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COVID-19 and the United States financial markets’ volatility

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ABSTRACT

We empirically investigate the effect of the official announcements regarding the COVID-19 new cases of infection and fatality ratio, on the financial markets volatility in the United States (US). We consider both COVID-19 global and US figures and show that the sanitary crisis enhances the S&P 500 realized volatility. Our findings are robust to different model specifications and suggest that the prolongation of the coronavirus pandemic is an important source of financial volatility, challenging the risk management activity.

1. Introduction

The new coronavirus crisis (COVID-19) outbreaks in China, in the city of Wuhan (Hubei region), and soon becomes a global sanitary crisis. On March 11, 2020, the virus has already affected more than 100,000 people in over 100 countries, having killed thousands. This evidence determined the World Health Organization (WHO) to declare the new coronavirus pandemic. Two months later, the infection cases overpassed 5 million people and several hundreds of thousands of deaths were reported at global level. At the same time, the stock markets recorded several shock waves starting with February 2020, whereas the financial volatility continued to increase in the context of COVID-19 uncertainty.

Even in its pre-pandemic phase, COVID-19 has severely affected the real economy, with a negative impact on trade, tourism, and transport industry, generating local food shortages (Albulescu, 2020). In addition, in the presence of stock markets price bubbles,¹ the COVID-19 impact on the financial system could not be ignored. Likewise, several early papers focus on the COVID-19 effects on stock markets returns (e.g. Ashraf, 2020; Zhang et al., 2020), whereas only few papers underline the COVID-19 impact on financial volatility (e.g. Albulescu, 2020; Bakas and Triantafyllou, 2020; Zaremba et al., 2020). We add to this new strand of the literature and we investigate the effect of official announcements regarding the COVID-19 new cases of infection, and fatality ratio, on the United States (US) financial markets’ volatility.

The financial volatility has different sources, related to economic conditions, institutional issues, or market uncertainty (Hartwell, 2018). Macroeconomic announcements also affect the financial volatility. In this line, Onan et al. (2014) find that good and bad announcements asymmetrically impact the financial volatility, whereas most of recent studies focus on the role of Economic Policy Uncertainty (EPU) in influencing the financial volatility (Antonakakis et al., 2013; Chen and Chiang, 2020; Kalyvas et al., 2019; Li et al., 2020; Mei et al., 2018; Su et al., 2019; Tiwari et al., 2019; Yen and Cheng, 2020; Zhenghui and Junhao, 2019). For example, Karnizova and Li (2014) predict the US recession using the interaction between EPU and stock market volatility, whereas

¹S&P 500 recorded a maximum of 3,380 points on February 14, 2020, representing an increase of 65%, as compared to February 14, 2015.

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Zhu et al. (2019) investigate how a fear index influences the US stock market volatility.

Different from these studies, we investigate the impact of coronavirus pandemic uncertainty (associated with the new infection cases and the fatality ratio reported at global level and in the US), on the financial markets’ volatility. Indeed, Zaremba et al. (2020) investigate the impact of COVID-19 on the stock market volatility at global level with a focus on the effect of governmental interventions, whereas Bakas and Triantafyllou (2020) analyze the impact of the global pandemic on commodity prices’ volatility. None of these papers investigate, however, the effects of the WHO official announcements regarding the propagation of the sanitary crisis. Therefore, we build upon Albulescu (2020) and we extend this analysis in several ways. First, we use daily data and we focus on the period of the pandemic phase of the crisis, starting with March 11, 2020. Second, different from Albulescu (2020) who focuses on the pre-pandemic case and the official figures reported in China, we consider the new infection case announcements and the fatality ratio reported at global level and in the US. Finally, in line with Ji et al. (2019), we use the S&P 500 realized volatility (RV) as a proxy for the US financial markets’ volatility. Compared with other metrics of financial volatility, RV seems to be more informative about the volatility level (Andersen et al., 2003). Like Albulescu (2020), we control for the role of US EPU in explaining the financial volatility level.

We discover that both the new infection cases and the fatality ratio recorded at global level and in the US, positively influence the US financial markets’ volatility. The next section briefly highlights some stylized facts about COVID-19. Section 3 presents the empirical approach and the results. The last section concludes.

2. The pandemic phase of COVID-19: Stylized facts

The pandemic phase of COVID-19 starts in March 11, with the official announcement made by WHO. Until the end of March, the new cases of infection increase exponentially, and the virus rapidly spreads worldwide. However, the social distance measures implemented by most governments contribute to a stabilization of daily reported new infection cases around 100,000 at global level, out of which 20,000 in the US (Fig. 1(a)). In this context, starting with May 15, 2020, most of US and European states decide to relax the social distance restrictions and to revive the economic activity, although the new coronavirus continues to spread in Latin America. Consequently, our sample ends in May 15, and covers the period of the pandemic phase of the first wave of COVID-19.2 Fig. 1(b) shows that the fatality ratio, computed as a ratio between the number of daily reported deaths and the total infection cases, continuously increased until the end of March, with a short downturn in the US during the second part of March.

