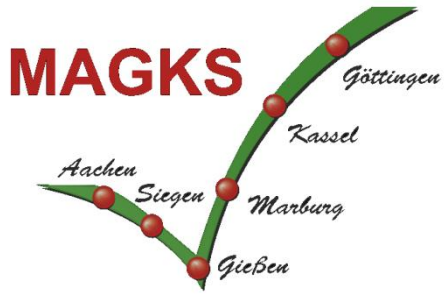

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COVID-19 and Financial Markets: A Panel Analysis for European Countries*

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Abstract

In order to fight the economic consequences of the COVID-19 pandemic, monetary and fiscal policy announced a large variety of support packages which are often unprecedented in size. In this paper, we provide an empirical analysis of the responses of European financial markets to these policy announcements. The key contribution is a very granular set of policy announcements, both at the national and the European level. We also differentiate between the first announcement in a series of policies and the subsequent announcements because the initial steps were often seen as bad news about the state of the economy. In a panel model we find that monetary policy, in particular through asset purchases, is effective in supporting the real economy and easing the pressure on governmental finances. Across all subsets of polices, it seems that monetary policy is more effective in supporting the stock market than national fiscal policy, though markets clearly distinguish between different types of policies.

Keywords: event study, announcements, fiscal policy, monetary policy, European Monetary Union

JEL classification: E44, E52, E62

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1 Introduction

The outbreak of the novel Coronavirus in China and East Asia at the beginning of 2020 forced authorities to take drastic measures to contain the spread of COVID-19. These measures led to a sharp reduction in economic activity. Initially, the economic fallout from the lockdown measures were mostly contained to Asian economies. This changed with the spread of the virus to the rest of the world in February and March 2020. Restrictions on cross-border travel, shelter-in-place orders and a reduction of public life to a minimum have a strong impact on economic activity. As a result, institutions such as the European Commission or the International Monetary Fund expect most advanced economies to enter the most severe recession since the Great Depression.[1] This economic burden comes on top of death toll and the global health impact.

In many economies, monetary and fiscal policy, both at the domestic level and the supra-national level, stepped in to support firms, financial institutions and households. Examples include European Central Bank's (ECB) Pandemic Emergency Purchase Programme (PEPP) worth 750 billion euro and the European Commission's SURE (Support mitigating Unemployment Risks in Emergency) program.

The aim of this paper is to provide an early assessment of the effectiveness of these policy measures. It is certainly too early to evaluate the transmission of rescue and stimulus packages to the real economy. For that we would need long data series on growth and employment. Instead, we conduct an event study using daily data and shed light on the response of financial markets to the announcement of those policies. We study the response of stock and bond markets. If markets believe the support packages to be effective, stock prices should rise on impact. If investors discount the future budgetary burden implied by fiscal stimulus measures, bond yields should increase. However, if markets believe a fiscal action to bring the economy back on a sustainable growth path, even declining bond yields are possible.

We restrict the analysis to a large set of European countries. Across Europe, the outbreak of COVID-19 has not been perfectly synchronized. Thus, there is a great variation of national fiscal policy responses to the crisis. In addition, there are supra-national policy responses from the ECB, the European Commission and the Eurogroup. This allows us to assess the relative effectiveness of national versus supra-national policy steps. We estimate a number of panel regressions with daily stock returns and changes in government bond yields. To explain the adjustment

[1] See https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-forecasts/spring-2020-economic-forecast-deep-and-uneven-recession-uncertain-recovery_en and https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020.

of financial markets, we construct a number of dummy variables that reflect the different layers of policy responses. We measure the reduction of economic activity with data from the Google Community Movement Report that tracks the decline in mobility patterns relative to normal.

As the key contribution, this paper uses a detailed data set of policy announcements. In particular, we allow for announcements of monetary policy, national fiscal policy and fiscal policy at the European level. We further split these policies into different branches of policies. For example, we allow for announcement of asset purchases by the central bank and relaxations in banks' access to refinancing through the central banks to have different coefficients. Furthermore, the market response to fiscal stimulus packages might be different to the reception of news about liquidity assistance programs. The temporal suspension of the restrictions implied by the Stability and Growth Pact (SGP) among euro area countries is likely to affect markets differently from the news about the European Commissions stimulus package. We believe that this disaggregation is important to take account of the vast variety of different policy initiatives. Many announcements are coded as a 0/1 dummy variable. If possible, however, we use the size of the program relative to GDP as the explanatory variable. For the asset purchase program of the ECB, which stipulates purchases according to the capital key, announcements are coded as a country's capital key in order to prevent the program having the same magnitude for Estonia and Germany, for example.

