When does Cash-flow Risk Matter to Investors? Evidence from the COVID-19 Pandemic

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Abstract

I use the exogenous shock to aggregate consumption caused by the COVID-19 pandemic to examine the importance of cash-flow risk for investors. I find that the industry long-run cash-flow risk predicted which industries performed worst during the pandemic. High cash-flow risk industries experienced abnormally low excess returns and substantially higher risk levels during the first three months of 2020. I use dividend futures data to show that the equity term structure inverted and forward equity yields proliferated after mid-March 2020, which may explain the heightened relevance of cash-flow risk during the pandemic.

JEL classification: G01, G12.

Keywords: COVID-19 pandemic, equity term structure, US industry performance, consumption shocks.

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I. Introduction

The prevailing view on the role of cash-flow growth expectations is that it has little effect on asset price fluctuations.[1] Cochrane (2011) argues that all price variations are driven by changes in expectations about future stock market returns. While over long run, the unconditional relation between the ex-ante cash-flow risk[2] and subsequent returns may well be modest and indeed insignificant, I document that the conditional relation is rather pronounced and directly linked to return performance. I provide a potential explanation of this heightened relevance of cash-flow risk during periods of economic distress and demonstrate that cash-flow risk matters to investors when the equity term structure inverts and expected dividend growth rates for short maturities decrease significantly.

This paper studies the cross section of industry reaction to the COVID-19 pandemic. The objective is to examine this unique exogeneous shock to aggregate consumption[3] in order to learn what drives firm valuations during downturn events. This paper identifies a theoretically-founded and fundamentally-driven predictor of industry performance during the pandemic. I show that the long-term sensitivity of investment cash-flows to consumption shocks (i.e. cash-flow risk) is useful when explaining the heterogeneity in industry reaction to COVID-19 and the 2008-2009 Global Financial Crisis.

Cash-flow risk is particularly relevant for asset prices during market downturns when growth expectations are low and investors fear losses on investment income from dividends. Landier and Thesmar (2020) use analyst forecast data and estimate that while risk premia have reverted back to its original level, 2020 earnings expectations are still reduced by 16% by mid-May 2020. I argue in this paper that as investors worry about potential drops in short-term dividends, which causes the equity term structure to invert, cash-flow risk becomes

[1] There are notable exceptions of papers showing that cash flows are useful in explaining future valuation primarily through affecting future cash-flow changes (Myers and De La O, 2018; Bollerslev, Xu, and Zhou, 2015; Chava, Gallmeyer, and Park, 2015; Maio and Santa-Clara, 2015; Chen, Da, and Zhao, 2013).

[2] In this paper, I use the Menzly, Santos, and Veronesi (2004) definition of cash-flow risk, which measures the sensitivity of dividend cash-flows to shocks in aggregate consumption.

[3] Coibion, Gorodnichenko, and Weber (2020) estimate that the aggregate spending dropped by 31 log percentage points during the COVID-19 pandemic.

priced in the cross section of industry returns realized during the COVID-19 pandemic. During normal times, however, firms are better able to smooth earnings and provide stable dividend payments, which allows investors to worry less (or not at all) about shocks to dividend income as it rarely happens.

In this paper, I document that cash-flow risk, measured using information observed before the outbreak, predicted which industries are to be hit the most by the pandemic crisis. I find that long-run cash-flow risk measured using data from 1929 to 2018 identified industries that experienced the lowest excess returns, lowest risk-adjusted excess returns and the highest levels of systematic and idiosyncratic risk during the virus outbreak. The long-run cash-flow risk of industries, alone, explains 21% of the total variation in daily excess returns observed between January 2, 2020 and March 25, 2020. This finding is particularly interesting, given that cash-flow risk does not explain much of the variation in unconditional industry excess returns.

Industries hit the most by the COVID-19 shock are 'Steel Works', 'Construction' and 'Coal'. Firms operating in these industries lost on average up to 60-80% of their equity value in the first three months of 2020. These two industries also have the highest long-run levels of cash-flow risk. On the other hand, firms operating in industries with a relatively low cash-flow risk, such as 'Telecommunication' or 'Utilities' firms, have been affected by the COVID-19 crisis significantly less as their cumulative loss during the first three months of 2020 was on average around 20%, see Figure 1.

[**Figure 1 about here**]

I use dividend futures data obtained from the Chicago Mercantile Exchange (CME) to estimate the implied term structure of equity premia. Shortly after the US declared an emergency status on March 13, 2020, the term structure of equity premia inverted and became strongly downward sloping. Moreover, the implied forward equity yields changed signs from negative to positive for all maturities traded on CME. Short maturities were the most affected; the implied forward equity yields increased by 50-60 percentage points after mid-March for one- to two-year maturities.

This paper speaks in favor of asset prices being driven by cash-flow shocks. I show that more than 20% of the variation in conditional equity returns corresponds to long-run cash-flow risk. This is consistent with Chen, Da, and Zhao (2013), who documents that for horizons longer than two years, cash-flow news are more important both for the firm and aggregate levels for stock prices than discount-rate news. Myers and De La O (2018) further argue against the irrelevance of cash flows by showing that cash flow growth expectations explain at least 93% of movements in the S&P 500 price-dividend ratio.

Nevertheless, many existing consumption-based theories do not identify cash-flow risk as an important driver of asset prices. For instance, the commonly used habit-formation model implies that heterogeneous cash-flow risk plays only a little role in explaining the cross-sectional differences in expected excess returns. Santos and Veronesi (2010) call this fact the "cash-flow risk puzzle." Sinagl (2019) proposes an alternative model that uses preference shocks instead of external habits which is able to, unlike a habit-formation model, reproduce many observed cross-sectional empirical observations with plausible levels of cash-flow risk. Sinagl (2019) also identifies that assets with high unconditional cash-flow risk have more volatile excess returns, more volatile systematic risk premia, more volatile risk-adjusted returns, higher CAPM betas and higher book-to-market ratios.

This paper belongs to a rapidly developing literature on the financial impacts of the COVID-19 pandemic. Gormsen and Koijen (2020) use futures market data to assess the implications for the GDP growth. Alfaro, Chari, Greenland, and Schott (2020) quantify the effects of unanticipated changes in infection rate on aggregate and firm-level returns. Baker, Bloom, Davis, Kost, Sammon, and Viratyosin (2020) document that the current pandemic is the first one to immediately affect the stock market through published news articles. Croce, Farroni, and Wolfskeil (2020) quantify the exposure of major financial markets to news shocks about global contagion risk and find that the market price of contagion risk is substantial. Kozlowski, Veldkamp, and Venkateswaran (2020) build a theoretical model that implies long-term scarring economic effects of the pandemic and Ludvigson, Ma, and Ng (2020) estimate substantial drops in industrial production and employment that will follow after the pandemic.

Ramelli and Wagner (2020) also study US industries and show that investors became increasingly concerned about corporate debt and liquidity during the COVID crisis. Nguyen (2020) provides empirical evidence of the impact of COVID-19 crisis on stock returns of eleven industry sectors in ten countries. This paper is different from Ramelli and Wagner (2020) and Nguyen (2020) or other existing COVID-19 papers because it uses the COVID-19 pandemic as an exogeneous event to examine whether cash-flow risk matters to investors during market downturns.

This paper is organized as follows. Section II describes the data used and discusses the estimation of the long-term cash-flow risk for US industries and the estimation of forward equity yields. Section III examines the response of US industries to the COVID-19 outbreak. Section IV discusses the importance of cash-flow risk for investors during market downturns. Next, I examine the relation between cash-flow risk levels and industry characteristics in Section V. Section VI compares the COVID-19 developments with the 2008-2009 global financial crisis and Section VII concludes.

II. Data & Measures

A. The COVID-19 Data

In this paper, I analyze the stock price reaction of the Fama French 30 industries to the COVID-19 pandemic. I examine the effects of the virus outbreak on average daily excess returns, CAPM βs, risk-adjusted returns (α) and return volatilities. I use price and dividend data collected for all firms listed in the US between January 2, 2020 and April 27, 2020. I first retrieve data for individual equities and then group them into Fama French 30 Industries following the SIC classification described on Kenneth French's website.[4]

In the afternoon of March 25, 2020, a $2 trillion package was announced to help the US economy ride out of the pandemic crisis. This package includes direct payments to taxpayers, expanded unemployment benefits, emergency loans for small businesses, money to shore up the heath care system, and $500 billion to bail out larger companies. I use March 25, 2020 as a cut off date for the main analysis of the importance of cash-flow risk during the COVID-19 crisis to avoid contamination of results caused by government interventions.

[**Table I about here**]

Daily stock price and dividend data is collected from the merged CRSP-Compustat Security Daily database. I limit my attention to common shares only ("tpci = 0") issued by firms listed on the NYSE, ASE and NASDAQ ("exchcd = 11,12,14"). I use the S&P 500 index ("gvkeyx = 000003") as a market proxy to estimate CAPM β and α, collected from the WRDS Compustat Index Daily database. Industry-level data observed during the COVID-19 pandemic is reported in Table I.

I use industry excess returns to estimate industry CAPM βs for the Fama French 30 industry portfolios. I use all available daily observations to compute value-weighted excess returns for each industry. I then regress the industry average returns on market daily excess returns to estimate the α (risk-adjusted return) and β (systematic risk) coefficients for each Fama French 30 Industry. This is not a rolling-window regression estimation as all data from January 2 to March 25, 2020 is used in the estimation process.

B. Estimating Long-run Cash-flow Risk

I estimate the long-run (unconditional) cash-flow risk individually for all Fama French 30 Industries using data on the aggregate personal consumption expenditures per capita of

[4]The daily excess returns are computed based on daily price appreciation plus dividend income, collected from Compustat Global Daily Stock Price database. I use the four-week Treasury Bill rate as a proxy of the risk-free rate, retrieved from the US Department of Treasury website (can be accessed here).

nondurable goods and services from the National Income and Product Accounts (NIPA) from 1929 until 2018. I use the PCE deflator to get real quantities of annual the log consumption growth.

Industry dividend data comes from the Kenneth French's website. I use annual return data for the Fama French 30 Industry Portfolios available from 1929 until 2018 to calculate annual dividend growth. I use industry-level data instead of individual firm-level details because firms are short-lived and firm-level data is exposed to high idiosyncratic noise. I use the annual level of industry dividends instead of monthly or quarterly levels because dividends payments, the main source of income to shareholders, are paid out infrequently. Working with annual dividends is consistent with using the 12-month or four-quarter trailing dividend commonly used by existing literature (Duffee, 2005; Menzly, Santos, and Veronesi, 2004).

For an industry j, the total level of cash dividend paid in year t is given by $D_t^j = DY_t^j \times V_{t-1}^j$, where DY_t^j is the industry-level dividend yield and V_{t-1}^j is the market capitalization value of industry j at time $t-1$. I first compute the industry-level dividend yield (DY_t^j) by subtracting the annual industry-level return without dividends from return with dividends. Next, I compute the industry-level log-dividend growth rate based on the dividend yields and industry market capitalization.

