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Impact assessment of the COVID-19 pandemic on financial markets

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Abstract

This article analyses the immediate consequences of the COVID-19 pandemic on financial markets in some of the hardest-hit countries. We first show that stock-market index returns reacted strongly and negatively to the COVID-19 pandemic. We then assess the impact of the demand-side accompanying economic measures, such as income support to cover salaries and debt relief for households, in mitigating this effect. Countries that introduced more generous income-support policies were better able to counter the pandemic's short-term harmful effects on financial markets. We calculate the potential country-level financial losses due to COVID-19 over the five first months of 2020 to have been between -40% and -26%. Once the mitigating effects of economic policy are taken into account, the actual financial loss is estimated at between -5% and -7% for France, Germany and the UK. These financial losses are higher elsewhere, with some exceeding -30%, especially in countries without income-support policies.

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1 Introduction

The economic crisis caused by the COVID pandemic and the associated public-health policies is of a kind that has never been experienced before. From a health point of view, the shock has been enormous. The pandemic has spread globally, and four months after the beginning of the World health crisis in early January 2020, over half of the World's population was under some form of confinement after the World Health Organization (WHO) officially declared the COVID-19 outbreak to be a global pandemic on March 11^{th} 2020. As of September 10^{th} 2021, the World number of confirmed cases exceeded 223 million, with over 4.6 million deaths (World Health Organization, 2021). Countries such as China, Italy, Spain, France, the United Kingdom and the United States have faced the most-severe consequences of the COVID-19 outbreak.

Beyond the over-riding public-health issues, there are growing concerns about the economic and financial consequences of COVID-19. Most countries have adopted various social-distancing measures, and many have introduced strict quarantine policies to slow the spread of the coronavirus. Common measures, so-called non-pharmaceutical interventions (NPIs), include school closure, workplace closure, travel restrictions, bans on public gatherings, stay-at-home requirements, and varying degrees of general or targeted confinement. Governments are however largely unaware of the extent to which these measures affect supply chains, the financial stability of businesses, the financial sector and households, and in general their economic and financial consequences. There is therefore considerable uncertainty about the economic and financial impacts of the COVID-19 pandemic.

Financial markets have reacted spectacularly to the COVID-19 outbreak. In March 2020, the US stock market activated the circuit-breaker mechanism four times in ten days. Since its inception in 1987, this breaker had previously only ever been triggered once (in 1997) (Zhang et al., 2020). Together with the US crash, stock markets in Europe and Asia have also plunged. FTSE, the UK's main equity index, dropped more than 10% on March 12^{th} 2020, in its worst day since 1987 (Zhang et al., 2020). The stock market in Japan fell by over 20% from its height in December 2019.

Stock-market returns react quickly to events: there is an extensive literature on their response to major events such as disasters (Kowalewski and Śpiewanowski, 2020), sports (Buhagiar et al., 2018), news (Li, 2018), the environment (Guo et al., 2020) and political developments (Bash and Alsaifi, 2019). In the current context, stock returns also reacted to epidemics such as Severe Acute Respiratory Syndrome (SARS) (Chen et al., 2007) and Ebola (Ichev and Marinč, 2018). However, the economic literature on global health crises such as the COVID-19 pandemic is rather scarce. A pandemic of comparable magnitude has never been observed in the history of the recent world. We are aware of a study by Demirguc-Kunt et al. (2020), who use different proxies for economic activity such as electricity consumption and NO_2 emissions in Europe and Central Asia to assess the economic impact of COVID-19. They find that social-distancing measures are associated with a decline in economic activity of around 10% across regions.