Another important contribution is that we differentiate between the first announcement in a series of policy steps and the subsequent announcements. The reason is that the response to the first announcement might be dominated by the revelation of private information through the policy step. For example, a surprise ECB announcement about unconventional policies could be interpreted in terms of an informational advantage of the ECB relative to market participants. If investors update their beliefs about the state of the economy, stock prices could fall rather than increase.

Finally, we include interacting terms in order to account for the heterogeneity across the sample countries. We let policy announcements interact with the growth rate of COVID-19 cases. This allows us to show that countries heavily affected by the disease respond differently from countries with moderate growth rates of cases.

Our findings can be summarized as follows: First, markets are sensitive to the number of COVID-19 infections. After controlling for the lockdown measures, stock prices fall and bond yields increase if the growth rate of infections increases.

Second, we find that monetary policy is effective in supporting the real economy

and easing the pressure on governmental finances. Announcements of asset purchase programs raise stock returns and reduce bond yields. The first in a series of purchase announcements signals private information of the central bank about the state of the economy. Hence, stocks fall after the first announcement but increase after subsequent announcements.

Third, fiscal announcements raise stock prices. For instance, tax-deferrals are particularly effective. Furthermore, we find that the impact of fiscal policy on national stock markets falls in the growth rate of COVID-19 cases. Hence, the transmission to stock markets is weaker for economies, which are relatively more affected by the virus. Across all subsets of polices, it seems that monetary policy is more effective in supporting the stock market than national fiscal policy. Bond yields increase after expansionary fiscal policy announcements. This is mostly driven by liquidity assistance programs. Hence, investors anticipate the implied future strain on government budgets. Once we allow for interaction terms, we find that the effect of domestic fiscal policy is heterogeneous across countries: countries with a low growth rate of COVID-19 cases benefit from fiscal policy in terms of lower bond yields. In contrast, countries most affected by the virus experience an increase in yields.

Third, the stimulus package announcement by the European Commission was accompanied by a strong drop in equity prices and a sharp increase in yields. Markets seem disappointed about both the design and the scope of the package. For stock prices, the single most effective measure at the European level is the suspension of the constraints implied by the Stability and Growth Pact. Following this announcement, stock prices increase by four percent. The same announcement, however, raises bond yields in the subset euro area countries as markets anticipate the drop in fiscal discipline.

Fourth, we find that monetary announcements that occur simultaneously to fiscal announcements are particularly powerful in boosting stock prices and reducing bond yields. Likewise, expansionary announcements of national fiscal policy that coincide with announcements of fiscal policy at the European level are particularly effective.

Our analysis is closely related to a small number of other recent studies on the financial market impact of COVID-19. Baker et al. (2020) construct an index of newspaper reporting on infectious diseases that covers not just COVID-19, but also previous episodes such as the SARS epidemic. The index has a strong effect on U.S. stock markets, but only since February 2020. Previous diseases, in contrast, left equity markets unaffected. Alfaro et al. (2020) study the sensitivity of the U.S. equity market to the Corona crisis, but also to other crises such as the SARS pandemic. They show that the number of infections has forecasting power for stock

returns.

In the early stage of the pandemic, firms should have been more affected if they were more exposed to the global economy, in particular to China. Ramelli and Wagner (2020) use U.S. data and show that stock prices are indeed more sensitive to news about the spread of the pandemic when global exposure is high.

Ettmeier et al. (2020) study the impact of the pandemic on corporate bond yields in the main European economies. They estimate a term structure model to obtain corporate bond yields for different maturities. The spread of COVID-19 is shown to affect long-term rates, implying that the economic consequences are considered long-lasting. Policy interventions reduce firms' refinancing conditions if they are coordinated across governments or when there is coordination between monetary and fiscal policy.