I use the Menzly, Santos, and Veronesi (2004) definition and estimate the cash-flow risk (CF risk) for all 30 Fama French Industry Portfolios by computing the unconditional long-term covariance between the dividend consumption share growth and consumption growth and subtracting the variance of consumption growth,

$$\text{CF risk}^i = \mathrm{E}_t\left(\mathrm{cov}_t\left(d\delta_t^i, dc_t\right)\right) - \sigma_C^2, \tag{1}$$

where $d\delta_t^i$ represents the growth rate of the dividend to aggregate consumption ratio of industry i, dc_t is the aggregate consumption growth, and σ_C is the variance of aggregate consumption.

[Figure 2 about here]

The value of the cash-flow risk determines whether an asset is a good or a bad hedge against bad economic conditions. Consider a negative consumption shock, such as the current COVID-19 outbreak. A negative cash-flow risk suggests that with a negative shock to consumption, such asset will constitute of a larger fraction of aggregate consumption. This asset will thus serve as a hedge against bad times as it will likely pay out relatively higher cash-flows to shareholders in times of economic distress (Menzly, Santos, and Veronesi, 2004).

[Table II about here]

I use all available data from 1929 to 2018 to estimate the unconditional covariance between the industry-level dividend growth and the aggregate consumption growth for the 30 Fama French Industry Portfolios and display results in Figure 2 and Table II. I find that firms from the 'Steel Works', 'Construction' and 'Coal' industries have the highest observed levels of cash-flow risk. These industries are highly exposed to aggregate consumption as new production and construction are typically the first to shut down in times of economic distress. Next, I document that 'Utility' and 'Telecommunication' firms have the lowest observed levels of unconditional cash-flow risk. Given that when a negative shock hits the economy, people are likely to continue using utility and telecommunication services, this finding seems to be intuitive.

Why do we observe heterogeneous cash-flow risk among US industries? One of the potential explanations for the existence of heterogeneous cash-flow risks is based on the savings propensity and willingness to spend of consumers that may differ across industries. My findings show that industries known to be exposed to relatively higher drops in production and customer demand during market downturns, such and firms operating in 'Construction' or 'Steel Works' industries, have relatively higher cash-flow risk, which is consistent with *the elasticity of demand* story.

One would expect that industries that produce goods bought by customers with a low demand elasticity to price shocks would also be associated with lower levels of cash-flow risk. Industries with customers that are generally less sensitive to shocks in price typically produce assets that have fewer substitutes, operate in less competitive product markets or produce necessities rather than luxury goods.

I find results consistent with this hypothesis. One example is the 'Healthcare' industry, which has a relatively low cash-flow risk. The estimated long-run cash-flow risk level for the healthcare industry is negative, which suggests that during market downturns, healthcare firms pay dividends that increase relatively more than dividends of firms in other industries. This finding is consistent with healthcare firms producing necessities bought by customers under any economic conditions, and thus generating stable sales over time. 'Chemicals', 'Telecommunication' and 'Utilities' are other examples of industries with a negative cash-flow risk that increase their dividend consumption share and pay out relatively more dividends in bad times. Firms in these industries are known to operate in less competitive environments.

C. Estimating the Term Structure of Equity Premia

In order to study investor expectations about the value of future payments over the next few years, I examine the term structure of equity yields estimated using S&P 500 dividend futures prices. Dividend futures data is informative of the aggregate investor expectations about growth rates and risk premia for different maturities. This maturity-specific information cannot be extracted from equity prices because a stock price contains aggregate information about the current valuation of all future dividends discounted to today.

I use dividend futures price data obtained from the Chicago Mercantile Exchange to estimate forward equity yields for the period between t and $t+n$, denoted as $e^f_{t,n}$. Given that dividend futures prices are quoted in forward and not spot prices, the forward equity yields are computed as

$$e^f_{t,n} = \frac{1}{n} \log\left(\frac{D_t}{F_{t,n}}\right), \tag{2}$$

where D_t is the most recent dividend payment recorded at t and $F_{t,n}$ is the observed futures price for dividends paid at $t + n$. I use the twelve-month trailing dividend for the S&P 500 index to measure D_t. I use data from Compustat and estimate daily dividends from returns with and without dividends times the closing S&P 500 index value from the previous day, consistent with Van Binsbergen, Hueskes, Koijen, and Vrugt (2013).

The n-year forward equity yield $e^f_{t,n}$ represents the difference between the maturity-specific risk premium ($\theta_{t,n}$) and the expected dividend growth rate between t and n ($g_t^{(n)}$).

$$e^f_{t,n} = \theta_{t,n} - g_t^{(n)}, \tag{3}$$

where $g_t^{(n)} = \frac{1}{n}\mathrm{E}_t\left(\log(D_{t+n}/D_t)\right)$.

[Figure 3 about here]

Figure 3 shows a structural break in the slope of the term structure of the implied forward equity yields. Shortly after the national emergency was declared in the United States in March 13, 2020, the equity term structure inverts as investors expectations about dividend growth rates and the perceived risk levels changed rapidly. Before March 13, the implied term structure of equity premia was upward sloping and relatively flat. After this date, the slope of the equity term structure becomes strongly negative. The most extreme difference between the implied forward yield on dividends received in one year (maturity $n = 1$) versus ten years (maturity $n = 10$) is observed in April 2020. In April, the forward equity yield for S&P 500 dividends received in one year (i.e. the end of 2020) reaches the highest level of more than 50%.

These findings suggest that investors started to take the COVID-19 pandemic seriously after the US declared a national emergency status. Before March 2020, the implied forward yields are negative across all maturities, which suggests that the expected dividend growth exceeded the maturity-specific risk premia for both short and long maturities. After mid-March 2020, investors' expectations about short-term dividends (received in one to two years) changed dramatically. The expected value of long-term dividends received five to ten years did not change as much.

I discuss the implications of the inverted equity term structure for the relevance of cash-flow risk for investors in Section IV.

III. Cash-flow Risk and Industry Performance

A. The Unconditional Relation

Using long-term return industry data collected between 1929 and 2018, I first examine whether industries with high cash-flow risk have had on average higher excess returns. Consistent with existing literature, I do not find any evidence that high cash-flow risk industries would exhibit significantly higher (or lower) unconditional excess returns, see Figure 4.

[**Figure 4 about here**]

A recent paper by Lan (2020) confirms this finding and shows that, unconditionally, the sum of low- and high-frequency fundamental cash flows variations are not associated with future market returns. The predictability comes only from the low-frequency component.

In the remainder of this paper, I focus my attention on conditional states, i.e. crises events such as the current COVID-19 outbreak or the 2008-2009 global financial crisis.

B. The Conditional Relation

Firms in 'Steel Works', 'Carry Equipment' 'Oil', 'Apparel', and 'Coal' industries have experienced the highest average decline in their equity value between January 2, and March 25, 2020. Figure 5 displays the average daily excess return observed in this period for all Fama French 30 Industries, sorted from the highest (lowest decline) to the lowest (highest decline) values.

The difference between the lowest average daily excess return recorded in the period between January 2, and March 25, 2020, and the highest average daily excess return is 0.95% on daily basis (i.e. -1.19% in the 'Coal' industry versus -0.24% in the 'Retail' industry). This corresponds to striking -5.28% and 20.9% per month or -60.5% and 239.4% per annum, respectively. This substantial range in observed returns points out that the industry reaction to the COVID-19 was not uniform across US industries.

[**Figure 5 about here**]

One may notice that industries that are losing the equity value the fastest are also exhibiting high cash-flow risk. Indeed, the relation between industry (value-weighted) average daily returns and the long-term cash-flow risk is negative, see the scatter plot from Figure 6. The industry cash-flow risk explains 21% of the total variation in excess returns.

[**Figure 6 about here**]

These results suggest that industry cash-flow risk of Fama French 30 industries became more relevant for investors during the COVID-19 pandemic. Hence, while the unconditional relation between the ex-ante cash-flow risk and subsequent return performance may well be more modest and indeed insignificant, the conditional relation is found to be particularly pronounced. I discuss the potential explanations of why cash-flow risk becomes important for investors during market downturns in Section IV.

The return predictability results provided in this section are consistent with Henkel, Martin, and Nardari (2011), who shows that the dividend yield and other commonly used term structure variables predict returns almost exclusively during recessions.

C. Industry-specific Systematic Risk

Firms in industries 'Oil', 'Steel Works', and 'Construction' exhibit the highest observed systematic risk levels during the pandemic, as measured using CAPM βs estimated using daily data from January 2, 2020 until March 25, 2020, see Figure 7. I find that industry cash-flow risk is positively related with CAPM β, see Figure 7. The highest (lowest) CAPM β of 1.2878 (0.6987) was recorded in the 'Oil' ('Mines') industry. These findings suggest that cash-flow risk is not only an important driver of excess returns as it also affected industry levels of systematic risk during the COVID-19 outbreak.

[**Figure 7 about here**]

[**Figure 8 about here**]

This result speaks of the cash-flow risk as an important contributor to and driver of not only the conditional return performance but also the conditional systematic risk of individual industries. The positive relation between cash-flow risk and CAPM β is perhaps not as surprising as the relation between excess returns and cash-flow risk because cash-flow risk was previously found to explain the unconditional long-run levels of industry βs by Sinagl (2019).

D. Risk-adjusted Returns (α)

Next, I document that firms in industries with high cash-flow risk ('Coal', 'Steel Works' or 'Oil') do not only exhibit a relatively high systematic risk but they also underperform the market the most by experiencing the lowest levels of risk-adjusted returns, see Figure 9 and 10. The unconditional cash-flow risk measured using data up to 2018 explains about 17% of the total industry variation in risk-adjusted returns observed during the virus outbreak across US industries, Figure 10.

[**Figure 9 about here**]

[**Figure 10 about here**]

The relation between the CAPM α and cash-flow risk is informative about the marginal impact of cash-flow risk on future excess returns observed during pandemic, after controlling for the effect of CAPM β. The fact that cash-flow risk predicts industry αs indicates that the long-run cash-flow risk measure contains additional information that is not included in industry βs.

E. Return volatility

Does return volatility observed during the turbulent first three months of 2020 differ among industries with different levels of cash-flow risk? I document that industries with high cash-flow risk do, indeed, exhibit relatively high standard deviations of daily excess returns observed between January 1, 2020 and March 25, 2020, see Figures 11 and 12.

[**Figure 11 about here**]

[**Figure 12 about here**]

F. Statistical Tests

I test the statistical significance of the predictive power of industry cash-flow risk to explain industry excess returns, CAPM βs, risk-adjusted returns (α), and return volatility during the first months of the COVID-19 pandemic. I regress these performance measures for the Fama French 30 Industries from Table I, using a cross-sectional regression with 30 observations, and report the regression coefficients in Table III. I use OLS and quantile (median) regressions to estimate regression coefficients attached to the long-run cash-flow risk.

[**Table III about here**]

I find that the industry-level cash-flow risk (estimated over period 1929-2018) is significantly related with all the four measures of returns and risk I consider in this paper. This single variable explains 21% of the total industry variation in average daily returns observed during the COVID-19 outbreak, i.e. from January to March 25, 2020. I further document that cash-flow risk is positively associated with industry CAPM βs and the standard deviation of industry excess returns.

