RUHR
ECONOMIC PAPERS

Paola D'Orazio
Maximilian W. Dirks

COVID-19 and Financial Markets: Assessing the Impact of the Coronavirus on the Eurozone

RUB

#859

Imprint

Ruhr Economic Papers

Published by

RWI – Leibniz-Institut für Wirtschaftsforschung
Hohenzollernstr. 1-3, 45128 Essen, Germany

Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstr. 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

Universität Duisburg-Essen, Department of Economics
Universitätsstr. 12, 45117 Essen, Germany

Editors

Prof. Dr. Thomas K. Bauer
RUB, Department of Economics, Empirical Economics
Phone: +49 (0) 234/3 22 83 41, e-mail: thomas.bauer@rub.de

Prof. Dr. Wolfgang Leininger
Technische Universität Dortmund, Department of Economic and Social Sciences
Economics – Microeconomics
Phone: +49 (0) 231/7 55-3297, e-mail: W.Leininger@tu-dortmund.de

Prof. Dr. Volker Clausen
University of Duisburg-Essen, Department of Economics
International Economics
Phone: +49 (0) 201/1 83-3655, e-mail: vclausen@vwl.uni-due.de

Prof. Dr. Ronald Bachmann, Prof. Dr. Torsten Schmidt, Prof. Dr. Manuel Frondel, Prof. Dr. Ansgar Wübker
RWI, Phone: +49 (0) 201/81 49-213, e-mail: presse@rwi-essen.de

Editorial Office

Sabine Weiler
RWI, Phone: +49 (0) 201/81 49-213, e-mail: sabine.weiler@rwi-essen.de

Ruhr Economic Papers #859

Responsible Editor: Thomas Bauer

ISSN 1864-4872 (online) – ISBN 978-3-86788-995-7

Ruhr Economic Papers #859

Paola D'Orazio and Maximilian W. Dirks

COVID-19 and Financial Markets: Assessing the Impact of the Coronavirus on the Eurozone

RUB

Bibliografische Informationen der Deutschen Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available on the Internet at **http://dnb.dnb.de**

RWI is funded by the Federal Government and the federal state of North Rhine-Westphalia.

http://dx.doi.org/10.4419/86788995
ISSN 1864-4872 (online)
ISBN 978-3-86788-995-7

Paola D'Orazio and Maximilian W. Dirks[1]

COVID-19 and Financial Markets: Assessing the Impact of the Coronavirus on the Eurozone

Abstract

COVID-19 has quickly emerged as a novel risk, generating feverish behavior among investors, and posing unprecedented challenges for policymakers. The empirical analysis provides evidence for a significant negative effect on stock markets of COVID-19-related measures announced in the Euro Area from January 1st, 2020 to May 17th, 2020. Further negative effects are detected for movements in bond yields, EU volatility index, Google trends, and infection rates. Health measures have, instead, a significant positive effect, while fiscal policy announcements are not significant.

JEL-Code: E44, G15

Keywords: Coronavirus; COVID-19; investor behavior; stock market volatility; containment policies; policy announcements; fiscal policy

July 2020

1 Both RUB. – All correspondence to: Paola D'Orazio, Ruhr-Universität Bochum, Universitätsstr. 150, 44801 Bochum, Germany, e-mail: paola.dorazio@rub.de

1. Introduction

To tackle the challenges posed by the spread of the COVID-19, between March and May 2020, all countries in the Euro Area (EA) have announced the implementation of fiscal stimulus packages aimed at sustaining national economies. These policies include measures on the expenditure (e.g., higher healthcare spending, short-time work benefits) or revenue (e.g., tax deferrals) side of the budget, and specific measures for particular sectors or regions of the economy. Besides fiscal policies, EA countries have focused on the adoption of COVID19-related measures such as lockdown of cities, border closures, and health policies to slow and stop the pandemic. To investigate the effects of this pandemic on stock market behaviors in the EA, we employ a panel regression approach. Our study investigates the link between the behavior of stock market indices and the volatility index, the long-term bond yield, investors, and public attention to the topic of coronavirus, as measured by Google Trends, and measures explicitly related to the COVID-19 outbreak. In particular, we consider both economic and COVID-19-related policies implemented in the EA in the period from January 1, 2020, to May, 17th, 2020.