The current paper aims to assess the impact of COVID-19 on financial markets in nine of the most-affected countries. We specifically establish the extent to which stock-market index returns in these countries reacted. We use panel data models to estimate the relationship between the growth rates in both the number of confirmed cases and deaths caused by COVID-19 and the returns of these nine major stock-market indices. We find that these returns are strongly and negatively

affected by both COVID-19 growth rates. These latter reflect the severity of the pandemic, and serve as proxies for the social-distancing measures that have been introduced, which include both voluntary measures and NPIs.[1]

The COVID-19 pandemic has also prompted a wide range of economic responses from governments around the world, alongside the drastic public-health measures. Most countries have introduced economic policies to support the economy and tackle the economic consequences of their health measures (both voluntary and NPIs). These economic policies have been both supply- and demand-side. Common measures include income support, debt- and contract-relief for households, fiscal measures, and international support. However, there has been substantial variation between governments in the type of measures adopted. For example, France is one of the countries with the most generous economic support, reflecting the position of President Macron who has stated that massive financial measures to support the economy would be taken "whatever the cost". France has introduced both supply- and demand-side economic policies, with in particular substantial income support. Conversely, China has not applied comparable income-support measures, with most budget expenditure being allocated to supply-side policies.[2]

In this context, we assess the impact of demand-side economic policies aimed to maintain income for individuals who lost their jobs or cannot work and provide household debt-relief, in terms of resilience to the pandemic. We find that while stock-market index returns were strongly and negatively affected by COVID-19, countries that implemented more-generous economic policies were better able to counter the short-term harmful effects of the pandemic. We calculate the potential country-level financial losses due to COVID-19 over the five first months of 2020 to have been between -40% and -26%. Once we take the mitigating effect of the accompanying economic policies into account, the actual financial losses were estimated to lie between -5% and -7% in France, Germany and the UK. These financial losses were higher elsewhere, with some exceeding -30%, especially in countries without income-support policies.

The remainder of the paper is structured as follows. Section 2 sets out the data we use and the methodological approach. Section 3 then discusses the results. Last, some concluding remarks appear in the final section.

2 Data and method

2.1 Data

We use balanced panel data for nine countries over the period from January 1st 2020 to May 27th 2020 at daily frequency. We have information on nine stock-market indices from all over the world (S&P 500, CAC 40, DAX 30, FTSE 100, FTSE MIB, IBEX 35, KOSPI, TOPIX and SHANGAI

[1] The severity of the pandemic is difficult to measure, as the number of confirmed cases is in part a function of how much testing is carried out. Fortunately, the number of confirmed deaths is less correlated with the testing regime, but still depends on each country's definition of COVID-19 deaths. Our analysis here relies on panel data, so that country-specific effects are controlled for.

[2] Although China announced the allocation of RMB 4.2 trillion (equivalent to 4.1% of GDP) to discretionary fiscal measures (IMF, 2020a) such as increased spending on epidemic prevention and control, medical-equipment production and public investment, little has been done to maintain the wages of those who could not go to their workplaces, whereas this income support has been used in many countries such as France, Germany and the United Kingdom.

SE) from the Datastream dataset in Thomson Reuters Eikon. We also have data on COVID-19 confirmed cases and confirmed deaths from the World Health Organization. Last, we use the Economic Government Policy Response Index (EPI) downloaded from the University of Oxford's website (Hale et al., 2020).[3] This latter index includes two different indices of public-policy interventions: i) income support and ii) debt- and contract-relief for households. The first income-support index records if the government is covering salaries or providing direct cash payments or universal basic income or similar for those who have lost their jobs or cannot work. This Includes payments to firms, if they are explicitly linked to payroll or salaries. The second index covers debt relief for households and shows whether the government is freezing financial obligations such as stopping loan repayments, preventing services like water from being cut off, or outlawing evictions. The overall (EPI) index, which is on a scale of 0 to 100, indicates the extent of economic demand-side support policies. It excludes supply-side policies, and so does not account for support to firms or businesses, or the total fiscal value of economic support. We therefore here focus on the effect of economic demand-side policies.