3. Empirical specifications and results

Our daily data comes from WHO situation reports (COVID-19 statistics) and S&P Dow Jones Indices database, respectively (RV data). We use the S&P 500 3-month realized volatility index as a proxy for the US financial markets’ volatility. We test a simple Ordinary Least Squares (OLS) regression investigating the new coronavirus impact on the financial volatility and we use a stepwise procedure.3 In the first step (Eq. (1)) we implement a naïve estimation whereas in the second step (Eq. (2)) we consider the US EPU as a control variable.4

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2 The social distance relaxation measures might be viewed as a start of a new wave of the sanitary crisis. Indeed, starting with June 2020, the new infection cases begin to rise both in the US and at global level.

3 We apply the ADF unit root test and the KPSS stationarity test to check the stationarity of our series. Both tests show that the series are stationary in level (a contradiction between the two tests appears only in the case of the fatality ratio series, the ADF test rejecting the stationarity). These results can be found in Appendix (Table A1).

4 All variables are expressed in natural log, except for the fatality ratio. The WHO situation reports are released at date “t” for the COVID-19 figures announced at “t-1”. Therefore, we use the first lag of COVID-19 data in our regression. In line with previous papers (e.g. Mei et al., 2018), and to avoid the endogeneity issues between financial volatility and economic policy uncertainty, we also use the first lag of EPU in our regression.
Table 1
COVID-19 new case announcements and financial volatility.

| OLS approach | Model 1 – Global | Control | Model 2 – US | Control |
|--------------|------------------|---------|-------------|---------|
| COVID-19t-1  | 0.157***         | 0.158***| 0.048***    | 0.048***|
|              | [0.008]          | [0.008]| [0.006]     | [0.006] |
| EPU t-1      | 0.026            | [0.027]| –0.117      | [0.055] |
| c            | 2.337***         | 2.210***| 3.591***    | 3.672***|
|              | [0.093]          | [0.165]| [0.064]     | [0.261] |
| R²           | 0.877            | 0.879   | 0.523       | 0.524   |

Notes: (i) 10%, 5% and 1% level of significance is denoted by *, ** and *** respectively; (ii) COVID-19 is associated with the new reported cases.

Table 2
COVID-19 fatality ratio and financial volatility.

| OLS approach | Model 1 – Global | Control | Model 2 – US | Control |
|--------------|------------------|---------|-------------|---------|
| COVID-19t-1  | 0.088***         | 0.088***| 0.030**     | 0.030** |
|              | [0.010]          | [0.010]| [0.011]     | [0.012] |
| EPU t-1      | 0.005            | [0.051]| –0.009      | [0.074] |
| c            | 3.531***         | 3.503***| 3.923***    | 3.967***|
|              | [0.062]          | [0.245]| [0.047]     | [0.348] |
| R²           | 0.595            | 0.596   | 0.127       | 0.128   |

Notes: (i) 10%, 5% and 1% level of significance is denoted by *, ** and *** respectively; (ii) COVID-19 is associated with the fatality ratio.

Table 3
COVID-19 new case announcements and financial volatility – robustness results.

| RLS approach | Model 1 – Global | Control | Model 2 – US | Control |
|--------------|------------------|---------|-------------|---------|
| COVID-19t-1  | 0.108***         | 0.108***| 0.070***    | 0.070***|
|              | [0.003]          | [0.003]| [0.002]     | [0.002] |
| EPU t-1      | 0.003            | [0.012]| 0.011       | [0.018] |
| c            | 2.879***         | 2.860***| 3.387***    | 3.325***|
|              | [0.040]          | [0.070]| [0.021]     | [0.087] |
| R²           | 0.564            | 0.578   | 0.372       | 0.373   |

Notes: (i) 10%, 5% and 1% level of significance is denoted by *, ** and *** respectively; (ii) COVID-19 is associated with the new reported cases.