The remainder of the paper is organized as follows. Section 2 presents the data used in the analysis and the empirical methodology. Section 3 presents the econometric results. Finally, we offer concluding remarks in Section 4.

2. Methodology and data

2.1. *Fixed effects panel regression model*

To address our research question, we employ a panel data regression approach to identify the time-varying relationship between the dependent and independent variables, by controlling for country-specific characteristics. In particular, we estimate the following fixed effects (FE) model

$$\begin{aligned}\Delta Stockindex_{i,t} = \beta_0 + \beta_1 \Delta Bondyield_{i,t} + \beta_2 V2TX_t + \beta_3 \Delta GoogleTrends_{i,t} \\ + \beta_4 gTotal\_Cases + \beta_5 COVIDM_{i,t} + \beta_6 FiscPolicy_{i,t} + \epsilon_{i,t} + \alpha_i\end{aligned} \tag{1}$$

where $\Delta Stockindex_{i,t}$ is the closing price of the stock market index of country i in first differences at day t; $\Delta Bondyield_{i,t}$ is the daily bond yield in first differences; $V2TX_t$ is the daily volatility index for the whole Euro Area; $\Delta GoogleTrends_{i,t}$ is the daily Google trends for the word "coronavirus" in first differences and $COVIDM_{i,t}$ is a vector of COVID19-related measures implemented at the country level. $FiscPolicy$ is a dummy variable for the application of a fiscal or monetary policy of country i at day t; $gTotalCases$ represents the growth rate of the total number of COVID-19 infections of country i; $\epsilon_{i,t}$ is the error term and α_i denotes the unobserved time-invariant individual effect. A detailed description of variables is provided in Table 1.

2.2. *Variables, data sources and description*

In this section, we describe the variables used in our analysis and the data sources; they are summarized in Table 1.

Variable	Definition	Source
Stock index (EA)	Daily stock market indices for Euro Area countries	Yahoo finance, Investing.com, Onvista
dGoogleTrends	Search Volume Index (SVI) for the word "coronavirus"	GoogleTrends
dbondyield	Long term government bond yields	Eurostat
V2TX	EU volatility index	STOXX
gtotal_cases	Total number of infected people	CoronaNet Database
fiscpolicy	Fiscal policy measures	OECD, IMF
lockdownpolicies	Measures aimed at curbing public life	CoronaNet Database
Closure of Schools		
Curfew		
Declaration of emergency		
Quarantine		
Restriction and regulation of Businesses		
Restriction and regulation of government services		
Restriction of mass gatherings		
Public awareness campaigns		
Lockdown		
health	Health-related measures	CoronaNet Database
Health monitoring		
Health resources		
Health testing and hygiene		
moving	Measures aimed at mobility restriction	CoronaNet Database
External border restriction		
Internal border restrictions		

Table 1.: Variables definitions and data sources. All variables are considered in the period 01.01.2020-17.05.2020. Variables highlighted in bold are constructed by aggregating the variables listed below.

We use the data of the Euro Area stock market indices over the period from January 1st to May, 17th 2020. The sample is composed of 17 countries[1] and 1504 observations; data has been retrieved from Yahoo Finance, Onvista, and Investing.com. The list of countries included in the analysis and the respective index is reported in Table 2.

Country	Stock Market Index	Source
Austria	ATX	Yahoo finance
Belgium	Bel20	Yahoo finance
Cyprus	CYMAIN	Investing.com
Finland	OMX Helsinki 25	Yahoo finance
France	CAC40	Yahoo finance
Germany	DAX PERFORMANCE INDEX	Yahoo finance
Greece	FTSE/ATHEX/ large cap	Investing.com
Ireland	ISEQ	Yahoo finance
Italy	FTSE MIB	Investing.com
Latvia	OMX RIGA	Onvista
Lithuania	OMXVGI	Yahoo finance
Malta	MSE	Investing.com
Netherlands	AEX	Yahoo finance
Portugal	PSI 20	Investing.com
Slovakia	SAX	Investing.com
Slovenia	Blue-chip SBITOP	Investing.com
Spain	IBEX 35	Yahoo finance

Table 2.: List of countries and respective indices included in the analysis. Luxembourg and Estonia are not included due to unavailability of data.