2.2 The empirical model

We wish to estimate the financial consequences of the COVID-19 pandemic, and to assess the impact of the accompanying economic policies. We construct an empirical model of stock-market index returns, where we assume a linear relationship between returns and the COVID-19 proxy variables.[4] This produces the following equation:

$$r_{it} = \alpha_i + \beta COVID_{it} + \lambda_t + \varepsilon_{it} \tag{1}$$

where the subscript i refers to the country (or stock-market index) and t to the time period. r_{it} is the stock-market index return, calculated as the change in the logarithm of the equity index i between $t-1$ and t. $COVID$ refers to the change over the same time period in the logarithm of either confirmed cumulated cases or confirmed cumulated deaths from COVID-19 (and as such are the day-to-day growth rates in these two series). The parameter β shows how stock-market index returns react to the growth rates of cases or deaths. When panel data models are estimated, it is customary to control for unobserved heterogeneity using fixed or random effects: these are the α_i terms in Equation (1). Depending on the assumptions made about their correlation with the other right-hand side variables, they will be regarded as fixed intercepts (fixed effects), which capture the impact of any time-invariant country or marketplace characteristics, or random variables (random effects). λ_t denotes a full set of day dummies. Last, the error term ε_{it} includes all other time-varying unobservable shocks to stock-market index returns.

[3] https://www.bsg.ox.ac.uk/covidtracker, accessed on May 28th 2020.

[4] Maloney and Taskin (2020) provide some evidence that the number of confirmed COVID-19 cases is a proxy for social distancing, which includes voluntary measures and NPIs. They show that much of reduced mobility in the United States is voluntary, driven by the number of COVID-19 cases and proxying for greater awareness of risk. They suggest that considerable social distancing will take place independently of NPIs, and that restrictions may often function more like a coordinating device among increasingly-predisposed individuals than as repressive measures per se. They confirm the direct impact of the voluntary component on economic activity, by showing that the majority of the fall in restaurant reservations in the United States and cinema spending in Sweden took place before the imposition of any NPIs.

3 Estimation results

For the estimation of stock-market index returns, we consider models with country-specific fixed effects. These are estimated using the Within estimator. The estimation results appear in Table 1. They are divided into four columns, representing two pairs of country- and both country and time fixed-effect specifications. They include alternately two explanatory variables for stock-market index returns: the day-to-day growth rates in total confirmed cases and total confirmed deaths from COVID-19.

All of the estimated coefficients on the COVID-19 variables are very significant and are of the expected signs, except in the last columns in Table 1. The estimated parameter on the growth rate of confirmed deaths becomes insignificant when we control for day dummies. Although significant, the estimated coefficient on the growth rate of confirmed cases is divided by three when controlling for day dummies in column (2). This reduction in power undoubtedly reflects the day fixed effects capturing much of the variation in the COVID-19 variables. We thus retain the models without day dummies for our analysis: dropping these day dummies avoids collinearity.

We explore the robustness of these estimates by looking for panel groupwise heteroskedasticity and cross-sectional correlation. We carry out a number of standard tests for panel groupwise heteroscedasticity (the LM, LR and Wald tests). We also carry out the test of cross-sectional dependence proposed by Pesaran (2021) and implemented in Stata by De Hoyos and Sarafidis (2006). These test results appear in Table 2, and strongly reject the null hypotheses of groupwise homoskedasticity and cross-sectional independence for all models.

We consequently re-estimate these models to account for heteroskedasticity and cross-sectional dependence using Driscoll and Kraay (1998) standard errors. The latter are robust to very general forms of cross-sectional and temporal dependence when the time dimension is large, as is the case here. The corresponding estimation results for fixed-effect models appear in Table 3. The estimated coefficients are of the expected sign and are similar to those in Table 1, although the estimated standard errors differ. The estimates show that returns fell by 0.24 and 0.23 percentage points following a 10 percentage-point higher growth rate of the number of cases of COVID-19 or the number of deaths from COVID-19, respectively.

Table 3 also reports the results from models controlling for government economic responses. These test for an effect of the demand-side economic support implemented in the sample countries. The results in columns (3) and (4) show that the government's economic measures had a positive impact on returns. An increase in the economic response index of 10 units results in 0.0010 to 0.0013 percentage-points higher returns. To see whether the economic measures mitigate the negative impact of the pandemic on financial returns, we add an interaction term between the COVID-19 variables and the index of economic measures to our baseline models. The results appear in the last two columns of Table 3. The estimated coefficient on the interaction term is positive in both columns. However, while the parameter is insignificant in column (5), that in column (6) is significant at the standard 95% level of statistical inference (even though the two interaction coefficients here are not statistically-significantly different from each other). In column (6) the economic measures mitigate the relationship between the growth rate of COVID-19 deaths and stock-market index returns. With no accompanying (demand-side) economic policies, returns fall by 0.351 percentage points after a 10 percentage-point rise in the COVID-19 death growth rate.