I further divide the first months of 2020 into four periods: Early Signs of COVID-19 (January 2 to January 31, 2020), Outbreak Period (February 1 to February 28, 2020), Turbulent Period (March 1 to March 25, 2020) and Post-stimulus Period (March 26 to April 27, 2020) to test when cash-flow risk contains the highest predictive power, see Table IV.

[**Table IV about here**]

I find that cash-flow risk predicted the stock return reaction to COVID-19 primarily during the early signs of the pandemic in January 2020, which is when the coefficient attached to cash-flow risk exhibits the highest absolute level of t-statistic. In January 2020, industries with the highest levels of cash-flow risk started to under-perform, see Figure 1. In the first month of 2020, the industry cash-flow risk explains 34% of the total variation in industry excess returns (and 29% of variation in risk-adjusted returns). In this period, cash-flow risk is also strongly tied with industry βs and return volatility.

In subsequent periods, cash-flow risk continues to contribute to explaining the industry levels of systematic risk and total return volatility (in both the Outbreak and Turbulent Period). In the Post-stimulus period, cash-flow risk is only mildly linked to industry return volatility with an overall lower (or zero) predictive power to explain daily excess returns and CAPM βs.

As a robustness check and to test whether the significance of regression results is not an outcome of outliers, I estimate the quantile regressions and report results in Panel B from Table III. The main results remain qualitatively robust to the use of quantile (median) regression.

IV. The Relevance of Cash-flow Risk during COVID-19: Evidence from Dividend Futures Prices

To shed some light on the conditional importance of industry cash-flow risk observed during the COVID-19 pandemic, I use dividend futures prices and estimate implied forward equity yields. Dividend futures data is helpful in determining the present value of payments received in different maturities, which allows us to back out growth-rate expectations and risk premia for different horizons. This information cannot be obtained from equity prices, see Van Binsbergen, Brandt, and Koijen (2012) for further discussion.

If implied forward equity yields increase, this can come from either a decrease in growth expectations or an increase in maturity-specific risk premia. Cash-flow risk is directly linked with dividend growth expectations. Firms with high cash-flow risk are expected to lower their dividend payouts in the presence of negative economic shocks. Assets with high cash-flow risk are, therefore, likely to exhibit relatively lower dividend growth rates in the presence of a negative shock to the aggregate consumption, such as the one caused by the COVID-19 pandemic.

In this paper, I argue that cash-flow risk is particularly relevant for asset prices during market downturns when growth expectations are low and investors worry about firms' ability to pay out promised dividends. Investors are particularly concerned about potential drops in short-term dividends, which causes the equity term structure to invert and cash-flow risk becomes priced in the cross section of industry returns realized during the COVID-19 pandemic. During normal times, however, firms are better able to smooth earnings and provide stable dividend payouts, which allows investors to worry less (or not at all) about shocks to dividend income.

I use dividend futures data to estimate a time series of implied forward equity yields. I will now demonstrate how a change in forward equity yields of S&P500 dividend strips reflects in asset prices. The price of any risky asset is the present value of all future dividend income, which can be decomposed into present values of individual dividend strips paid at maturity n ($P_{t,n}$).

$$P_t = \sum_n^{\infty} \frac{D_{t,n}}{(1 + r_{t,n})} = \sum_n^{\infty} P_{t,n} \tag{4}$$

where the present value of each dividend strip $P_{t,n}$ is given by

$$P_{t,n} = D_{t,n} \exp\left(-r_{t,n}\right). \tag{5}$$

The variable $r_{t,n}$ represents the maturity-specific discount rate. Van Binsbergen, Brandt, and Koijen (2012) decompose $r_{t,n}$ into three components: the maturity-specific risk premium ($\theta_{t,n}$), the expected dividend growth rate from t to $t+n$ ($g_{t,n}$), and the nominal yield for maturity n ($y_{t,n}$).

$$r_{t,n} = -n(\theta_{t,n} + y_{t,n} - g_{t,n}) = -n(y_{t,n} - e^f_{t,n}) \tag{6}$$

I find that forward equity yields for short maturities increased by 30-50 percentage points after the US declared a national emergency on March 13, 2020, see Figure 3. Forward equity yield levels peaked in April 2020 and then partially reverted in mid-May. Nevertheless, as of mid-May, forward yields are still up by up to 30% (10%) percentage points for dividends paid in the end of 2020 (2022), relative to 'pre-COVID-19' times. This significant increase in $e^f_{t,n}$ is consistent with a significant decrease in growth expectations and/or increase in the perceived risk premium over the next one to two years.

Landier and Thesmar (2020) study analyst forecasts of corporate earnings and estimate that as of mid-May 2020, forecasts over 2020 earnings have been reduced by 16%. The revision of growth rates is particularly noticeable for short-run forecasts, while long-run growth forecasts have reacted much less and featured less disagreement. Landier and Thesmar (2020) further estimate that the discount rate dynamics, that contain changes in the nominal yields and risk premia have reverted back to its original levels in mid-May. The observed increase in forward equity yields that lasted until at least mid-May is, therefore, most likely driven by lower dividend growth expectation.

Giglio, Maggiori, Stroebel, and Utkus (2020) surveyed retail investors and found that following the crash, the average investor turned more pessimistic about the short-run performance of both the stock market and the real economy. The survey results show that investors perceived higher probabilities of both further extreme stock market declines and large declines in short-run real economic activity. The long-run (10-year) growth expectations remained largely unchanged. Their results are consistent with the implied forward equity yields I estimated in Section II and display in Figure 3.

How does the term structure of equity premia relate to the impact of cash-flow risk on asset prices? As mentioned earlier, cash-flow risk is directly linked with growth expectations. When cash-flow risk is high and the economy is hit by a negative shock to aggregate consumption ($dc_t < 0$), such as the COVID-19 shock, the growth rate expectations will decrease relatively more:

$$\frac{\partial g^i_{t,n}}{\partial \text{CF risk}^i} \leq 0 \text{ if } dc_t < 0, \tag{7}$$

for an asset i. Any decrease in growth rate $g^i_{t,n}$ due to high cash-flow risk is then transmitted into a decrease of asset price P^i_t. As a result, assets with high cash-flow risk will exhibit relatively lower returns and higher return volatility during downturns. This hypothesis is consistent with the empirical evidence provided in Section III that shows that industries with the highest levels of cash-flow risk exhibited lower excess returns and higher return volatility during the first three months of 2020.

The Asymmetric Value of Cash Flows

Why is cash-flow risk not priced in equity returns during good (and normal) times, as Figure 4 suggests? In good times, dividend income is rather stable and less exposed to business cycle fluctuations in good times. Firms are able to manage earnings and better plan dividend payments to meet investor expectations during market upturns (Kirschenheiter and

Melumad, 2002). It may be the case that cash-flow risk becomes relevant primarily when managers can no longer smooth earnings and investment income (dividends) becomes affected by business cycle shocks relatively more.

Fuller and Goldstein (2011) find that dividends matter to shareholders more in declining markets than advancing ones. Shareholders value a dividend increase more in market downturns and dividend-paying stocks outperform non-dividend-paying stocks by 1 to 2% more per month in declining markets than in advancing markets. Goldstein, Goyal, Lucey, and Muckley (2015) add that this phenomenon is also observed globally.

Schmalz and Zhuk (2019) provide another piece of evidence suggesting that cash flows matter more in market downturns than upturns. They document that stocks' reaction to earnings news is about 70% stronger in downturns than in upturns. Schmalz and Zhuk (2019) claim that project-specific fundamental news in downturns contains more relevant information for investors than news performance in upturns. If the value of dividends is particularly high during downturns, cash-flow risk sensitivity will become particularly important for investors during crises. This asymmetric preference for dividends and managerial ability to smooth earnings during good times may, therefore, be one of the reasons why cash-flow risk predicts performance in market downturns.

V. Cash-flow Risk and Industry Characteristics

Industry cash-flow risk is correlated with the book-to-market ratio and cash-flow duration. I examine the relation between the industry level of cash-flow risk and the average annual dividend growth and find that industries with high cash-flow risk have relatively low average dividend growth, and therefore low cash-flow duration. These are also the industries that have performed relatively worse during the first three months of 2020 and lost up to 60% of their equity value between January 2 and March 25, 2020, as documented in Figure 1.

[Table V about here]

Existing research provides a duration-based explanation for the importance of cash-flow risk of value stocks (Lettau, Ludvigson, and Wachter, 2008; Lettau and Wachter, 2007). This explanation is based on two observations. First, growth stocks pay off more of their cash flows in distant future and have higher cash-flow duration than value stocks. Second, the term structure of equity is downward sloping (Van Binsbergen and Koijen, 2017; Van Binsbergen, Hueskes, Koijen, and Vrugt, 2013; Van Binsbergen, Brandt, and Koijen, 2012). As a result, value stocks' returns covary more with cash-flow shocks.

Weber (2018) documents a relatively high return premium earned by short-duration firms. This premium is strongly time-varying. Weber (2018) proposes that investors sentiment and mispricing may help explain this premium. In this paper, I provide an alternative explanation for this short-duration premium, the cash-flow risk factor. I show that firms with low duration exhibit high cash-flow risk, which becomes priced and correlated with returns during downturns.

The timing of cash flows may become particularly important for investors in times of financial distress. During financial crises, firms with front-loaded dividends are likely to suffer more as investors are aware of the fact that the current drop in cash-flows is unlikely to be substituted by higher income in future (when the financial crisis is over). The total losses due to financial distress, measured as the proportion of the total long-term investment income are, thus, more substantial among low-duration assets. Investors may, consequently, sell assets with lower duration during market downturns, which will further decrease their firm valuation.

Next, I analyze industry-level financial ratios (other than the BM ratio or duration of cash flows) for the Fama French 30 industries using data from 1970 to 2019 and find that the forward long-term price-to-earning to growth ratio (PEG) is negatively associated with industry cash-flow risk. The forward long-term PEG explains 25% of the industry variation in cash-flow risk, see Figure 13. When PEG is high, investors expect high earnings growth in future (or the stock is overpriced). Forward-looking long-term PEG is based on future earnings estimates. When investors estimate high future earnings, it's highly likely that they also believe in higher dividend payments. PEG can, thus, be considered as another measure of cash-flow duration as high PEG firms have lower expected investment cash-flow growth rates.

[**Table VI about here**]

But why do investors value cash flows more during market downturns? Liquidity concerns and leverage might help answer this question. Ramelli and Wagner (2020) show that investors became increasingly concerned about potential tightening of financial constraints during the COVID-19 pandemic. They demonstrate that changes in corporate cash holdings were able to explain the cross section of stock returns during the pandemic but not before. Moreover, Fahlenbrach, Rageth, and Stulz (2020) show that firms with less financial flexibility experience lower returns until March 23 and benefit more from the government intervention news on March 25.