The Google search volume index is accepted as a valuable measurement for investor attention and investor sentiment (see Da et al. 2011, among others). In our analysis, we considered the search frequency in Google for the word "coronavirus" in the period

[1]Estonia and Luxembourg were not included in the analysis due to unavailability of data for some crucial variables.

from January 1st to May, 17th 2020[2]. Figure 1 reports the behavior of the stock index for each country included in the analysis and the respective trends observed in volumes of search in Google. By observing the dynamics of the series, it is evident that the through of the index corresponds to a peak in Google trend series. Moreover, we see that there are some countries, such as Lithuania, Malta, Slovakia, and Slovenia, characterized by very low volatility of the stock market. Higher volatility is instead detected in Austria, Belgium, France, Germany, Greece, Italy, and Spain, which are indeed among the most affected countries in terms of infections and death rates (see discussion below).

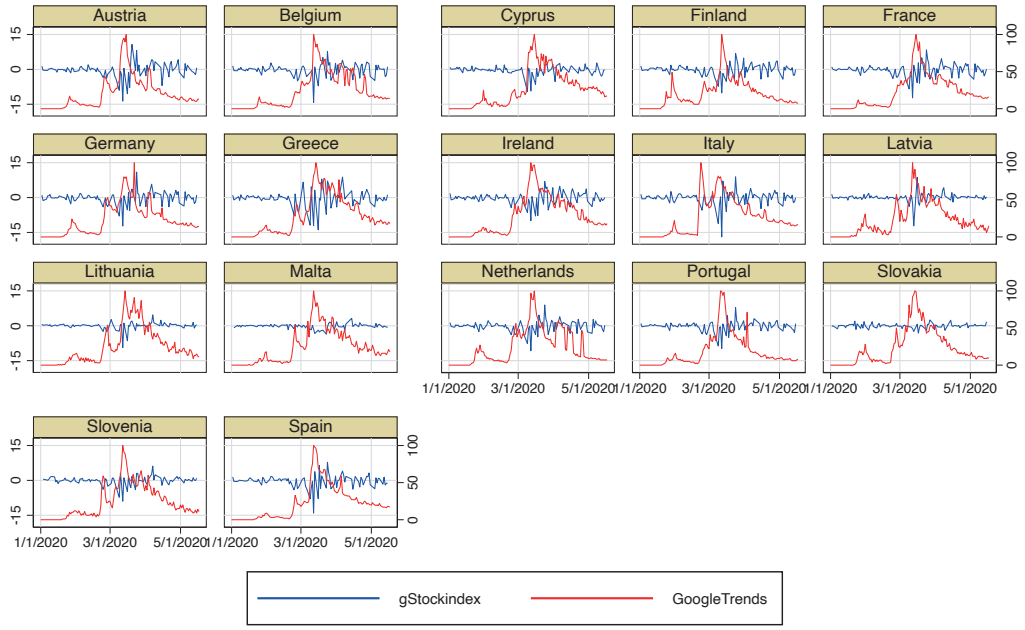

Figure 1.: EA stock indices and Google trends by country over the period 01.01.2020-17.05.2020. Source: Authors' elaboration

Bond yields data are retrieved from the Maastricht Treaty EMU convergence criterion series from Eurostat. The Maastricht Treaty EMU convergence criterion series relates to interest rates for long-term government bonds denominated in national currencies with a maturity of around ten years. Bond data is available daily for all countries of the EA except Estonia as there are no sovereign debt securities that are aligned with the definition of long-term interest rates for convergence purposes.