Table 1: Estimation results

Model	(1)	(2)	(3)	(4)
Specification	FE	FE	FE	FE
Cases	-0.0242***	-0.0084**		
	(0.0025)	(0.0026)		
Deaths			-0.0231***	-0.0065
			(0.0068)	(0.0045)
Constant	0.0008**	0.0064**	0.0002	0.0041***
	(0.0002)	(0.0026)	(0.0006)	(0.0009)
Time FE	No	Yes	No	Yes

Note: Standard errors are in (); *, ** and *** refer respectively to the 10%, 5% and 1% significance levels; P-values are in [ ]. Stock market equity index returns represent the dependent variable. It is calculated as the first (logarithmic) difference of stock market equity indices. The explanatory variables Cases and Deaths represent respectively the first (logarithmic) differences of the number of cases of COVID-19 and the number of deaths from COVID-19.

Table 2: Panel groupwise heteroscedasticity and cross-sectional dependence tests

Model	Lagrange-Multiplier Test	Likelihood-Ratio Test	Wald Test	Pesaran test
(1)	83.86***	15.78*	1417.92***	34.94***
(2)	181.72***	112.70***	500.02***	-5.05***
(3)	84.62***	18.13**	1165.84***	35.45***
(4)	183.05***	116.23***	510.65***	-4.99***

Notes: The LM, LR and Wald tests consider the null hypothesis H0: Homoscedasticity against H1: Groupwise Heteroscedasticity; Pesaran's test of cross sectional independence considers the null hypothesis of cross-sectional independence against the alternative of cross-sectional dependence; *, ** and *** refer to the rejection of the null at the 10%, 5% and 1% significance levels respectively.

Table 3: Estimation results with adjusted standard errors

Model	(1)	(2)	(3)	(4)	(5)	(6)
Cases	-0.0242***		-0.0212***		-0.0267***	
	(0.0084)		(0.0079)		(0.0090)	
Deaths		-0.0231***		-0.0231**		-0.0351***
		(0.0110)		(0.0105)		(0.0114)
Eco Index			e^{-4}*	$1.3e^{-4}$**		
			($5e^{-5}$)	($4.8e^{-5}$)		
Eco Index×Cases					0.0004	
					(0.0003)	
Eco Index×Deaths						0.0007**
						(0.0003)
Constant	0.0008	0.0002	-0.0029	-0.0041*	-0.0001	-0.0010
	(0.0019)	(0.0017)	(0.0023)	(0.0022)	(0.0018)	(0.0017)

Note: Driscoll and Kraay's (1998) standard errors are in (); *, ** and *** refer respectively to the 10%, 5% and 1% significance levels. Stock market equity index returns represent the dependent variable. It is calculated as the first (logarithmic) difference of stock market equity indices. The explanatory variables Cases and Deaths represent respectively the first (logarithmic) differences of the number of cases of COVID-19 and the number of deaths from COVID-19. Model (1) and (5) are the same than those in Table 1.

With a policy response this fall is smaller at $0.0351 - [0.0007 \times \text{Eco Index}]$ percentage points.

To illustrate the financial impact of COVID-19, and those of the accompanying economic policies, we calculate the drop in the stock-market indices from COVID-19 over the January 1^{st} 2020 - May 27^{th} 2020 period. We first use the results from column (6) in Table 3 for these calculations, introducing the day-to-day values of the EPI index and the growth rates of deaths for each country. We then calculate the predicted stock-market index returns in the same model, but setting the index of economic measures equal to zero. We can therefore use both predictions to calculate the financial losses over the whole period as $1 - \left[\Pi_{t=1}^{T}(1+\widehat{r}_{it})\right]$.