I find that firms with a high cash-flow risk have relatively higher average payables turnover ratios. The payables turnover ratio explains around 10% of the cross section of long-run industry cash-flow risk. These findings imply that for firms with high cash-flow risk, cash flows may be relatively more important as they have high annual purchases relative to average accounts payables. High total purchases can result from high cost of sales or a high annual changes in inventory. Firms that have stocked up and have high inventory, may be more struggling to sell their products during crises and may, thus, become more exposed to business cycle shocks, which would increase their cash-flow risk. The ability to continue selling firm products is then particularly important during crises when financial constraints become binding and it becomes more difficult for firms to raise external cash.

In summary, I conclude that the industry long-run cash-flow risk is correlated with the industry-specific book-to-market ratio, long-term average annual dividend growth, forward price-to-earnings to long-term growth (PEG) ratio, and the average payables turnover ratio that measures short-term illiquidity.

VI. Similarities with the 2008-2009 Global Financial Crisis

We have experienced another major financial downturn after the investment bank Lehman Brothers collapsed in September 2008. This collapse led to a global financial crisis (GFC) that affected most countries worldwide. I examine whether the industry long-term heterogeneous cash-flow risk also predicted which industries suffered the most during the first months of the GFC. If the same industries are found to perform badly, relative to the market or other industries, we may infer some commonalities in how certain types of industries with heterogeneous cash-flow risks may react to future economic crises.

I find that firms in the 'Steel Works', 'Coal', 'Chemicals' and 'Fabricated Products' exhibited the lowest average daily returns between August 1, 2008 and December 31, 2008. The difference between the lowest average excess return of -0.8% ('Meals') and the highest average daily excess return of -0.05% is -0.75% on the daily basis, or -189% per annum. Similarly to the industry reaction to the COVID-19 pandemic, we observe that the industry reaction to the GFC in the first few months after the Lehman Brothers collapsed was heterogeneous.

During the first few months of the GFC, when the financial collapse was the most dramatic (and fast), industries with high cash-flow risk exhibited the lowest excess returns, highest CAPM βs, and the highest return volatility, see Figure 14. These results are very strikingly similar to the industry reaction to COVID-19 crisis.

[**Figure 14 about here**]

[**Table VII about here**]

During both crises studies in this paper, 'Steel Works' performed among the worst during the first months of the financial turmoil. One of the most important results, displayed in Figure 14, shows that the industry variation in average daily excess returns during the first few months after the collapse of Lehman brothers is negatively related with the industry-level long-term cash-flow risk, which is consistent with COVID-19 pandemic period.

[**Table VIII about here**]

I run the same regression tests as in Section III and find that 32% of the industry variation in average daily excess returns observed between August 1 and December 31, 2008, is explained using a single variable, the long-run industry cash-flow risk.[5] Unlike during the COVID-19 pandemic, industry long-rum cash-flow risk does not explain the observed variation in risk-adjusted returns. Results from other return and risk measures examined here are, however, similar in terms of quantity and signs when the COVID-19 outbreak results are compared with the GFC. The regression results covering the GFC period are summarized in Table VIII.

VII. Conclusion

The COVID-19 pandemic has caused a unique exogeneous shock to aggregate consumption. I use this event to analyze the role of cash-flow risk in driving changes in asset prices during downturns. The long-run cash-flow risk, estimated well ahead the first coronavirus symptoms were observed in China, explains much of the industry variation in average excess returns, systematic risk, risk-adjusted returns and return volatility in the period between January 1, 2020 to March 25, 2020.

I explain this conditional importance of cash-flow risk for investors during the COVID-19 pandemic using the implied forward equity yields. In mid-March 2020, the equity term structure inverted and market expectations about dividend growth decreased substantially for short-term maturities. The pandemic and subsequent lockdowns made investors worried about dividend income, which cause the equity term structure to invert and cash-flow risk became priced in the cross section of industry excess returns. Cash-flow risk matters to

[5]In this section, the industry-level cash-flow risk estimated using data from 1929-2007 to use only such information that was available from to the GFC.

investors mainly in the presence of large negative economic shocks as during normal times, firms are able to provide stable dividend payments and investors worry less (or not at all) about shocks to dividend income.

I show that there are striking similarities in the ability of long-term cash-flow risk to predict performance of industries during the GFC and the current COVID-19 pandemic. While the unconditional relation between long-run cash-flow risk and long-run return performance may well be modest and indeed insignificant, the conditional relation between long-run cash-flow risk and subsequent returns is found to be particularly pronounced. This paper provides evidence suggesting that cash-flow risk as an important contributor to conditional performance and conditional risk levels during market downturns.

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Figures

Total cumulative return for selected industries (January 1 - June 2, 2020)

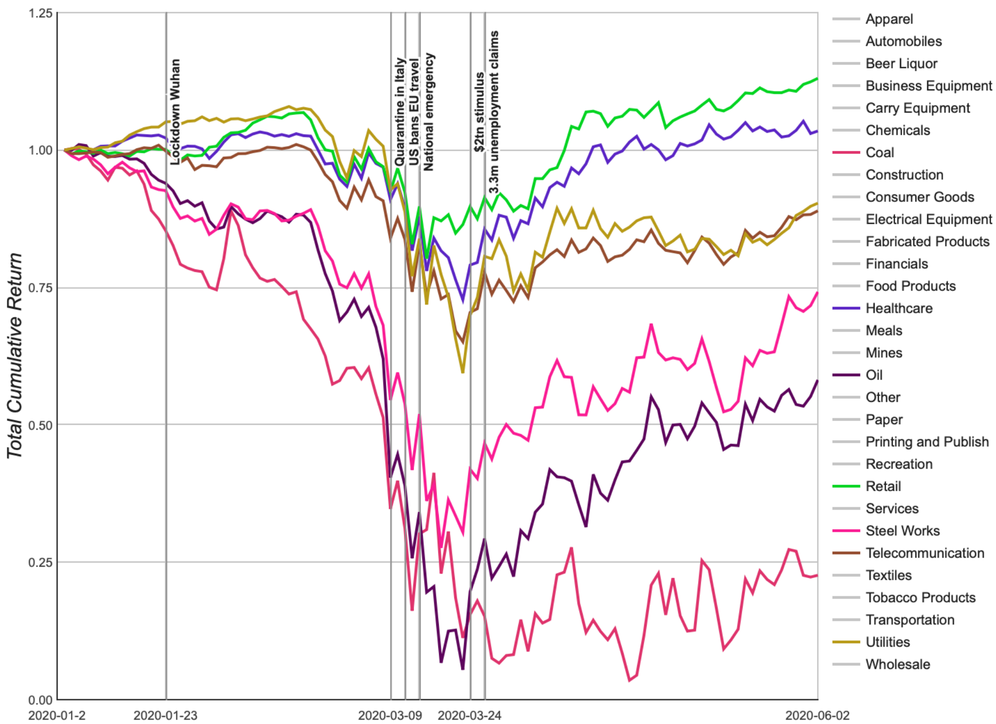


Figure 1: This figure displays the total cumulative return for selected industries with high cash-flow risk ('Steel Works', 'Coal' and 'Oil') and low cash-flow risk ('Telecommunication', 'Utilities', 'Retail' and 'Healthcare') observed between January 2, 2020 and June 2, 2020.

Long-term industry cash-flow risk (1929-2018)

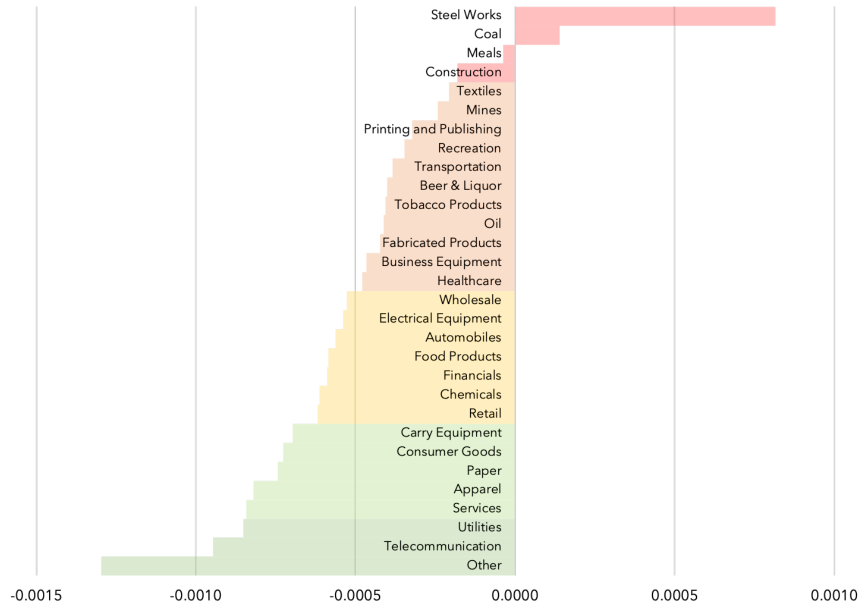
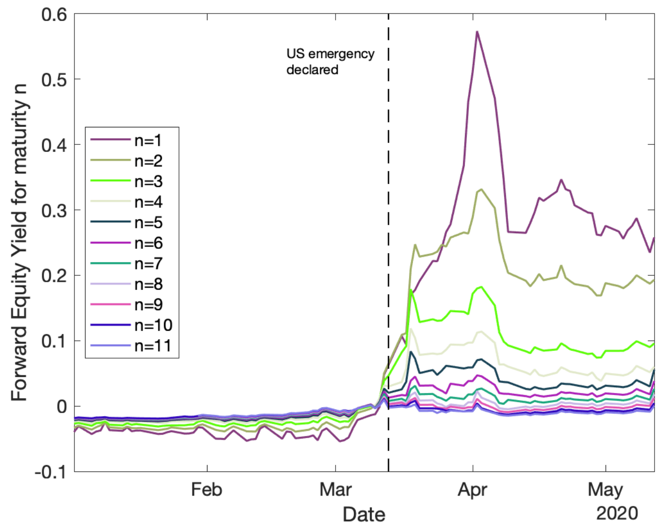
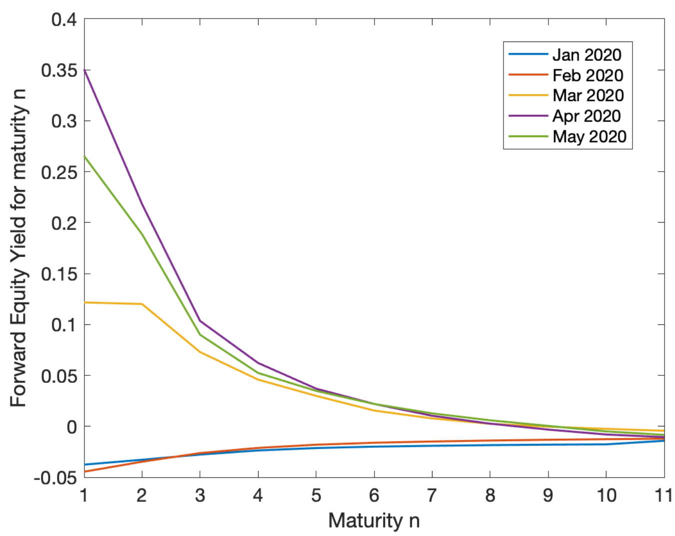


Figure 2: This figure displays the Menzly, Santos, and Veronesi (2004) unconditional long-run level of cash-flow risk measured using data from 1929 to 2018 for Fama French 30 industries. The industry cash-flow risk is estimated using annual data as the covariance between aggregate consumption growth and dividend share growth, see equation (1).