Table 4
COVID-19 fatality ratio and financial volatility – robustness results.

| RLS approach | Model 1 – Global | Control | Model 2 – US | Control |
|--------------|------------------|---------|-------------|---------|
| COVID-19t-1  | 0.032***         | 0.032***| 0.017***    | 0.016***|
|              | [0.000]          | [0.000]| [0.000]     | [0.000] |
| EPU t-1      | –0.000           | [0.003]| –0.003      | [0.004] |
| c            | 3.890***         | 3.893***| 4.025***    | 4.044***|
|              | [0.004]          | [0.017]| [0.003]     | [0.022] |
| R²           | 0.664            | 0.664   | 0.639       | 0.628   |

Notes: (i) 10%, 5% and 1% level of significance is denoted by *, ** and *** respectively; (ii) COVID-19 is associated with the fatality ratio.
RV_t = c + αCOVID_t − 1 + ε_t, \hspace{1cm} (1)
RV_t = c + αCOVID_t − 1 + βEPU_t − 1 + β_t, \hspace{1cm} (2)

with \( ε_t \sim N(0, \sigma^2) \).

We estimate two models, with a focus on the global level reported data (Model 1), and on the US figures (Model 2). Further, we perform two types of analyzes, investigating the role of new case announcements and the effect of fatality ratio. In Table 1 we present the impact of announcements related to new infection cases. We clearly notice that COVID-19 positively influences the financial volatility. In addition, we see that the figures reported at global level have a stronger impact on RV than those reported for the US. Likewise, the markets are more sensitive to the coronavirus spillover at global level. Further, the impact of EPU is insignificant, a result in contradiction with most early findings reported in the literature. However, this evidence might be explained by the fact that COVID-19 uncertainty dominates the policy-induced uncertainty during the sanitary crisis.

In Table 2 we show the estimates of fatality ratio’s influence on financial volatility. These results are quite similar to the previous ones, stating that COVID-19 has a positive and a significant impact on the financial volatility. Once again, the fatality ratio reported at global level has a stronger influence on the S&P 500 realized volatility as compared to the US fatality ratio.

To test the robustness of our findings we resort to a robust least squares (RLS) estimation. Indeed, the OLS results might be affected by the existence of outliers in the COVID-19 figures, especially in the case of the US reported data, at the beginning of our sample. Therefore, in a subsequent analysis we use the RLS approach, and more specifically the M-estimation (Huber, 1973), which is less sensitive to outliers. Table 3 indicates the significant effect of COVID-19 on the financial volatility. In line with the main findings (Table 1), we notice that the effect of EPU is insignificant. At the same time, the figures reported at global level have a stronger impact on RV as compared to those reported in the US.

Finally, we perform an RLS estimation considering the impact of fatality ratio. Although marginal, the effect of recorded fatality ratio remains significant in all the cases, confirming the findings in Table 2 and supporting their robustness. All in all, our estimations confirm the early findings reported in the literature about the effect of COVID-19 on the financial volatility (e.g. Albulescu, 2020; Zaremba et al., 2020). Moreover, our findings show that, during the new coronavirus pandemic phase, COVID-19 has a clear positive impact on the financial volatility.

Table 4

4. Conclusions

We have tested the impact of COVID-19 official announcements on the financial volatility, with a focus on the pandemic phase of the crisis. To this end, we have used the S&P 500 realized volatility as a proxy for the US financial markets’ volatility and we have compared the impact of data reported at global level and in the US. The outcomes of our empirical investigation underline the fact that: (i) the new infection cases reported at global level and in the US amplify the financial volatility, (ii) the fatality ratio has a significant and positive impact on the volatility, (iii) the effect of COVID-19 data reported at global level is stronger as compared to the effect triggered by the data reported in the US, (iv) the impact of EPU on the financial volatility is not significant during the pandemic phase of COVID-19.

To conclude, our robust results highlight that the persistence of COVID-19 crisis, and its related uncertainty, amplifies the US financial markets’ volatility, affecting thus the global financial cycle.

Credit author statement

Conceptualization, literature review data curation, methodology, formal analysis, writing – first version of the manuscript, writing - review & editing, supervision

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Appendix

Table A1
Table A1
Unit root and stationarity tests.

| Level     | RV          | COVID-19 | New US | Fatality Global | Fatality US | EPU         |
|-----------|-------------|----------|--------|-----------------|-------------|-------------|
| ADF       | −5.631***   | −4.493***| −8.475***| 1.001           | −2.480      | −10.15***   |
| KPSS      | 0.667*      | 0.650*   | 0.543* | 0.205*          | 0.763*      | 0.239       |

Notes: (i) *, ** and *** denotes the rejection of null hypothesis at 10%, 5% and 1% level respectively; (ii) New Global = new infection cases reported at global level, New US = new infection cases reported in the US, Fatality Global = fatality ratio at global level, Fatality US = fatality ratio reported in the US; (iii) The null of ADF test is the existence of a unit root, whereas the null of KPSS test is the stationarity; (iv) a trend was used in the case of fatality ratio series.

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