The results are summarized in Figure 1. The black solid bars depict country financial losses in the first five months of 2020, as percentages, without any policy interventions. The United States, France, Germany, Italy, the UK and Spain would have experienced financial losses ranging from -40% to -35%. The predicted financial losses in Asian countries are slightly lower: -33% for China, -29% for Japan and -26% in Korea. Fortunately, most countries implemented accompanying demand-side economic policies to cover the salaries of those who lost their jobs or cannot work. The extent of these measures varied across countries, producing different degrees of resilience to the pandemic. The grey dotted bars in Figure 1 show the actual financial losses from COVID-19 in the first five months of 2020. The countries with the most-generous economic policies were better able to counter the harmful effects of the pandemic. France, Germany and the UK were the most-resilient countries thanks to the scope of their respective accompanying income-support policies.

The actual financial losses due to COVID-19 in these countries amounted to only -5% to -7%. These financial-loss estimations are of comparable size to economic-loss estimations in Demirguc-

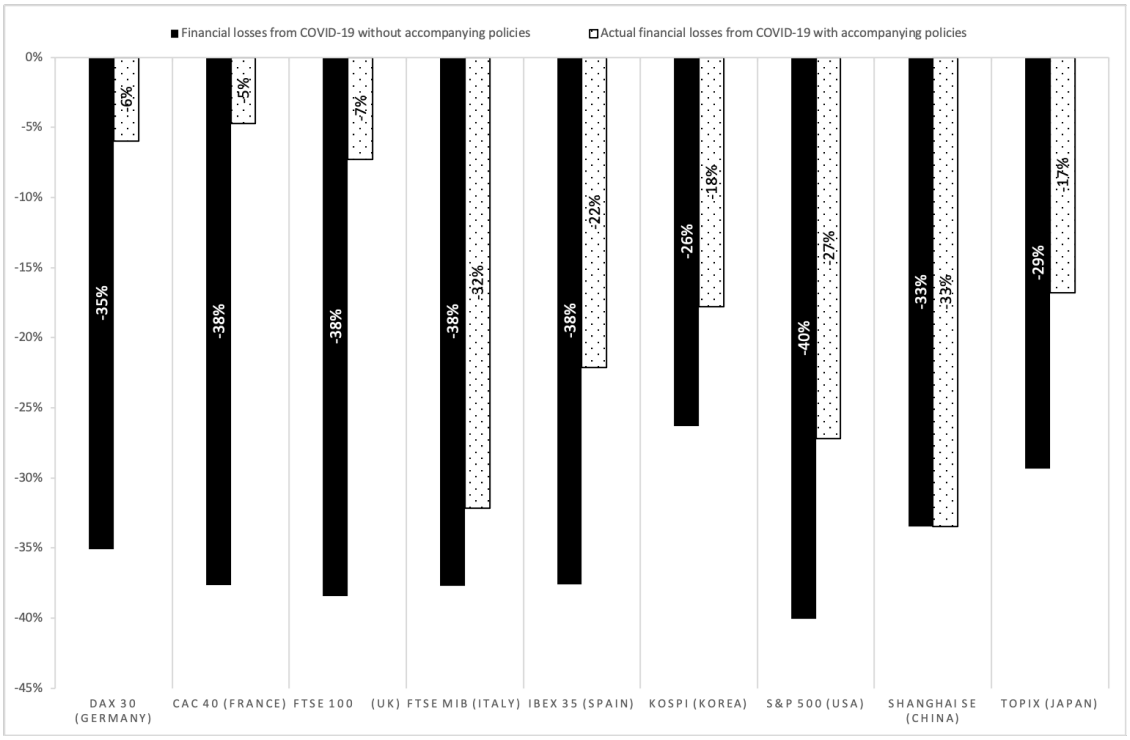

Figure 1: Financial losses from COVID-19 (January 2020 to May 2020)

Kunt et al. (2020), where the expected decline in economic activity is around 10% across Europe and Central Asia. They are also comparable to the 6% lower real GDP resulting from the Spanish Flu pandemic in Barro et al. (2020). The estimated financial losses should be compared to the counterfactual without accompanying economic policies. For example, the French economic measures reduced financial losses by 30 percentage points. These financial losses can also be compared to those in countries where these policies were not introduced, such as China. The negative financial impact of COVID-19 was five times higher in China than in France, despite there being six times fewer deaths from COVID-19. China is one of the most financially-affected countries, together with the United States and Italy. The demand-side economic policies in the United States mitigated the financial losses due to COVID-19 by 12 percentage points, reducing actual losses to -27%. The hardest-hit among those implemented accompanying demand-side economic policies is Italy, which recorded a -32% fall in its stock market index during the five first months of 2020.