The paper most closely related to our contribution is Heyden and Heyden (2020). The authors study the response of stock prices in Europe and the U.S. to news about Corona deaths and monetary and fiscal policy measures. They find that stock prices fall on the day the first COVID-19 victim is in the news. Monetary policy contributes to an increase in stock prices, while fiscal policy tends to lower prices. It should be stressed that for each country the authors use the first policy measure only. Many countries, however, implemented a series of monetary and fiscal support steps ranging from liquidity support over stimulus measures in terms of asset purchases or interest rate cuts to the introduction of short-term work. Some of these measures might be more effective than others, which is why we employ a set of disaggregated policy indicators. In addition, the very first policy step could be considered a signal of how bad the situation is, while the subsequent policy steps are more likely to be effective in stabilizing the economy. For this purpose, we use the entire sequence of policies adopted in order to gauge the market responses. Furthermore, the analysis in Heyden and Heyden (2020) does not include supra-national policy packages, which are important for member countries of the European Union or the euro area, respectively.

The remainder of the paper is organized as follows: Section two explains the data set. Section three introduces the panel model, while the results are discussed in Section four. Section five provides concluding remarks and policy implications.

2 Data

In this section, we introduce the large data set that is the basis for our empirical analysis.

The sample period is February 17, 2020 to April 24, 2020 and the data frequency is daily for a five day week (Monday to Friday). We include 29 countries, 26 member countries of the European Union plus the United Kingdom Norway and Switzerland. We dropped Cyprus for reasons of data availability. Hence, the sample countries are Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Lithuania, Latvia, Luxembourg, Malta, Netherlands, Austria, Portugal, Slovenia, Slovakia, Finland, Denmark, Sweden, Poland, Czech Republic, Hungary, Croatia, Bulgaria, Romania, Norway, Switzerland and the UK.

As the dependent variable, we use either stock prices or bond yields. For each country, we obtain the leading national stock price index and the yield on 10-year government bonds. The daily change in the stock price index (in percent) and the bond yield (in percentage points) is used in the estimations. All series are drawn from Thomson Reuters. Figure (1) shows the normalized levels of stock prices and 10-year bond yields. We see that stock prices drop sharply beginning in mid March. The response of bond yields, however, is much more heterogeneous across countries. Figure (2) shows the cross-sectional standard deviations of stock market returns and yield changes. The graph shows a large variation of both variables across countries, most notably when the virus hit most European economies in March.

As independent variables we make use of different categories:

First, to estimate the impact of COVID-19, we use the log-differences of the confirmed COVID cases in line with Alfaro et al. (2020). The difference used is always between days $t-1$ and $t-2$ because these are the confirmed COVID cases in real time and, thus, form the basis for decisions on the financial markets. Our dependent variables consist of daily data on weekdays only. Given that COVID cases also increase on weekends though, we decide to use the average log-difference over those three days as the measure between Friday and Monday. This is even more justified as in some countries testing and reporting of COVID cases is substantially lower on weekends while the omitted cases are normally added to the reports on Monday. Moreover, we also us the very same method with respect to the number of COVID deaths. However, this regressor performed poorly in the estimation, possibly because it does not contain any new information. This is because it is informative about the number of COVID-19 cases lagged two weeks.[2] For the number of Corona cases in each country, we use the series `confirmedcases` from the Oxford-based Coronavirus Government Response Tracker[3] and add data of confirmed cases from https://www.worldometers.info/coronavirus/ to fill the remaining gaps. In general,

[2]Of course, this does not mean that all confirmed COVID cases lead to deaths within a two week period, but rather that the trends are similar.

[3]See https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker.

both data sources provide rather similar results. With those data we compute two different measures of COVID cases. First, the log-difference of the COVID cases in the respective country, `Covid-Cases`, and, second, the log-difference in COVID cases in the rest of the world, `Covid-Cases-World`, which are computed as the difference between the confirmed cases in the world minus the cases in the respective country. Besides the log-difference, we add another variable which is the first difference of the log-difference. This measure gives an indication whether 'flattening the curve' of COVID growth cases has an impact on financial variables.

