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Investors' risk attitudes in the pandemic and the stock market: new evidence based on internet searches

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Investors' risk attitudes in the pandemic and the stock market: new evidence based on internet searches

Key takeaways

- *The sharp drop and subsequent rebound in global stock markets in the current pandemic focuses attention on changes in investors' risk attitudes.*
- *A new Covid-19 risk attitude (CRA) index for 61 markets, based on internet searches in Google and Baidu, does a good job at capturing investors' attitudes toward pandemic-related risks.*
- *Stock markets are more sensitive to changes in the CRA index in more financially developed economies. Stock markets are less sensitive in jurisdictions that have restricted mobility less and that have enacted other containment measures against the pandemic.*

1. Introduction

The Covid-19 crisis has left a deep mark on stock markets, with a fall in prices similar to those experienced during the Great Depression in 1929, and a subsequent rebound. The observed equity price reaction relates to changes in traditional drivers such as relative price shifts and risk aversion measures, but it could also reflect changes in investors' attitude towards risk in the pandemic.¹ The aim of this Bulletin is to use information on internet searches on Google and Baidu to derive a measure of stock market investors' concerns about the pandemic and to assess how such a measure could explain the sharp drop and subsequent rebound in stock markets. We focus on the initial period of the Covid-19 pandemic, covering up to end-April 2020.

The role of investors' risk attitude could be particularly relevant in a time of sudden large shocks and when fundamental drivers suffer from higher uncertainty. The US Economic Policy Uncertainty index has peaked in April 2020 at levels more than twice as high as previous records (Baker et al (2020)). Shiller (2020) even sees Covid-19 as two pandemics – one in the real economy, and the other in the perception of the impact the first one might have. However, while the impact of fundamental drivers on US stock returns during the pandemic has already been studied (Ding et al (2020) and Alfaro et al (2020)), the role of investors' risk attitudes has received less attention.

The analysis in this Bulletin focuses on mid-February to end-April 2020, including an initial period of severe sell-off in global equity markets (until mid-March), as well as a recovery – in some cases by almost

¹ "Risk attitude" is defined as the natural inclination of an investor to evaluate a risk situation in a favourable or unfavourable way and to act accordingly (Rohmann (2002)). It is a generic orientation (as a mindset) towards taking or avoiding a risk when deciding how to proceed in situations with uncertain outcomes. It is different from risk propensity (ie attitude towards taking risks) or risk aversion (ie attitude towards avoiding risks).

half of the previous drop – from then to end-April. We show that traditional drivers of equity markets – such as changes in the value of the US dollar, oil prices, measures of risk aversion – and the unconventional monetary policy measures adopted are not able to fully capture the evolution of stock market prices during this period. To study the evolution of investors’ risk attitude towards the pandemic, we construct for each market a new “Covid-19 risk attitude” (CRA) index, based on the number of internet searches in different markets. The idea is that web searches for terms related to Covid-19 reflect people’s concern about the pandemic and its economic consequences. Interestingly, during the first months of the pandemic the CRA index foreshadowed the actual number of recorded infections globally. This indicates that for investors the economic effects of the pandemic are globally linked and are not confined to the areas directly affected by the virus. From the last week of March until the end of April, a fall in the CRA index reflects a reduction in investors’ concern and goes hand in hand with the recovery in equity prices.

Results indicate that investors’ risk attitude as captured by internet searches played a significant role in most stock markets over and above what is explained by other more traditional drivers. On average, the CRA index explains an additional 6% of the observed equity price variation in the sample period.² In particular, stock markets are more sensitive to changes in the CRA index in more financially developed economies. Markets are less sensitive in those jurisdictions that have restricted mobility by less and have enacted other containment measures against the pandemic.

