, that the low realized dividends on the long end could reflect the European sovereign debt crisis of 2011, which was probably unexpected in 2008.

Figure 8: A lower bound on growth expectations by maturity as implied by dividend markets



The blue line shows the lower bound on changes in expected dividend growth between between July 31 and November 31 in 2008. The line shows that dividend growth was revised down with up to 25% on the 2-year horizon for the S&P 500. The red line shows the realized dividends x years into the future (relative to a pre-crisis trend of 4% nominal). The realized dividends where approximately 30% below the pre-crisis trend after 2 years for the S&P 500. The dotted yellow line shows the lower bound on changes in expected dividend growth between January 15 and March 18 2020. The lower bound is as low as observed during the financial crisis. The figure shows results for the S&P 500 to the left and for Euro Stoxx 50 to the right.

the expected excess return, $g_t^n - \theta_t^n$, as a function of maturity. The functional form that we fit in each period follows Nelson and Siegel (1987).

The results are presented in Figure 9. As the short-term dividend prices in the US did not move much during the first 10 years, even though the market fell from February 20 to March 5, the long-term dividend prices fell. As the growth implications are presumably more negative in the short term, this corresponds to an increase in expected excess returns, for instance, due to persistent shifts in risk aversion of households or concerns about a persistent tightening of constraints among institutional investors. Changes in expected excess returns on long-term claims is commonly observed during times of stress (Gormsen (2020)). In EU, both short- and long-term dividend prices dropped during the same period, more consistent with a shock to both growth expectations and expected excess returns. During the period from March 5 to 12, in which growth expectations changed sharply, we see that both short- and long term dividend prices fell sharply in both geographies.

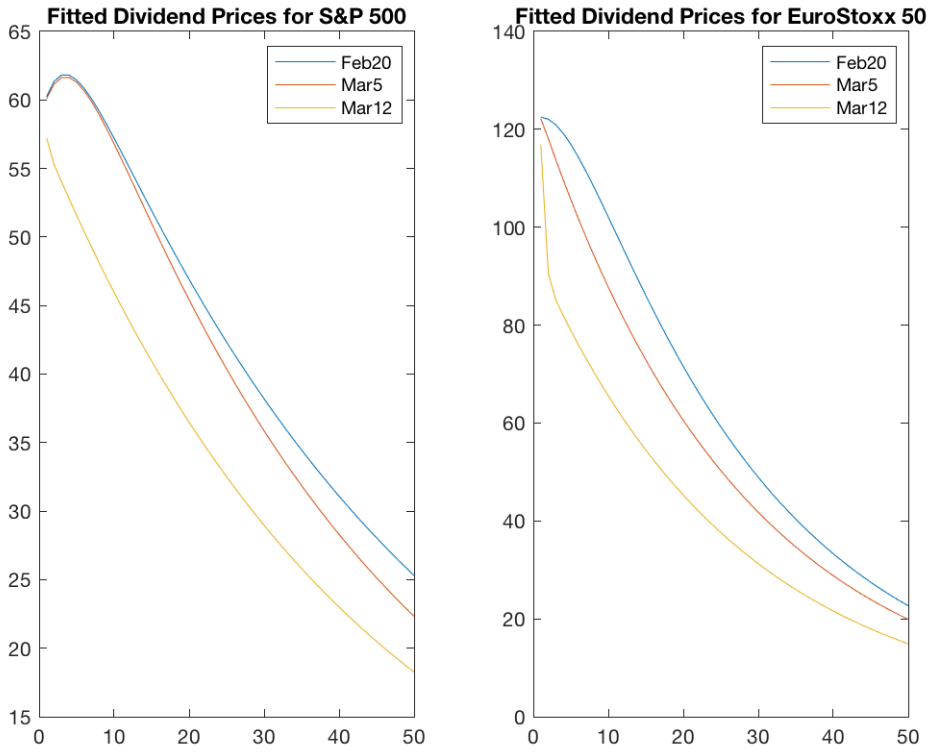
Our results have implications for asset pricing theories. It is well known that it is oftentimes difficult to identify the economic shocks that caused asset prices to move (Cutler et al. (1989)). The unique feature of the ongoing events is that the nature of the shock is clear, as well as the temporal structure.

Although there is uncertainty about the long-term consequences, it seems reasonable to assume that the short-term economic growth consequences are more severe than the consequences after, say, five years. Moreover, the initial decline in the aggregate stock market in the US, with a small response to short-term dividend prices, suggests that modest shocks to short-term expectations can trigger large and persistent changes in expected excess returns. We can write the discount rate in (1) as

$$\mu_t^{(n)} = y_t^{(n)} + \theta_t^{(n)},$$

where $y_t^{(n)}$ is the risk-free discount rate and $\theta_t^{(n)}$ the expected excess return, which is the additional compensation required by investors for the uncertainty in future dividends. As we know that most of the variation in stock markets is due to variation in $\mu_t^{(n)}$ and as, see Figure 3, $y_t^{(n)}$ fell sharply, $\theta_t^{(n)}$ increased.

Figure 9: Reconciling the stock market and dividend price responses



This figure shows estimated prices of dividends for different maturity. For both S&P 500 and Euro Stoxx 50, we fit the term structure of dividend prices to the functional form on Nelson and Siegel (1987) under the restriction that the price of all the dividends sum to the market. We estimate the prices separately on February 20, March 5, and March 12. Maturity measured on the x-axis is in years.

9 Conclusion

In periods of economic and financial distress, getting accurate, forward-looking measures of the expected path of the economy is key for policy makers. We show that dividend futures constitute a useful tool for policy makers and market participants in this regard.

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