Second, we identify policy events in three different categories: monetary events, fiscal events and (European) fiscal events. Our first empirical strategy is to use dummy variables taking a value of 1 for every announcement date and 0 otherwise. We also correct for the time of the announcement. When an announcement was made after markets closed, we assign the event dummy to the next trading day. One example is the ECB's announcement of the PEPP, which was made on March 18 close to midnight. The announcement could not have influenced stock prices and bond yields before March 19. It should be noted that all policy measures appear to be expansionary, irrespectively of the category chosen. The only exception may be the interest rate hike in the deposit rate from -0.25% to -0.1% by Danmarks Nationalbank on March 19. However, this measure was introduced with additional refinancing operations, which should have a larger effect. Hence, we do not need to distinguish between positive and negative announcements. Moreover, for all three event groups we add an interaction term with the growth rate of COVID-19 cases, checking whether the effectiveness of policy measures varies with the extent to which the countries are faced with the pandemic.

In addition to this broad categorization, we disentangle the events in each category into different groups: for the `Monetary-Events`, we built four subcategories, which are `Additional`, `Purchases`, `Rate` and `Refinancing`. `Additional` accounts for any monetary policy announcement made which does not belong to the other three subcategories. Typical examples in this respect are the easing of collateral constraints or a reduction in required reserves by central banks. Since the details of those announcements vary widely, they are implemented as 0/1 dummies. `Purchases` cover all announcements concerning the introduction or expansion of purchase programs. Since those programs are typically announced by referencing to the size of the program, we compute this variable as the effective economic impact, which is the size of the program relative to real GDP in 2019. This is in line with calculations of fiscal events by Bruegel.[4] Note that purchase programs announced by the ECB are as-

[4]See https://www.bruegel.org/publications/datasets/covid-national-dataset/.

sumed to be equally distributed among the euro area countries based on the capital key of the ECB. This is what is announced for the expansion of the Public Sector Purchase Programme (PSPP) and the introduction of the PEPP. Since Greek bonds are not bought under the PSPP, the respective enlargement of this program is not included as an event for Greece.

`Rate` covers all key interest rate changes by central banks. This measure is introduced as the change of interest rates in percentage points. `Refinancing` covers all announcements of additional refinancing operations by central banks. Since the actual take-up of funds is unknown at the time of the announcement, this variable is constructed as a 0/1 dummy.

(National) fiscal events, `Fiscal-Events`, are also divided into four subcategories: `Deferrals`, `Impulse`, `Liquidity` and `Shorttime`. `Deferrals` contain mainly tax-postponements in order to temporarily reduce the tax-burden of companies or households. Since the actual use of those deferrals is ultimately determined by the private sector, this variable is introduced as a 0/1 dummy. `Impulse` measures all economic stimulus given by governments. These can broadly take the form of either tax reductions or increased government expenditures. Since the size of those programs is generally well communicated by the governments, we use the size relative to GDP in 2019. `Liquidity` is measured by credit or guarantees to the private sector given by the fiscal authorities. Thus, it is different from impulses as liquidity support has to be repaid and is temporary. Besides, we also take the size of the measure relative to GDP in 2019. The variable `Shorttime` indicates whether the respective country has introduced or expanded some kind of short-term working scheme in the Corona crisis. Since at the time of the announcement the actual demand and, thus, the costs for the scheme are unknown, this variable is introduced as a 0/1 dummy.

The European fiscal events, `Fiscal-EU`, are subdivided into three categories, namely `Impulse`, `Liquidity` and `SGP`. `Impulse` and `Liquidity` are constructed in the same fashion as for the national fiscal events. For the respective contribution of the European events on national levels, we categorize the events as being conducted by the European Union or the Eurogroup. While the prior affects all EU-countries, the latter affects only those being also part of the monetary union. The size of these events is determined by the relative size of a country as given by its share in GDP in 2019. This being said, there are no European events for the three non-EU countries in our sample (Norway, Switzerland and United Kingdom). `SGP` is a 0/1 dummy covering the effect of the announcement of the temporary suspension of the Stability and Growth Pact (SGP) by the European Commission.

Table (1) provides the number of events across countries and across event categories.