Term structure of equity premia before and during the COVID-19 pandemic



(a) Equity term structure in 2020



(b) Equity term structure as a function of maturity n

Figure 3: This figure displays the implied term structure of equity premia estimated using forward equity yields ($e^f_{t,n}$) computed based on CME S&P500 dividend futures price data between January 1, 2020 and May 12, 2020. Panel (a) shows the development of $e^f_{t,n}$ for all dividend futures maturities traded on CME in 2020. Panel (b) displays the implied term structure of the forward equity yield as a function of maturity n.

Long-term average Monthly Excess Returns & Cash-flow risk (1929-2018)

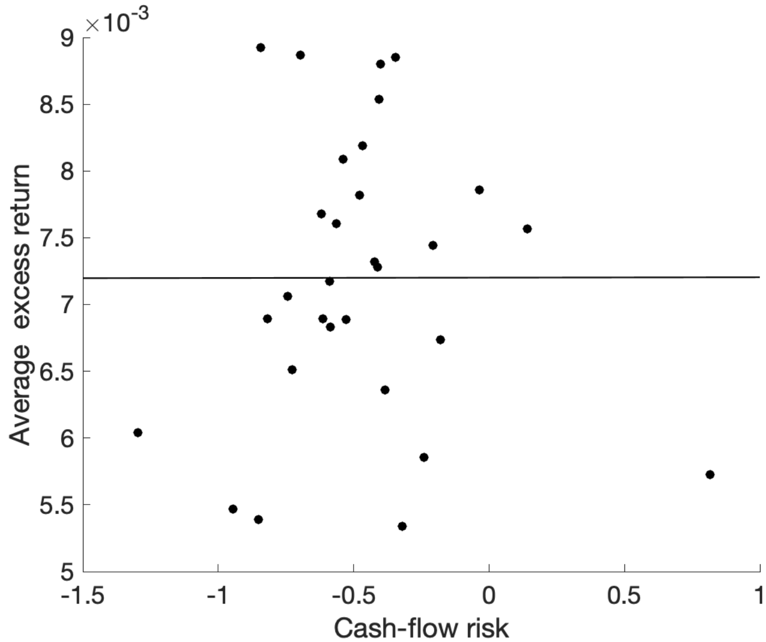


Figure 4: This figure displays the relation between the long-term (unconditional) monthly average excess returns and cash-flow risk measured using data from 1929 to 2018 for Fama French 30 industries.

Average Daily Excess Returns during the COVID-19 Crisis

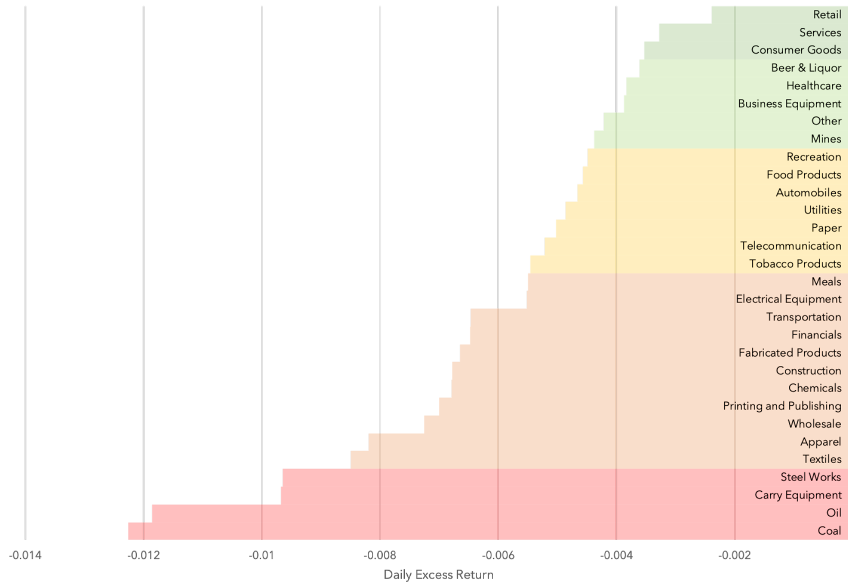


Figure 5: This figure displays the average daily excess returns observed between January 2, 2020 and March 25, 2020, for all Fama French 30 Industries sorted from the highest to its lowest value.

Cash-flow risk and Average Excess Returns during the COVID-19 pandemic

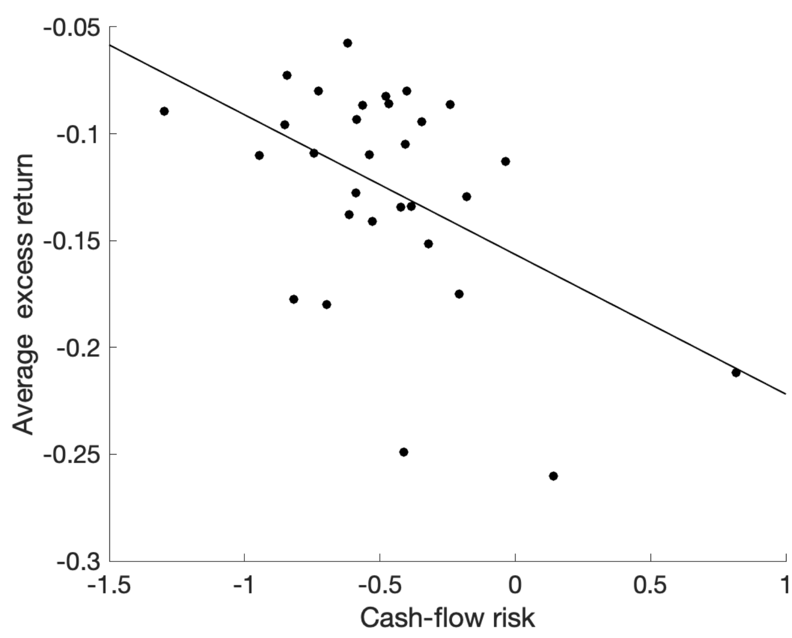


Figure 6: This figure illustrates the relation between the long-term level of cash-flow risk and average daily excess returns observed between January 2, 2020 to March 25, 2020, for Fama French 30 Industry portfolios.

CAPM β during the COVID-19 Crisis

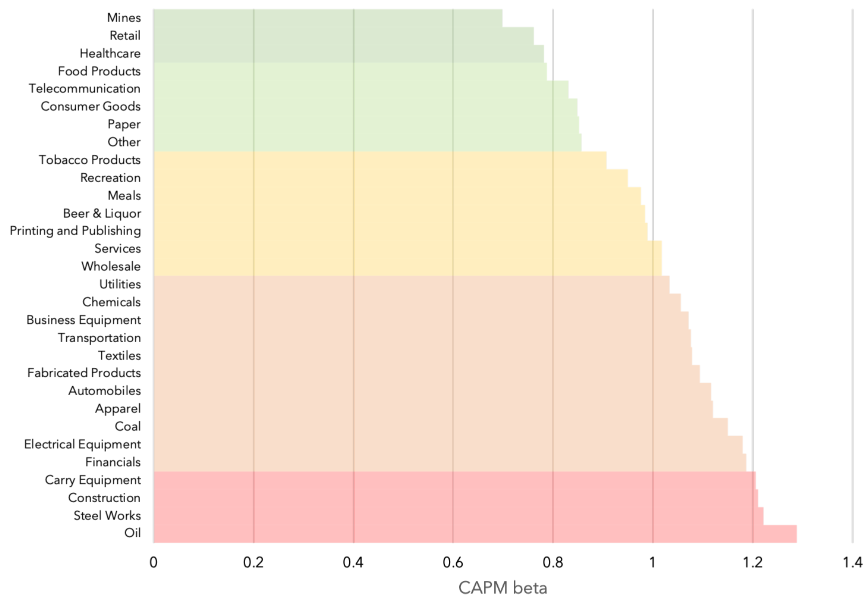


Figure 7: This figure displays the industry CAPM β estimated using daily return data observed between January 2, 2020 and March 25, 2020, for all Fama French 30 Industries, sorted from the lowest to its highest value.

Cash-flow risk and CAPM β

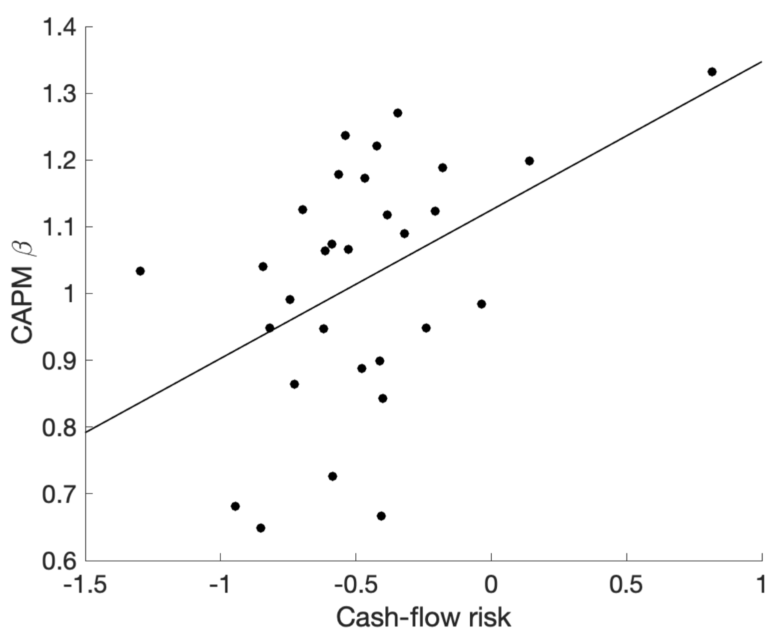


Figure 8: This figure illustrates the relation between the long-term level of cash-flow risk and CAPM β (measured using daily return data from January 2, 2020 to March 25, 2020) for Fama French 30 Industry portfolios.

Daily Risk-adjusted Returns (α) during the COVID-19 Crisis

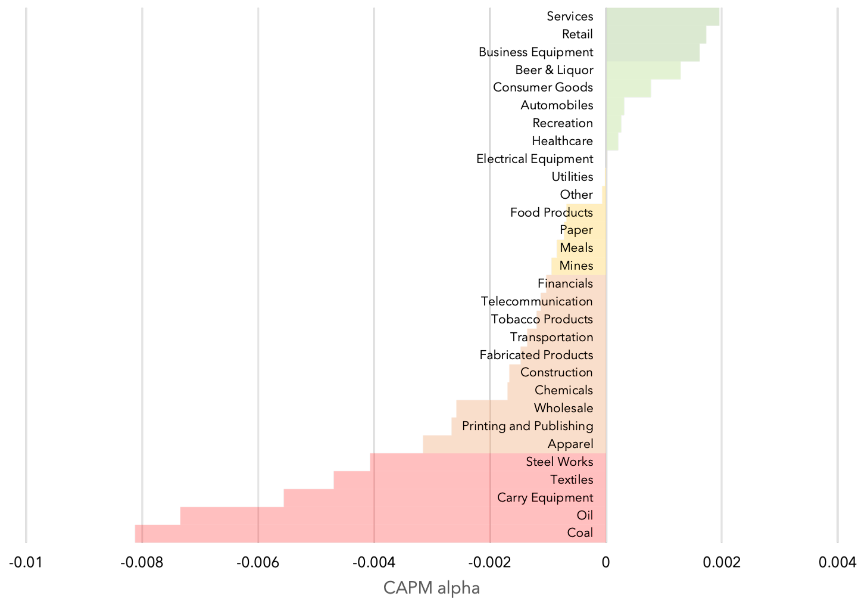


Figure 9: This figure displays the average daily risk-adjusted returns (α) estimated using daily return data observed between January 2, 2020 and March 25, 2020, for all Fama French 30 Industries, sorted from the lowest to its highest value.