The variable V2TX indicates investor sentiment and overall economic uncertainty in the Euro Area. It is computed by measuring the 30-day implied volatility of the EURO STOXX 50 and is designed to reflect the market expectations of near-term up to long-term volatility by measuring the square root of the implied variance across

[2]The decision to use the word "coronavirus" derives from the inspection of Google trends in the EA. We found that this is the word most associated with the search of information related to the pandemic, both in the EA and worldwide. Moreover, when opting for the word "corona", we realized that we could have incurred in a biased analysis because it has a different meaning, for example, in the case of the Italian language. We also considered the Google trends for the word "Covid-19" and found that it scores very low in the search frequency.

all options of a given time to expiration. Also in this case, a peak is detected around mid-March.

Regarding the measures implemented at the country level, we considered the CoronaNet Database (Cheng et al. 2020). The database is related to the CoronaNet Research Project, which aimed at collecting government responses to the coronavirus from more than 190 countries since January 1st, 2020. The data include more than 10,000 separate policy announcements and reports source links, descriptions, targets (i.e., other countries), the type and level of enforcement, and a comprehensive set of policy types. The data yields detailed information on (i) the level of government responding to the coronavirus crisis (e.g., national, regional/state, local/municipal); (ii) specific actions taken (e.g., travel bans, investments in the public health sector, etc.); (iii) geographical areas targeted by these measures; (4) who or what they are targeting (e.g., foreigners, ventilators); (v) compliance mechanisms (e.g., mandatory or voluntary); (vi) timing of policy responses. Data on COVID-19-related measures are included in the econometric analysis using three dummy variables, i.e., *lockdown*, *health*, and *moving*. Each dummy is constructed by aggregating different variables contained in the CoronaNet Database, as shown in Table 1.
We considered also fiscal policy announcements at the country level. This data has been retrieved from IMF (2020) and OECD (2020). The review of fiscal policies took into account the economic responses governments are taking to limit the human and economic impact of the COVID-19 pandemic. They include (i) additional government spending (such as medical resources, keeping people employed, subsidizing SMEs, public investment) and foregone revenues (such as the cancellation of certain taxes and social security contributions); (ii) deferred tax payments; (iii) export guarantees, liquidity assistance, credit lines through national development banks. The comparison with the number of COVID-19-related policies announced in the same period shows that the countries that have implemented the highest number of COVID-19-related measures are Finland and Portugal, followed by Ireland and Italy. Fiscal policy measures were announced in all countries; the highest number of announcements have been recorded in the Netherlands, Spain, France and Greece. Finally, we considered also the total number of infected people; the most affected countries in the months analyzed are Italy and Spain, followed by Germany and France.

Table 3 reports the descriptive statistics of the variables mentioned above. It should be noted that large differences between the minimum and the maximum value of the variable Stock index are caused due to different construction methods of the country-specific stock indices. Figure 1 shows the country-specific stock indices and the Google Trends data for the word "coronavirus" by country between 01.01.2020 and 17.05.2020 and provides a clearer picture of how financial markets are affected by the COVID-19 crisis. The figure shows that growth rates of stock market indices became much more volatile as investors became more aware of the spread of the coronavirus and vice versa.

3. Results

We applied a FE panel regression to study the effects of COVID-19-related policies and fiscal policy announcements, movements in bond yields, stock market volatility, Google trends and infection rates on stock markets in the Euro Area.

Empirical results for the baseline setting are reported in Table 4. Column 1 shows the results performed by considering the aggregate categories of variables retrieved

Variable	Mean	Std. Dev.	Min.	Max.	N
Stockindex	4094.631	4796.981	28.5	25477.55	1575
bondyield	0.338	0.645	-0.85	4.15	1606
V2TX	32.94	19.682	10.69	85.621	1581
GoogleTrends	23.797	23.024	0	100	2346
total_cases	16508.562	44589.628	0	230698	2346
fiscpolicy	0.037	0.189	0	1	2346
lockdownpolicies	0.073	0.26	0	1	2346
health	0.041	0.199	0	1	2346
moving	0.028	0.165	0	1	2346

Table 3.: Summary statistics

from the CoronaNet Database. Columns 2-9 report estimation results for alternative model specifications. Finally, column 10 reports the results of the estimation by taking into account all COVID-19-related variables considered without aggregate them by category.