All in all, we identify 427 events in the various categories. Please note, however, that several events could occur on the same day when governments or central banks announce a package of different measures at the same time. We see that the number of events is relatively equally distributed among countries with a mean of 14, a maximum of 19 and a minimum of 9 events. Moreover, with one exception being the interest rate rate changes by the central bank, we find a sufficient number of events in almost all categories. The exception is due to the fact that the ECB did not change its key interest rate in the sample period.

Figure (3) shows the distribution of the event dates divided into the three broad categories. We see that the events are concentrated in mid to end of March. However, some important European and monetary events also occur in April. Note that the announcements by the European Commission, the Eurogroup or the ECB are recorded as events in several countries in our sample.

Third, in order to account for the reduction in economic activity due to lockdown measures by the government or simply the fear of people getting infected with the Coronavirus when leaving their homes, we use data from the Google Community Mobility Report as a summary statistic that is available at https://www.google.com/covid19/mobility/. The data, which is using information from Google products such as Google Maps, reports the reduction in movement trends over time relative to a baseline case, broken down into different fields. We use the mobility indicators for the following fields: Transit Stations, Workplaces and Residential.[5] However, we do not use this index in our estimation but rely on the very same procedure as for COVID cases. In other words, we take the log-differences of the index while the respective value for period t is always the difference between $t-1$ and $t-2$.

Finally, we also add US-monetary policy events with the very same subcategories as for the monetary events explained above. The reasoning is that i.e. global stock markets are frequently influenced by US-monetary policy.

3 A panel model

We estimate a standard panel model with country fixed effects. The dependent variable, $\Delta y_{t,i}$, is either the percentage change of the leading stock market index (in percent) or the change in the yield on a 10-year government bond (in percentage

[5]Three more categories would have been available with Grocery, Parks and Retail. However, we do not believe that those are good indicators to measure economic activity, i.e. that those contain additional information not present in the data of the three categories we use.

points) of country i at time t. The estimated model is

$$\Delta y_{t,i} = c_i + \boldsymbol{\beta_1 C_{t,i}} + \boldsymbol{\beta_2 X_{t,i}^{mon}} + \boldsymbol{\beta_3 X_{t,i}^{fis}} + \boldsymbol{\beta_4 X_t^{EUfis}} + \boldsymbol{\beta_5 X_t^{Fed}} + \boldsymbol{\beta_6 X_{t,i}^{lock}} + \varepsilon_{t,i}, \quad (1)$$

where c_i is the country fixed effect. We include six sets of explanatory variables. The vector $\boldsymbol{C_{t,i}}$ captures information on the growth rate of COVID-19 cases, both at home and in the rest of the world. The other vectors collect the policy announcements discussed in the previous section. The first, denoted as $\boldsymbol{X_{t,i}^{mon}}$, summarizes the announcement of the different monetary policy measures introduced before. Announcements of fiscal policy at the national (European) level are summarized by $\boldsymbol{X_{t,i}^{fis}}$ ($\boldsymbol{X_t^{EUfis}}$). The announcements of the Federal Reserve are included in the vector $\boldsymbol{X_t^{Fed}}$, while the Google Mobility Report data summarizing the effective lockdown is denoted as $\boldsymbol{X_{t,i}^{lock}}$. The $\boldsymbol{\beta}$ vectors summarize the estimated coefficients. Asset markets should respond to unanticipated news only. To interpret the regression coefficients in terms of the impact of policy, we need to assume that the growth rate COVID-19 cases as well as the policy announcements were unexpected. Given the extraordinary nature of the crisis, this assumption does not seem to be too restrictive. In fact, many of the policies came as a surprise, both with respect to the timing of the announcements and the scope of the scope of the policy measures. For example, the ECB decision to implement the €750 billion PEPP was announced after an unscheduled meeting of the Governing Council on March 18.

4 Results

We report the results for two dependent variables, namely the daily percentage change in the leading stock price index and the daily change in 10-year bond yields.

4.1 The response of stock prices

Table (2) shows the estimated coefficients for the panel model on the stock market. We report estimates from different specification with a varying degree of granularity of policy measures. We also allow for interaction terms between the three branches of policy, i.e. monetary, domestic fiscal and European fiscal, and the growth rate of COVID-19 cases. Hence, we are interested in whether the effectiveness of policies varies with the extent countries are affected by the Coronavirus. The inclusion of interaction terms allows us to, at least partially, account for the heterogeneity of the responses across the sample countries.