Cash-flow risk and risk-adjusted returns (CAPM α)

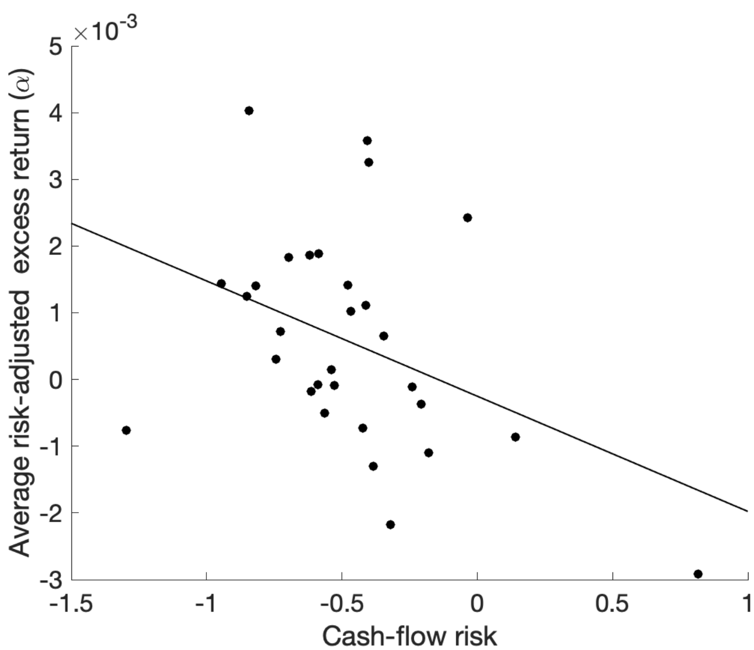


Figure 10: This figure illustrates the relation between the long-term level of cash-flow risk and risk-adjusted returns (measured using daily return data from January 2, 2020 to March 25, 2020) for Fama French 30 Industry portfolios.

Excess Return Volatility during the COVID-19 Crisis

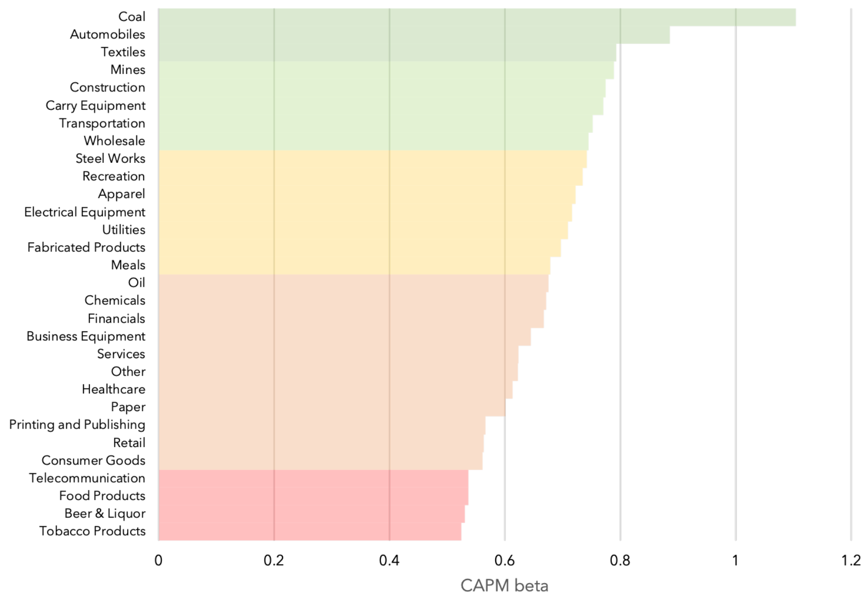


Figure 11: This figure displays the industry return volatility estimated using daily return data observed between January 2, 2020 and March 25, 2020, for all Fama French 30 Industries, sorted from the lowest to its highest value.

Cash-flow risk and Return Volatility

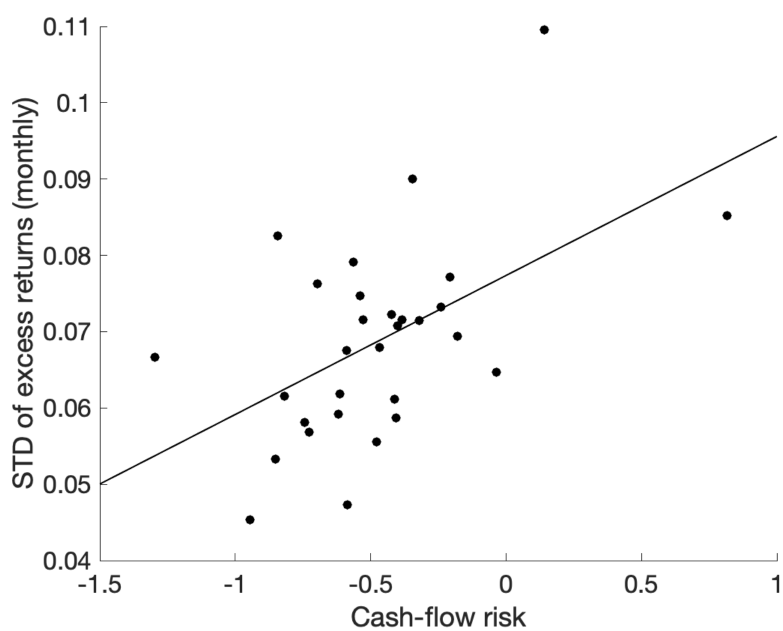
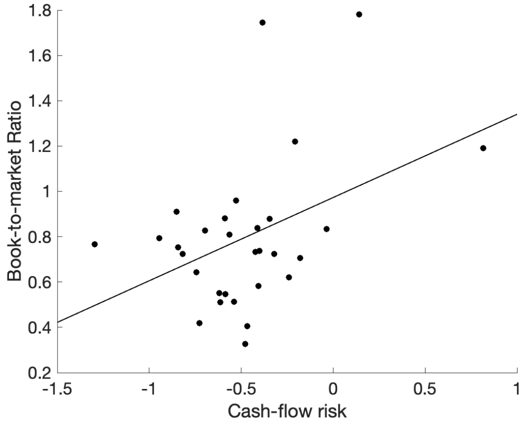
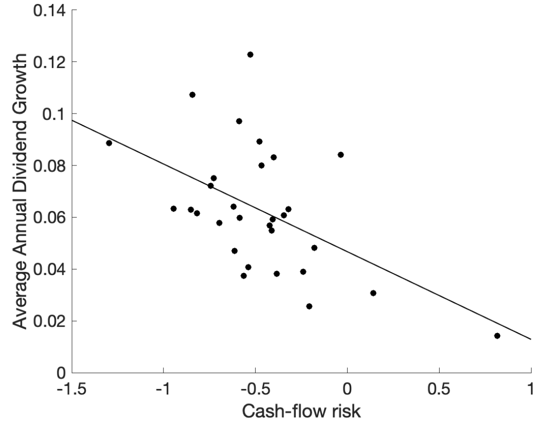


Figure 12: This figure illustrates the relation between the long-term level of cash-flow risk and return volatility (measured using daily return data from January 2, 2020 to March 25, 2020) for Fama French 30 Industry portfolios.

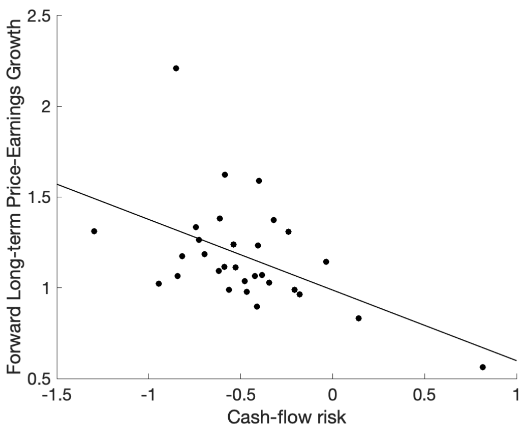
Cash-flow risk and Industry Characteristics (1929-2018)



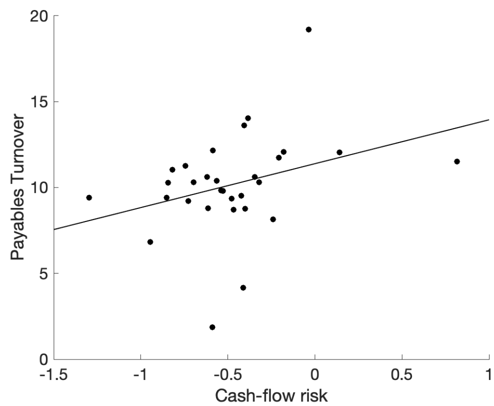
(a) Book-to-market Ratio



(b) Annual Dividend Growth



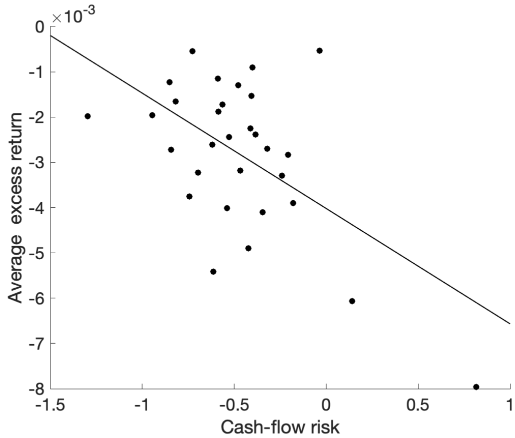
(c) Forward Long-term Price-Earnings Growth



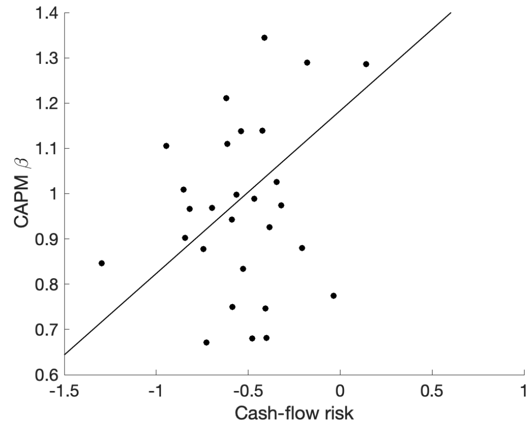
(d) Short-term Illiquidity

Figure 13: This figure illustrates the relation between the long-term level of cash-flow risk and the average book-to-market ratio in panel (a), annual dividend growth in panel (b), forward long-term price-earnings to growth ratio in panel (c), short-term illiquidity measured using payables turnover in panel (d), for Fama French 30 Industry portfolios, computed using data from 1929-2018.