2. The Covid-19 risk attitude index

“Risk attitude” reflects an investor’s inclination to evaluate the effects of the pandemic. This concept is difficult to measure directly and in a timely fashion. The literature suggests four different types of indices to measure investors’ attitude or sentiment (Baker and Wurgler (2007); Tetlock (2007)). The first type are market-based indices (using eg trading volumes or option-implied volatility). While these indices are easily observable and readily available, they could be conceptually flawed, being the equilibrium outcome rather than reflecting changes in behaviour on the demand side. The second type of indices are survey-based (eg consumer/investor confidence indices). These measures could be able to disentangle supply and demand but lack the daily frequency needed for stock market analysis. The third type are news-based sentiment indices exploring keywords in newspapers. These indices could be a plausible solution to reveal concerns in case of negative shocks but require computational costs to access and evaluate unstructured big data pools, and might not necessarily be comparable across different countries. The fourth type are internet search-based indices (using internet searches such as Google Trends) that are easier to use in the case of a largely unexpected shock as the Covid-19 pandemic. Internet search-based indices might be more forward-looking than news-based indices because people search mainly for terms they are not familiar with and which are sometimes not in the public domain and therefore not widely reported in the news.³

All in all, in the case of a pandemic, internet search-based measures tackle most of the disadvantages of other sentiment indices. They can reveal the risk attitude of consumers or investors directly and without high computational burdens. A popular indicator of this type is the Financial and Economic Attitude Revealed by Search (FEARS) index suggested by Da et al (2015), which aggregates the volume of internet

² A number of amplifiers and institutional frictions could be at play, so this quantification should be considered with caution. A first amplifier could be the effects of de-risking/de-leveraging by risk parity funds (Schrimpf, Shin and Sushko (2020)), that generated forced selling. Another amplifier could be the cascading impact of stop-loss orders, and feedback loops due to dynamic hedging (as in the 1987 stock market crash). A third amplifier could be impaired intermediation due to balance sheet constraints and an evaporation of liquidity as bank and non-bank intermediaries were hit by tighter risk limits. Such factors give rise to non-linearities in stock price movements and lead to asset fire sales.

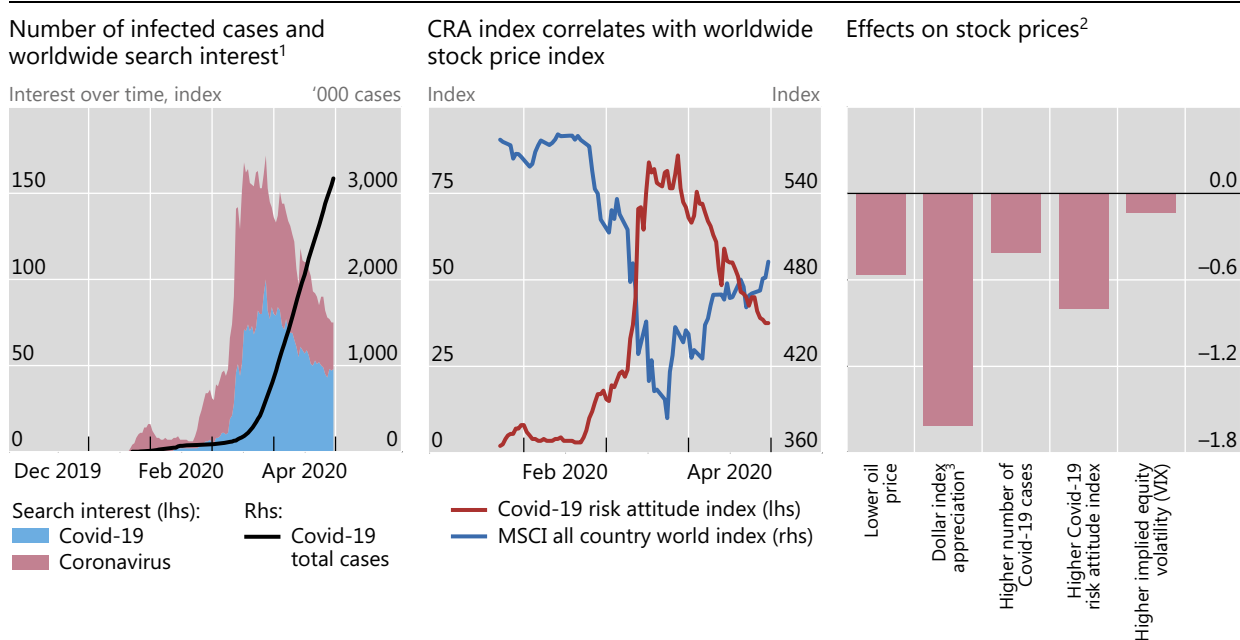
³ As an illustration, the news-based index of the San Francisco Fed (Buckman et al (2020)) only slightly leads the University of Michigan’s Index of Consumer Sentiment and it lags our Covid-19 risk attitude index (see www.frbsf.org/economic-research/indicators-data/daily-news-sentiment-index/).

search queries such as “recession”, “bankruptcy” and “unemployment” from millions of US households. For daily data between 2004 and 2011, FEARS is shown to predict short-term equity return reversal.