All five specifications include information on the growth rate of the domestic and

global COVID-19 cases. For all five models, the estimated coefficient on the growth rate of domestic cases is negative and highly statistically significant. A larger increase in the reported COVID-19 cases reduces the stock market valuation. The change in the growth rate, however, remains insignificant. The global number of cases enters with a positive sign, which is puzzling at first sight. However, the change in the growth rate of the global number of cases has a highly significant negative coefficient, which is large in absolute magnitude. Stock prices fall strongly if the global growth rate of COVID-19 cases accelerates.

All five estimated models contain the three Google Mobility indicators that summarize the effectiveness of the lockdown measures as mentioned before. The more people stay at home, the higher is the `Google-Residential` indicator and, thus, the lower the stock price. The `Google-Transit` variable, however, enters with a negative coefficient, suggesting that less mobility measured on train stations, for example, raises stock prices. The third category, `Google-Workplace` enters with an insignificant coefficient. The increase in activity at home as measured by the `Google-Residential` indicator is of course inversely related to activity at the workplace, such that the latter does not contain additional information.

In general, the marginal impact of the lockdown measures appears limited as most coefficients are insignificant across the five alternative specifications. A possible reason for this is that the reported number of COVID-19 cases already summarizes the information about the severity of the crisis investors are most sensitive to.

In the first column, we differentiate only between monetary and domestic fiscal events as well as fiscal events at the European level. Neither of the coefficients is statistically different from zero. This finding supports the need to dis-aggregate the policy measures in order to shed light on subsets of policies.

With interaction terms, see column II, broadly defined fiscal events now enter with a positive sign. However, a larger growth rate of COVID-19 cases reduces the effectiveness of fiscal policy. Hence, fiscal policy was most supportive for member countries with a relatively low growth rate of Corona cases.

In the third column, we split monetary, fiscal and European fiscal events into the subcategories introduced in the previous section. Announcements of asset purchases by the central bank have the expected positive sign. Likewise, other types of policy events, which we summarize by the variable `Monetary-Additional`, have the expected positive sign. An announcement of a policy initiative in this category raises stock prices by 1.6 percent. Changes in the requirements for refinancing operations have a negative sign, which is counter-intuitive. National fiscal policy is mostly ineffective in driving stock prices. All types of fiscal policy, remain insignificant or

have the wrong sign.

Fiscal stimulus measures at the European level also enter with a large negative sign. The negative sign could reflect the fact that markets were disappointed by the design or the volume of the fiscal impulses. This is also consistent with the response of bond yield changes presented below, which increase by 0.4pp when the European stimulus measures were announced. Stock prices are most sensitive to the announcement that the European Commission suspends the SGP. Upon this announcement, stock prices increase by four percent on average. Market participants were clearly focused on the constraints imposed by the SGP, such that a relaxation of these constraints boosts equity markets.

An announcement of a drastic policy step, either monetary or fiscal, could also be interpreted as a signal about the state of the economy. Suppose markets are incompletely informed about the true state of the economy. A drastic rate cut by the central bank could reveal private information of the central bank suggesting that the situation is worse than expected. Jarocinski and Karadi (2020) introduced this notion of information shocks into the literature. If the information component of an expansionary announcement dominates the policy component, the effect could become negative such that stock prices fall. In the panel framework, we cannot differentiate between information shocks and policy surprises.

Instead, we differentiate between the first announcement of each policy type and the subsequent announcements. This captures the notion that the first fiscal or monetary measure is likely to be dominated by the information component. Hence, if the sign of the coefficient on the first step is different from the sign of the coefficient on the subsequent measures, information shocks could be important.

The fourth column reports the extended model which accounts for information effects. We find that the information shock matters for announcements of asset purchases by the central bank. The initial announcement has a negative impact on the stock market, suggesting that investors updated their information set and adjusted to the negative news about the economic situation. Subsequent announcements have the expected positive sign.

For most other measures, the distinction between the first and the remaining measures does not seem to play an important role. The only exception is the coefficient on `Fiscal-Deferrals`, which is significantly positive once we control for the first announcement of this kind. The stock market valuation increase if fiscal policy temporarily reduce the tax burden of the private sector.