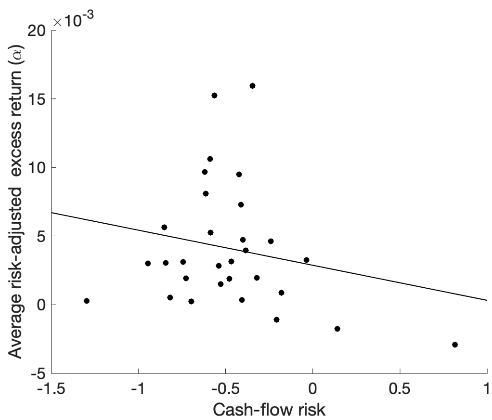
Cash-flow risk and Industry Performance during the 2008-2009 Global Financial Crisis



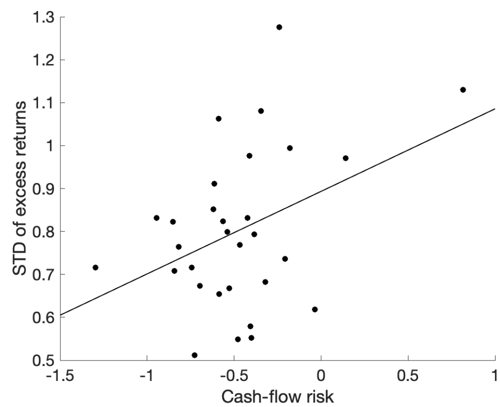
(a) Excess Returns



(b) CAPM β



(c) Risk-Adjusted Excess Returns



(d) Return Volatility

Figure 14: This figure illustrates the relation between the long-term level of cash-flow risk and average daily excess returns in panel (a), CAPM βs in panel (b), average daily risk-adjusted excess returns (CAPM α) in panel (c), and return volatility in panel (d), as measured using daily return data from August 1, 2008 and December 31, 2008, for Fama French 30 Industry portfolios. Industry cash-flow risk is measured using annual data between 1929-2007.

Tables

Performance of FF30 Industries during the COVID-19 Crisis

Table I: This table reports the value-weighted average daily excess returns (*Ret*), CAPM βs, average daily risk-adjusted returns (CAPM α) and return volatility (Vol) measured using the standard deviation of daily excess returns, for the Fama French 30 industries (FF30) observed between January 1, 2020 and March 25, 2020. Average excess returns, CAPM βs and risk-adjusted returns (CAPM α) are estimated using daily data observed from January 1, 2020 to March 25, 2020.

FF30 Industry	*Ret*	CAPM β	CAPM α	Vol
Apparel	-0.0082	1.1198	-0.0032	0.7410
Automobiles	-0.0047	1.1167	0.0003	0.8843
Beer & Liquor	-0.0036	0.9847	0.0013	0.6057
Business Equipment	-0.0039	1.0712	0.0016	0.6668
Carry Equipment	-0.0097	1.2067	-0.0056	0.7293
Chemicals	-0.0068	1.0554	-0.0017	0.6670
Coal	-0.0123	1.1497	-0.0081	1.1226
Construction	-0.0068	1.2114	-0.0017	0.7673
Consumer Goods	-0.0035	0.8490	0.0008	0.5859
Electrical Equipment	-0.0055	1.1804	0.0000	0.7687
Fabricated Products	-0.0066	1.0947	-0.0015	0.6966
Financials	-0.0065	1.1871	-0.0010	0.7157
Food Products	-0.0046	0.7881	-0.0007	0.5535
Healthcare	-0.0038	0.7816	0.0002	0.6264
Meals	-0.0055	0.9757	-0.0009	0.6823
Mines	-0.0044	0.6987	-0.0009	0.7646
Oil	-0.0119	1.2878	-0.0073	0.8653
Other	-0.0042	0.8574	-0.0001	0.5923
Paper	-0.0050	0.8527	-0.0007	0.6026
Printing and Publishing	-0.0070	0.9891	-0.0027	0.7423
Recreation	-0.0045	0.9495	0.0003	0.7358
Retail	-0.0024	0.7618	0.0017	0.5624
Services	-0.0033	1.0175	0.0020	0.6373
Steel Works	-0.0096	1.2216	-0.0041	0.7735
Telecommunication	-0.0052	0.8306	-0.0011	0.5751
Textiles	-0.0085	1.0788	-0.0047	0.7885
Tobacco Products	-0.0055	0.9073	-0.0012	0.5532
Transportation	-0.0065	1.0764	-0.0014	0.7632
Utilities	-0.0049	1.0328	0.0000	0.7074
Wholesale	-0.0073	1.0183	-0.0026	0.7294

Long-term Cash-flow risk: FF30 Industries (Sorted)

Table II: This table reports the unconditional levels of cash-flow risk for the Fama French 30 industries (FF30) measured using annual data from 1929 to 2018, sorted from the highest to the lowest level.

FF30 Industry	CF risk (x1000)
Steel Works	0.816
Coal	0.140
Meals	-0.036
Construction	-0.181
Textiles	-0.206
Mines	-0.241
Printing and Publishing	-0.321
Recreation	-0.346
Transportation	-0.384
Beer & Liquor	-0.400
Tobacco Products	-0.406
Oil	-0.412
Fabricated Products	-0.423
Business Equipment	-0.466
Healthcare	-0.478
Wholesale	-0.527
Electrical Equipment	-0.539
Automobiles	-0.563
Food Products	-0.585
Financials	-0.588
Chemicals	-0.613
Retail	-0.619
Carry Equipment	-0.696
Consumer Goods	-0.727
Paper	-0.743
Apparel	-0.819
Services	-0.842
Utilities	-0.850
Telecommunication	-0.946
Other	-1.297

COVID-19 Pandemic: Regression Results

Table III: This table presents the regression coefficient estimates and t-statistics in parenthesis. The industry-level average daily excess returns (Ret), CAPM βs, risk-adjusted returns (CAPM α), and return volatility are regressed against the industry long-run cash-flow risk (CF risk). Panel A (B) reports OLS (Quantile) regression results. Average daily excess returns (Ret), CAPM βs, risk-adjusted returns (CAPM α), and return volatility (Vol) are measured using daily data observed between January 2 and March 25, 2020. CF risk for Fama French 30 industries is measured using data from 1929 to 2018. ***,**,* represents statistical significance at 1%, 5% and 10% level, respectively.

Panel A: OLS Regressions

	Jan 2 to Mar 25, 2020			
	Ret	CAPM β	CAPM α	Vol
CF risk	-2.998***	140.433*	-2.753***	155.829***
	-[2.741]	[1.890]	-[2.407]	[2.991]
Intercept	-0.007	1.079	-0.003	0.781
	-[11.374]	[24.096]	-[3.978]	[24.885]
R^2	21.16%	11.31%	17.15%	24.21%

Panel B: Quantile Regressions

	Jan 2 to Mar 25, 2020			
	Ret	CAPM β	CAPM α	Vol
CF risk	-2.872***	159.834*	-2.355*	150.818*
	-[2.575]	[1.702]	-[1.843]	[1.902]
Intercept	-0.007	1.108	-0.002	0.788
	-[9.830]	[19.255]	-[3.522]	[18.611]

COVID-19 Pandemic: The Importance of Cash-flow Risk in Sub-Periods

Table IV: This table presents the regression coefficient estimates and t-statistics in parenthesis. The industry-level average daily excess returns (Ret), CAPM βs, risk-adjusted returns (CAPM α), and return volatility are regressed against the industry long-run cash-flow risk (CF risk). Panel A (B) reports OLS (Quantile) regression results. Average daily excess returns (Ret), CAPM βs, risk-adjusted returns (CAPM α), and return volatility (Vol) are measured using daily data observed in the following sub-periods for Fama French 30 industries: January 2 to January 31, 2020; February 1 - February 28, 2020; March 1 - March 25, 2020 and March 26, 2020 to April 27, 2020. CF risk for Fama French 30 industries is measured using data from 1929 to 2018. ***,**,* represents statistical significance at 1%, 5% and 10% level, respectively.

Panel A: OLS Regressions

	Early Signs of COVID-19: Jan 2 to Jan 31, 2020				Outbreak Period: Feb 1 to Feb 28, 2020				Turbulent Period: Mar 1 to March 25, 2020				Post-Stimulus Period: Mar 26 to Apr 27, 2020			
	Ret	β	α	Vol	Ret	β	CAPM α	Vol	Ret	β	α	Vol	Ret	β	α	Vol
CF risk	-4.481***	346.062*	-4.569***	118.397***	-0.786	346.062*	-4.569	138.013**	-4.839	173.944***	-1.353	316.507***	-0.573	173.944	-1.353	162.339*
	-[3.803]	[1.934]	-[3.579]	[3.399]	-[0.934]	[1.934]	-[1.274]	[2.160]	-[1.540]	[2.242]	-[0.558]	[3.036]	-[0.282]	-[1.366]	-[0.558]	[1.662]
Intercept	-0.004	1.044	-0.003	0.315	-0.005	1.044	-0.001	0.464	-0.015	1.094	-0.005	1.424	0.005	1.094	-0.005	0.792
	-[5.357]	[9.686]	-[4.302]	[15.006]	-[10.599]	[9.686]	-[1.486]	[12.054]	-[8.172]	[23.414]	-[3.139]	[22.672]	[4.381]	[23.414]	-[3.139]	[13.465]
R^2	34.06%	11.79%	31.39%	29.21%	3.02%	11.79%	5.48%	14.28%	7.81%	15.22%	1.10%	24.76%	0.28%	15.22%	1.10%	8.98%

Panel B: Quantile Regressions

	Early Signs of COVID-19: Jan 2 to Jan 31, 2020				Outbreak Period: Feb 1 to Feb 28, 2020				Turbulent Period: Mar 1 to March 25, 2020				Post-Stimulus Period: Mar 26 to Apr 27, 2020			
	Ret	β	α	Vol	Ret	β	CAPM α	Vol	Ret	β	α	Vol	Ret	β	α	Vol
CF risk	-4.080***	629.185***	-4.634***	144.836***	-0.677	629.185***	-0.415	125.487*	-4.288	159.834	-0.507	237.660	0.916	159.834	-0.507	165.906
	-[2.255]	[2.436]	-[2.234]	[2.527]	-[0.646]	[2.538]	-[0.432]	[1.959]	-[1.218]	[1.566]	-[0.165]	[1.434]	[0.443]	[1.369]	-[0.180]	[1.173]
Intercept	-0.004	1.112	-0.003	0.328	-0.005	1.112	0.000	0.437	-0.015	1.127	-0.004	1.361	0.006	1.127	-0.004	0.781
	-[2.255]	[6.955]	-[2.911]	[7.952]	-[7.570]	[7.088]	-[0.220]	[11.224]	-[6.444]	[16.154]	-[1.931]	[14.828]	[5.339]	[16.089]	-[2.353]	[1.173]

Industry Characteristics (Unconditional Levels: 1929-2018)

Table V: This table reports the long-run levels of the cash-flow risk (CF risk), average firm size, average book-to-market ratio (BM), average annual dividend growth (div_g), average forward long-term price-earnings growth (peg^f) and the average payables turnover (Pay Turn) for the Fama French 30 industries (FF30) measured using data from 1929 to 2018.