Following a similar approach, we construct a Covid-19 risk attitude index for 61 markets by considering the number of internet searches for the keywords “Covid-19” and “coronavirus”, respectively, as provided by Google Trends and Baidu, which is widely used in China. Graph 1 (left-hand panel) reports our CRA index at the global level. It starts on 16 December 2019 and shows more searches for coronavirus from mid-January. After the World Health Organisation officially named the virus “Covid-19” on 11 February, the respective searches rose sharply until both terms reached about equal importance from mid-March onwards. Similar patterns are visible for country-level search indices (not reported). As our keywords are mostly substitutes of each other, we use the simple average of the number of searches for the two to build our Covid-19 risk attitude index (centre panel).

Covid-19 risk attitude index helps to explain stock prices drop and recovery

Graph 1



¹ Data from worldwide Google search queries for the terms “Covid-19” and “coronavirus”. Each series is indexed to 100 by peak search interest. Data accessed on 4 May 2020. ² The bars show the average estimated change in equity prices from a one standard deviation shock in the respective variables. The reported effects are obtained using mean estimators from 61 country models. In particular, we regress the daily equity returns of each market on the fundamentals (oil, USD shortage, number of cases) as well as a risk aversion measure (VIX) and the CRA index. ³ Trade-weighted US dollar index: broad, goods and services.

Sources: Federal Reserve Bank of St Louis, FRED; Bloomberg; Baidu; coronavirus.jhu.edu/map; Datastream; Google Trends; Refinitiv Eikon; worldometers.info; authors’ calculations.

In the early period of the pandemic, our CRA index foreshadows the effective number of Covid-19 infection cases. In particular, the global CRA index leads the worldwide number of recorded Covid-19 infection cases until the last week of March (Graph 1, left-hand panel).⁴ This finding holds for each of the 61 countries. As discussed above, a large number of people started searching for coronavirus and Covid-19 in mid-January, even though the number of cases in most countries was still low. Our CRA index therefore reflects concern about the effects of the pandemic in each country and could be a good leading indicator of its economic effects. The centre panel shows that our CRA index is inversely related to worldwide stock prices (the correlation is -0.98). The CRA index increases in tandem with the initial

⁴ For the period from mid-January to the last week of March, a formal test indicates that the CRA global index Granger causes the overall number of people infected by Covid-19 but not vice versa. For a discussion on how search trend activity could be used to supplement traditional surveillance systems to contain flu, see eg Kandula and Shaman (2019).

substantial drop in equity prices and falls in intensity from the last week of March, with the recovery in the stock markets.

3. Stock market responses to Covid-19

We explore how daily equity returns are affected by traditional drivers and investor risk attitude using linear regression models for 61 countries. Traditional variables used in the regressions include the oil price dynamic, which is relevant to capture the effects on the stock market of (current and future) disruptions in oil agreements experienced in the first quarter of 2020 and the change in the trade-weighted US dollar index, which captures US dollar shortages – particularly relevant in several emerging market economies (Bruno and Shin (2015); Avdjiev, Eren and McGuire (2020)). We also include the actual change in the number of Covid-19 cases in each country and, as a check, the number of global infections. Finally, to control for investors' risk aversion, we also include the VIX (a measure of implied equity volatility) and complement it with our country-specific CRA index to reflect the attitude (or concern) of investors about withstanding the pandemic shock.