The analysis on the baseline setting shows that the stock market is affected by movements in the bond yields, the volatility index, Google trends, and the number of infections. The relationship between these variables and the dependent variable is negative and highly significant. In particular we observe that for one unit increase in the time variation of the bond yields, the stock market index is expected to decrease by 142.8 units, holding all other variables constant. Also lockdown policies have strong effects: for one unit increase in lockdown policies, the stock market index is expected to decrease by 45 units. Similarly, measures aimed at mobility restrictions have a negative relationship with the dependent variable and they are significant at 10% level. As expected, the announcement of policies related to improvements in the health sector[3] is positively correlated with the stock market behavior. Fiscal policies announcements are also characterized by a positive coefficient; it is however not significant. When comparing these results to alternative model specifications (see Columns 2-9), we find that they are robust.

Finally, we examine a specification of the model where all COVID-19-related measures contained in the CoronaNet database are considered without aggregating them by category. This step of the analysis allows us to disentangle the specific effects of individual measures. We start by looking at the signs and significance of bond yields, the volatility index, google trends, total cases, and fiscal policy announcements; they show the same magnitude and signs observed in the other model specifications. Moving to the individual measures, we observe that the measures that have a stronger negative impact (in terms of the magnitude of the coefficients) are mass gathering restrictions, internal border restrictions, followed by quarantine announcements. Concerning measures that instead of a positive and significant impact we notice health resources[4] (1% significance) and the restriction of non-essential government services. (10% significance).

[3]These policies include measures which affect the material (e.g., medical equipment, number of hospitals for public health) or human (e.g., doctors, nurses) health resources, government policies that seek to monitor the health of individuals who are afflicted with or who are likely to be afflicted with the coronavirus or policies which tries to sample large populations for coronavirus regardless of the suspected likelihood of affliction with coronavirus.

[4]Government policies which affect the material (e.g., medical equipment, number of hospitals for public health) or human (e.g., doctors, nurses) health resources of a country.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	dStockindex	dStockindex	dStockindex	dStockindex	dStockindex	dStockindex	dStockindex	dStockindex	dStockindex	dStockindex
dbondyield	-142.8***		-159.9***	-144.9***	-146.1***	-143.5***	-134.3***	-143.8***	-146.5***	-146.7***
	(-3.40)		(-3.86)	(-3.43)	(-3.47)	(-3.41)	(-3.20)	(-3.41)	(-3.48)	(-3.49)
V2TX	-0.673***	-0.822***		-0.541**	-0.819***	-0.625***	-0.844***	-0.605**	-0.724***	-0.780***
	(-2.77)	(-3.47)		(-2.24)	(-3.45)	(-2.64)	(-3.58)	(-2.49)	(-2.99)	(-3.24)
dGoogleTrends	-2.263***	-2.271***	-2.005***		-2.274***	-2.252***	-2.527***	-2.369***	-2.306***	-1.713***
	(-3.63)	(-3.70)	(-3.26)		(-3.64)	(-3.61)	(-4.09)	(-3.79)	(-3.69)	(-2.64)
gtotal_cases	-0.407**	-0.424***	-0.514***	-0.411**		-0.412**	-0.413**	-0.397**	-0.412**	-0.418***
	(-2.53)	(-2.67)	(-3.30)	(-2.55)		(-2.56)	(-2.56)	(-2.46)	(-2.56)	(-2.61)
fiscpolicy	17.15	20.29	4.199	15.68	18.82		18.08	20.04	17.46	21.13
	(0.85)	(1.03)	(0.22)	(0.78)	(0.93)		(0.90)	(0.99)	(0.87)	(1.05)
lockdownpolicies	-45.02***	-40.80**	-56.17***	-54.31***	-45.58***	-45.26***		-40.01**	-50.93***	
	(-2.73)	(-2.52)	(-3.55)	(-3.32)	(-2.76)	(-2.74)		(-2.43)	(-3.14)	
health	64.87***	62.22***	59.47***	69.09***	63.74***	65.70***	59.20***		59.97***	
	(3.08)	(3.00)	(2.84)	(3.27)	(3.02)	(3.12)	(2.82)		(2.86)	
moving	-45.47*	-46.95**	-52.94**	-48.52**	-46.31**	-45.63*	-57.37**	-36.76		
	(-1.93)	(-2.03)	(-2.27)	(-2.06)	(-1.97)	(-1.94)	(-2.48)	(-1.57)		
socialdistancing										-58.09
										(-1.61)
rest_nonessential_govt										103.2*
										(1.90)
rest_nonessential_bus										31.89
										(0.97)
rest_massgatherings										-107.6**
										(-2.55)
quarantine										-63.56**
										(-2.07)
publicawarenesscampaign										-29.45
										(-0.86)
otherpolicy										-0.838
										(-0.02)
newtaskforce										50.79
										(1.18)
lockdown										-27.22
										(-0.24)
internalborderrestrictions										-139.9***
										(-2.95)
hygiene										111.4
										(0.69)
healthtesting										33.65
										(0.67)
healthresources										84.76***
										(3.24)
healthmonitoring										-26.39
										(-0.59)
externalborderrestriction										28.93
										(1.10)
declarationofemergency										-43.93
										(-0.87)
curfew										-60.64
										(-0.72)
closureofschools										-54.37
										(-1.35)
_cons	14.14*	18.45**	-4.818	10.76	15.59*	13.46	16.59**	13.90*	14.88*	16.51**
	(1.70)	(2.27)	(-1.04)	(1.30)	(1.87)	(1.62)	(2.00)	(1.66)	(1.79)	(1.98)
N	1504	1555	1521	1504	1504	1504	1504	1504	1504	1504