FF30 Industry	CF risk (x1000)	Firm Size (in $1000)	BM	div_g	peg^f	Pay Turn
Automobiles	-0.563	1141.003	0.809	0.037	0.989	10.387
Beer & Liquor	-0.400	5459.113	0.737	0.083	1.589	8.768
Printing and Publish	-0.321	568.561	0.725	0.063	1.374	10.299
Business Equipment	-0.466	1239.115	0.406	0.080	0.979	8.701
Carry Equipment	-0.696	2377.222	0.827	0.058	1.186	10.299
Chemicals	-0.613	1290.100	0.511	0.047	1.382	8.791
Apparel	-0.819	836.875	0.723	0.061	1.176	11.041
Construction	-0.181	448.423	0.706	0.048	0.965	12.084
Coal	0.140	632.401	1.781	0.031	0.833	12.046
Electrical Equipment	-0.539	723.142	0.512	0.041	1.238	9.843
Fabricated Products	-0.423	739.226	0.734	0.057	1.066	9.533
Financials	-0.588	966.165	0.881	0.097	1.115	1.869
Food Products	-0.585	1662.112	0.546	0.060	1.623	12.152
Recreation	-0.346	644.017	0.878	0.061	1.028	10.610
Healthcare	-0.478	1006.254	0.326	0.089	1.037	9.366
Consumer Goods	-0.727	1894.828	0.420	0.075	1.264	9.219
Meals	-0.036	872.740	0.835	0.084	1.144	19.210
Mines	-0.241	820.888	0.620	0.039	1.310	8.136
Oil	-0.412	2143.509	0.839	0.055	0.897	4.173
Other	-1.297	1786.454	0.767	0.089	1.311	9.424
Paper	-0.743	1275.956	0.644	0.072	1.334	11.258
Retail	-0.619	1692.423	0.550	0.064	1.095	10.623
Services	-0.842	998.490	0.753	0.107	1.066	10.274
Tobacco Products	-0.406	11279.620	0.584	0.059	1.233	13.613
Steel Works	0.816	553.436	1.190	0.014	0.562	11.504
Telecommunication	-0.946	3217.059	0.794	0.063	1.023	6.842
Transportation	-0.384	1174.643	1.744	0.038	1.070	14.050
Textiles	-0.206	395.935	1.221	0.026	0.988	11.744
Utilities	-0.850	1760.479	0.910	0.063	2.209	9.417
Wholesale	-0.527	466.155	0.959	0.123	1.114	9.796

Correlation Analysis: Fama French 30 Industries Financial Ratios

Table VI: This table displays the correlation levels between the median values of selected financial ratios for the Fama French 30 industries, measured using data from 1970 to 2019. I examine the correlation levels between the median level of gross return (Ret), return on equity (ROE), pre-tax profit margin (PM), trailing price-earnings to growth ratio (PEG), forward price-earnings to long-term growth ratio (PEG_f), payables turnover (Pay Turn), operating cash flows to current liabilities ratio (Ocf/Ltc), gross profit to total assets ratio (Prof/AT), effective tax rate (Tax), dividend yield (DY), cash flow to total liabilities ratio (Cash/D), Shillers Cyclically Adjusted P/E Ratio ($PE^{A}dj$), book-to-market ratio, interest to average long-term debt ratio (Int/D), inventory to current assets ratio (Inv/A), receivables to current assets ratio (Rec/A), sales to stockholders equity ratio (Sal/E), receivables turnover (Rec Turn) and long-run cash-flow risk. Financial ratios data comes from the WRDS Financial Ratios Industry Level database.

	Ret	ROE	PM	PEG	PEG_f	Pay Turn	Ocf/Ltc	Prof/AT	Tax	DY	Cash/D	$PE^{A}dj$	BM	Int/D	Inv/A	Rec/A	Sal/E	Rec Turn	CF Risk
# Firms	-0.084	-0.233	-0.063	-0.183	-0.150	-0.491	-0.416	-0.101	0.135	-0.105	-0.588	-0.230	-0.116	0.017	-0.338	-0.097	-0.259	-0.144	-0.142
Ret		0.411	0.296	0.349	0.118	0.197	0.044	0.162	-0.170	0.087	0.089	0.249	-0.294	0.091	0.129	-0.380	0.066	0.330	-0.204
ROE			0.768	0.499	0.258	0.251	0.145	0.332	0.188	0.479	0.411	0.687	0.210	-0.429	0.481	-0.142	0.411	0.271	-0.133
PM				0.571	0.483	-0.088	0.381	-0.155	0.115	0.723	0.282	0.447	0.219	-0.620	0.110	-0.093	-0.161	0.037	-0.151
PE					0.783	0.132	0.226	0.126	-0.017	0.566	0.153	0.469	0.044	-0.634	0.167	-0.082	0.048	0.247	-0.317
PE_f						-0.027	0.225	-0.010	0.217	0.530	0.119	0.316	-0.016	-0.605	0.038	0.031	-0.153	0.025	-0.503
Pay Turn							0.077	0.269	-0.086	-0.099	0.319	0.247	0.059	0.107	0.263	-0.203	0.546	0.551	0.323
Oc/Ltc								-0.408	-0.224	0.283	0.716	0.230	0.151	-0.280	-0.332	0.237	-0.286	0.178	0.063
Prof/AT									0.290	-0.220	0.199	0.179	-0.177	0.168	0.631	-0.358	0.645	0.420	-0.194
Tax										0.072	-0.045	-0.002	-0.115	-0.228	0.150	-0.089	0.028	0.041	-0.317
DY											-0.007	0.107	0.305	-0.533	0.107	0.028	-0.177	-0.047	-0.171
Cash/D												0.458	0.105	-0.173	0.162	0.097	0.152	0.273	0.079
$PE^{A}dj$													0.284	-0.393	0.244	0.255	0.383	0.157	-0.177
BM														-0.330	0.283	0.220	0.279	-0.091	0.325
Int/D															-0.153	-0.076	0.047	0.014	0.022
Inv/A																-0.475	0.641	0.293	0.175
Rec/A																	-0.215	-0.647	-0.225
Sal/E																		0.493	0.089
Rec Turn																			0.126

Performance of FF30 Industries during the first months of 2008-2009 Global Financial Crisis

Table VII: This table reports the value-weighted average excess returns (*Ret*), CAPM βs, risk-adjusted returns (CAPM α) and the return volatility (Vol) measured using the standard deviation of daily excess returns, for the Fama French 30 industries (FF30) observed between August 1, 2008 to December 31, 2008. Average excess returns, CAPM βs and risk-adjusted returns (CAPM α) are estimated using daily data observed from August 1, 2008 to December 31, 2008. Industry cash-flow risk (CF risk) is measured using annual data between 1929-2007.

FF30 Industry	CF risk (x1000)	*Ret*	CAPM β	CAPM α	Vol
Apparel	-0.777	-0.0017	0.9663	0.0005	0.7647
Automobiles	-0.486	-0.0043	1.1512	-0.0016	0.9149
Beer & Liquor	-0.443	-0.0009	0.5271	0.0036	0.4396
Business Equipment	-0.347	-0.0034	0.9155	0.0028	0.7009
Carry Equipment	-0.634	-0.0031	0.9576	-0.0020	0.6569
Chemicals	-0.546	-0.0055	1.1238	-0.0026	0.9039
Coal	0.548	-0.0061	1.2884	-0.0018	0.9700
Construction	-0.218	-0.0026	1.2009	0.0013	0.9359
Consumer Goods	-0.768	-0.0007	0.6678	0.0010	0.5109
Electrical Equipment	-0.486	-0.0033	1.0536	0.0033	0.7993
Fabricated Products	-0.324	-0.0050	1.1440	0.0094	0.8355
Financials	-0.762	-0.0018	1.3065	0.0063	1.0717
Food Products	-0.609	-0.0014	0.6814	0.0020	0.5804
Healthcare	-0.536	-0.0012	0.6860	0.0007	0.5594
Meals	-0.002	-0.0005	0.7682	0.0032	0.6133
Mines	-0.259	-0.0029	1.1475	0.0001	1.1395
Oil	-0.345	-0.0025	1.2772	0.0005	0.8774
Other	-1.469	-0.0020	0.8463	0.0003	0.7162
Paper	-0.773	-0.0021	0.7946	0.0044	0.6212
Printing and Publishing	-0.317	-0.0031	0.9737	0.0016	0.7869
Recreation	-0.298	-0.0043	1.0749	0.0058	1.0496
Retail	-0.623	-0.0008	0.7706	0.0105	0.6291
Services	-0.862	-0.0028	0.8966	0.0011	0.6921
Steel Works	1.025	-0.0061	1.6331	-0.0014	1.0740
Telecommunication	-0.906	-0.0011	0.9795	0.0048	0.7459
Textiles	-0.101	-0.0028	0.8805	-0.0011	0.7362
Tobacco Products	-0.358	-0.0011	0.6857	0.0006	0.5168
Transportation	-0.309	-0.0024	0.8551	0.0073	0.6932
Utilities	-0.903	-0.0016	0.8594	0.0006	0.6583
Wholesale	-0.508	-0.0024	0.8278	0.0014	0.6605

2008-2009 Global Financial Crisis: Regression Results

Table VIII: This table presents the regression coefficient estimates and t-statistics in parenthesis. The industry-level average daily excess returns (Ret), CAPM βs, risk-adjusted returns (CAPM α), and return volatility are regressed against the industry long-run cash-flow risk (CF risk). Panel A (B) reports OLS (Quantile) regression results. Average daily excess returns (Ret), CAPM βs, risk-adjusted returns (CAPM α), and return volatility (Vol) are measured using daily data observed between August 1, 2008 to December 31, 2008. Cash-flow risk for Fama French 30 industries is measured using data from 1929 to 2007. ***,**,* represent statistical significance at 1%, 5% and 10% level, respectively.

Panel A: OLS Regressions

	Ret	CAPM β	CAPM α	STD(Ret)
CF Risk	-1.971***	278.394***	-1.336	165.259***
	-[3.619]	[3.238]	-[0.984]	[2.352]
Intercept	-0.004	1.089	0.001	0.836
	-[10.320]	[20.188]	[1.744]	[18.950]
R^2	31.87%	27.25%	3.34%	16.50%

Panel B: Quantile Regressions

	Ret	CAPM β	CAPM α	STD(Ret)
CF Risk	-2.831***	188.151	-1.372	244.690***
	-[2.313]	[1.045]	-[0.463]	[2.091]
Intercept	-0.004	1.090	0.002	0.931
	-[5.818]	[9.402]	[1.243]	[11.717]