3.1 Covid-19 risk attitudes matter in addition to fundamentals

We have simulated how a change in each explanatory variable correlates with stock prices. To make the test comparable, we have imposed the change to be equal to one standard deviation in the respective variables. The results reported in the right-hand panel of Graph 1 show that an appreciation of the dollar has the biggest impact. A one standard deviation increase in the trade-weighted US dollar index is correlated with a 1.61% reduction in equity prices. Meanwhile, a one standard deviation fall in oil prices is on average linked to a 0.57% cent daily reduction in equity prices. These results are statistically significant not only on average for the 61 countries analysed, but also for the vast majority of the countries individually. By contrast, a higher number of infection cases has a very low and no significant effect on daily equity prices. Overall, the above-mentioned variables (represented by the first three histograms in the right-hand panel of Graph 1) explain on average 44% of equity price variation in our country models.

Interestingly, the CRA index explains an additional 6% of equity price variation over the sample period.⁵ This effect is economically relevant. A one standard deviation increase in the CRA index in a given market determines an average daily reduction of 0.80% in stock market prices. The complete model, including the VIX, which measures risk aversion, explains 51% of equity price variability.⁶

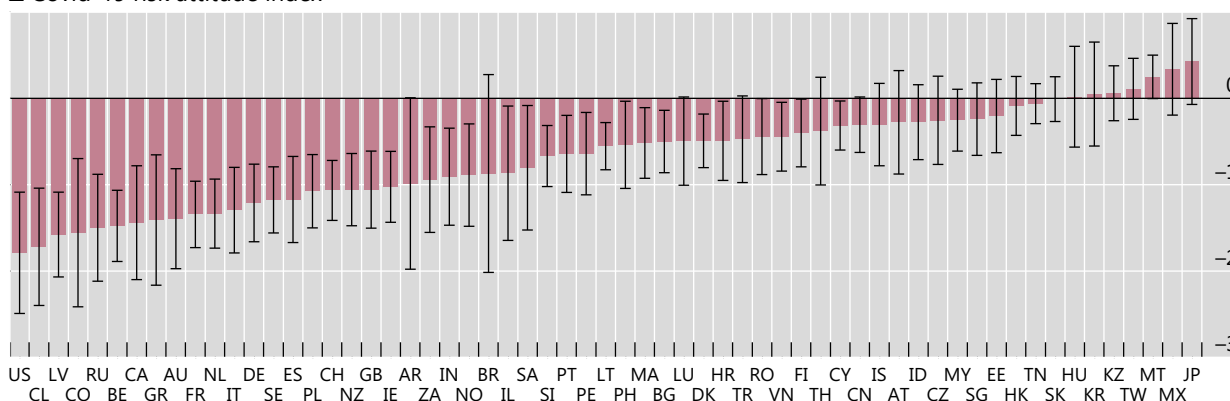
3.2 Differences in investors' attitudes towards the pandemic at the country level

In Graph 2, we further explore the response of national equity markets to changes in the CRA index. More internet searches for coronavirus and Covid-19 correlate significantly with equity prices in more than 60% of the stock markets we study. The impact is more pronounced in America and Europe than in Asian markets. The equity price dynamic of most Asian countries that entered the pandemic earlier and could have had readjustments before, such as China, Indonesia, Korea, Singapore and Japan, are not significantly correlated with the CRA index.

⁵ This result is robust to a number of checks reported in the online appendix: (i) including in the regressions the difference in global Covid-19 cases or using $\Delta(\text{VIX})$ instead of the level of the VIX; (ii) including a dividend future price as a proxy for growth expectations (available for 10 countries); (iii) including the Google mobility measure as an additional explanatory variable (it starts on 15 February 2020 and is available for 55 countries); (iv) including in the model the change in the money market rate and a complete set of dummies that take the value of 1 if an unconventional monetary policy measure has been announced on a specific day (test conducted for 48 countries).

⁶ The explanatory power is quite good even compared with models that use more granular data. For example, the panel model used by Ding et al (2020) for 6,000 firms in 56 countries is able to explain between 46 and 52% of the equity price variation.

Δ Covid-19 risk attitude index



The bars show the estimated change in equity prices after a one standard deviation shock in the Covid-19 risk attitude index.

Sources: Federal Reserve Bank of St Louis, FRED; Bloomberg; Baidu; coronavirus.jhu.edu/map; Datastream; Google Trends; Refinitiv Eikon; worldometers.info; authors' calculations.