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4.: Estimation results for Equation 1 and alternative model specifications.

4. Concluding remarks

COVID-19 has quickly emerged as a novel risk, generating feverish behavior among investors, and posing unprecedented challenges for policymakers.

By considering a novel database on COVID-19-related policies, our analysis shows that, besides having economic effects on GDP growth and inflation expectations of economic agents, as discussed in the rapidly emerging literature (see Guerrieri et al. 2020; del Rio-Chanona et al. 2020, among others), their effects also quickly spread to financial markets. Our paper contributes, on the one hand, to the literature on the effects of extreme events on financial markets; on the other hand, to the growing research on the impact of COVID-19 on stock markets. In particular, we take into account the announcements of fiscal and COVID-19-related policies and measure their effects on the stock market behavior.

Our analysis provides evidence for a significant negative effect of changes in bond yields, EU market volatility, and Google trends on financial markets' dynamics. Moreover, it emphasizes the role of COVID-19-related measures announced and implemented at EA country-level in the past five months. In particular, a significant role is played by the measures that concern the lockdown and mobility restriction; they have negatively affected the stock markets in the period under scrutiny. In contrast, policies related to improvements in the health sector have a significant positive effect on stock market movements. These results are robust across different model specifications.

Fiscal policy announcements do not matter in any of the settings considered in the analysis.

A sectoral analysis to investigate which assets have been, and are, more exposed to the COVID-19 shock in the Euro Area is beyond the scope of this study. Similarly, an analysis that also includes other countries such as the UK, US, China, or G20 countries would also be of particular interest to understand financial markets behaviors - and detect potential cross-country differences - in times of pandemic. We leave both analyses for future research.

References

Cheng, C., A. Barceló, Hartnett, R. Kubinec, and L. Messerschmidt (2020). Covid-19 government response event dataset (coronanet v1.0). *https://www.coronanet-project.org*.

Da, Z., J. Engelberg, and P. Gao (2011). In search of attention. *The Journal of Finance 66*(5), 1461–1499.

del Rio-Chanona, R. M., P. Mealy, A. Pichler, F. Lafond, and D. Farmer (2020). Supply and demand shocks in the covid-19 pandemic: An industry and occupation perspective. *arXiv preprint arXiv:2004.06759*.

Guerrieri, V., G. Lorenzoni, L. Straub, and I. Werning (2020). Macroeconomic implications of covid-19: Can negative supply shocks cause demand shortages? Technical report, National Bureau of Economic Research.

IMF (2020). Policy responses to covid-19-policy tracker. Technical report, International Monetary Fund.

OECD (2020). Key country policy tracker. Technical report, Organization for Economic Co-operation and Development.