Last, our findings on the extent of the financial losses appear reasonable in that they are consistent with most of the International Monetary Fund's forecasts for 2020 economic growth, if we take into account the expected economic recovery in the second semester of 2020. The projections from the World Economic Outlook (IMF, 2020b) for World growth forecasted a drop of 4.9% in 2020. At the country level, the 2020 growth forecasts were almost -13% for France, Italy and Spain, and -10% for the UK. These projections were around -8% for the US and Germany, -6% for Japan, and +1% for China. Moreover, the latest update from the World Economic Outlook (IMF, 2021) for World growth recorded the following 2020 economic growth rates: -8% for France, -9%

for Italy, -11% for Spain and -10% for the UK. These calculations are around -3% to -5% for the US, Germany and Japan, and +2% for China.

4 Conclusion

This article has discussed the short-term financial impacts of the COVID-19 pandemic in nine of the hardest-hit countries over the five first months of 2020. This has been by far the most important pandemic in recent human experience. Our analysis has shown that COVID-19 resulted in large significant financial losses. However, the short-term negative financial impact of the pandemic were counterbalanced by generous demand-side fiscal economic measures, such as income support to cover the wages of those who lost their jobs or cannot work, and debt relief for households. These measures allowed financial markets to be more resilient regarding the short-term harmful effects of the pandemic.

Although there is a clear healthcare rationale for voluntary social-distancing measures and non-pharmaceutical interventions (NPIs), it is also evident that these policies cause great economic and financial damage. Accompanying monetary and fiscal policies help reduce this damage. As long as these economic policies remain in force, economies will be prevented from catastrophic increases in unemployment and firm bankruptcies, at the expense of issuing public debt.[5] Dealing with these trade-offs is a key challenge confronting policymakers.

We recognize, however, that our assessments of the financial impact of COVID-19 and the accompanying economic policies are partial in two senses. First, we have only looked at the short run, without addressing the long-run consequences that will depend on the duration and extent of social distancing and the accompanying economic policies. There is a risk that prolonged non-pharmaceutical interventions (NPIs) will have a large negative effect on overall financial, economic and social well-being, which may lead to longer-run concerns over unemployment and firm bankruptcy. The long-run impact should also take into account the cost of issuing public debt to finance the economic measures under consideration. Second, our economic-policy evaluation here has focussed on fiscal measures to support demand, leaving to one side supply-side fiscal measures and other monetary-policy measures. There is thus a great deal of room for research into the impacts of particular fiscal policies, especially supply-side support policies such as loans to keep firms from going bankrupt, and monetary policies aimed to maintain the liquidity and health of financial markets during the COVID-19 pandemic.

As a final remark, we believe that our analysis offers grounds for reflection over the optimal choices of the kind and level of NPIs to contain pandemics, and the accompanying economic policies aimed at mitigating the financial and economic damage. There is indeed a compelling need to address the health crisis while limiting the economic and financial losses. This may be reached either by shifting to less-sweeping containment policies that do not strangle the economy, as suggested by Acemoglu et al. (2020), Shigeru et al. (2020) and Ichino et al. (2020), among others, or by mitigating the harmful economic and financial effects of containment policies via fiscal eco-

[5] Blanchard (2020) claims that at interest rates below 1% debt sustainability is not called into question, even with a large rise in debt ratios. However, investors are asking for higher interest rates than 1%, which may lead debt to be unsustainable.

nomic policies that are financed without recourse to debt, but rather by digital or environmental taxes, as has been debated by the European Authorities.

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