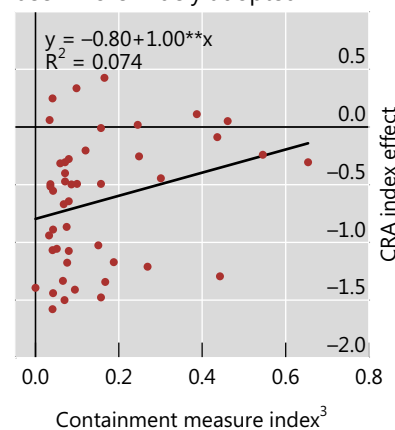
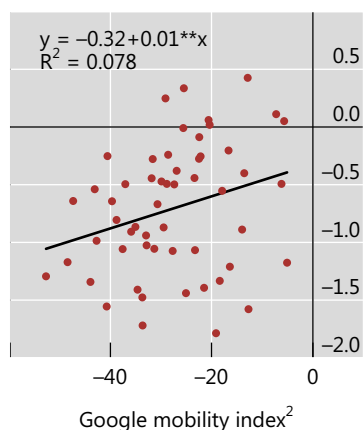
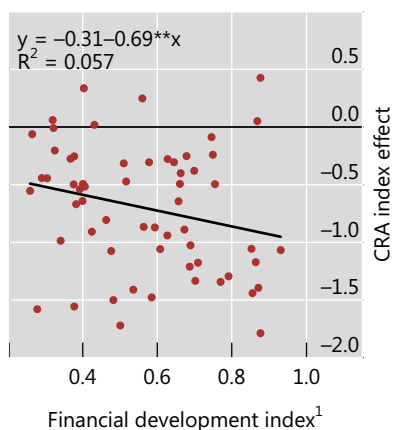
We find that the effect of the CRA index on stock market prices depends on institutional characteristics that affect investors' ability to withstand the pandemic. First, we find that the (negative) CRA effect is larger for more financially developed countries, whose markets are more integrated and efficient and have a broader investor base. The left-hand panel of Graph 3 shows the negative correlation between the country-specific CRA index effect on equity prices and a financial development index (Sviryzdenka (2016)).

Effect of the Covid-19 risk attitude index on stock prices

Higher in more financially developed countries...

...and lower where individual mobility has been restricted less...

...and where other containment measures (excluding mobility) have been more widely adopted



Robust standard errors. ** denotes results significant at the 5% level.

¹ The indicator goes from 0 to 1. ² The index is the simple average of percentage changes in visits to parks, retail and recreation, transit stations and workplaces over the period 15 Feb–30 Apr 2020. ³ The index is the simple average of the number of measures adopted in each country over the period 23 Jan–5 Apr 2020. Containment measures include: activity cancellation, helping people to stay home, healthcare specialisation, miscellaneous hygiene measures, public cleaning, public education and incentives, public interaction and hygiene, and school closure. They do not include measures that imply isolation or other direct limitation to mobility such as travel restrictions.

Sources: Sviryzdenka (2016); Federal Reserve Bank of St Louis, FRED; World Bank; Bloomberg; Baidu; coronavirus.jhu.edu/map; Datastream; epidemicforecasting.org/containment; Google COVID-19 Community Mobility reports; Google Trends; Refinitiv Eikon; worldometers.info; authors' calculations.

Second, we find that sensitivity to the CRA index is larger in countries that experienced a more drastic reduction in mobility, as measured by the Google mobility index (Graph 3, centre panel). This probably reflects the immediate negative impact of the pandemic on economic activity. Third, we find that the reaction of equity prices to the CRA index is lower in jurisdictions that have developed more containment measures (excluding those involving mobility limitations) to combat the pandemic (right-hand panel). This could reflect reduced concerns of investors about the pandemic's negative effects on the economy in jurisdictions where the spread of the virus has been more actively fought.⁷ Where additional indicators are available, the sensitivity of stock prices to the CRA index effect is lower in economies with a higher number of hospital beds per inhabitant and a higher government expenditure on health services as a share of GDP.

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⁷ The correlations reported in three panels of Graph 3 remain statistically significant also in a more general model that considers simultaneously the three indicators. The R^2 of this model is 23%.

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