Finally, the fifth column of the table reports estimates for a model that is augmented by announcements of the U.S. Federal Reserve (Fed). The first three categories

of U.S. monetary policy enter with a negative and significant coefficient. Hence, European stock prices fall when the Fed cuts the Federal funds rate. Only the fourth category, `Monetary-US-Refinancing`, enters with the expected positive sign. One explanation of this counter-intuitive finding is that information effects, similar to the effects described before, change the sign of the coefficients. If the Fed decision reflects a deterioration of economic activity in the U.S., stocks in Europe should fall. All other coefficients remain broadly unchanged when U.S. policy responses are included.

4.2 The response of bond yields

We now turn to the results for the change in 10-year bond yields as the dependent variable. Table (3) reports all estimated coefficients. An increase in the number of COVID-19 cases raises bond yields, suggesting that investors anticipate future fiscal burdens associated with the pandemic. The change in the growth rate of cases, however, has a negative coefficient. An acceleration of the growth of Corona cases reduces yields, probably reflecting that monetary rescue packages become more likely if the spread of the virus gains momentum.

Broadly defined monetary events reduce bond yields. Hence, the expansionary policies of the ECB were effective in shifting the expected path of future short-term interest rates and effectively reducing the refinancing costs for governments. Among the different monetary events, it is predominantly the announcement of asset purchases that contributes to lower long-term interest rates. A relaxation of the refinancing measures, in contrast, increases interest rates.

Announcements of national fiscal policy raise yields. This is mostly driven by the announcements of national liquidity assistance programs. The results are consistent with the view that investors predominantly see the fiscal burden rather than the stimulating impact on the economy as the main consequence of the expansionary fiscal policy steps. Before the outbreak of COVID-19, several countries suffered from elevated levels of government debt. The consequences of the drop in economic activity and the fiscal support packages contribute to the rising debt burden. Investors charge higher interest in order to be willing to hold long-term government bonds. We also see that the increase in borrowing costs of governments is driven by countries which are strongly affected by the virus. This is because once we allow for an interaction between national fiscal policy and the growth rate of COVID-19 cases, the coefficient on the interaction term is significantly positive, while fiscal policy as such is no longer significant.

Once we disentangle the national fiscal policies into subcategories, however, we find

that fiscal stimulus measures reduce bond yields. Hence, the stimulus packages are effective in relaxing financial conditions. In contrast, the announcement of the European stimulus package contributes to higher sovereign bond yields. The coefficient on `Fiscal-EU-Impulse` is positive and highly significant. Markets seem to be aware of the long-term budgetary consequences of stimulus announcements, such that interest rates increase.

We find again that announcements of the Fed enter with an unexpected sign. When the Fed announced the purchase of assets, European bond yields rise. All lockdown variables remain insignificant.

Taken together, the results suggest that purchase programs of the central bank are the single most effective instrument during the Corona pandemic. These announcements raise stock prices and reduce bond yields across almost all specifications. Likewise, fiscal stimulus measures reduce long-term interest rates. However, the effect of other fiscal policy measures, both domestic and at the European level, remains limited. The reason could be that investors (i) were disappointed by the size of the fiscal policy responses or (ii) discount future refinancing needs of European governments.

4.3 Subsamples

We now present results for subsets of countries. The first subset of countries is the group of member countries of the euro area. The second subset is restricted to relatively large countries irrespective of their membership to the euro area or EU. Dropping smaller countries of the sample, for instance the Baltic countries, raises the liquidity of the average sample country and narrows the analysis to countries with better data availability. As a cut-off value, we use a level of GDP in 2019 of more than 100 billion euro. Thus, we end up with 20 countries in this subset being Belgium, Germany, Ireland, Greece, Spain, France, Italy, Netherlands, Austria, Portugal, Finland, Denmark, Sweden, Poland, Czech Republic, Hungary, Romania, Norway, Switzerland and the UK.

Table (4) presents the estimated coefficients when we narrow the set of countries to euro area member countries.[6] Most of the results discussed before remain valid. ECB announcements summarized by the variables `Monetary-Additional` and `Monetary-Purchase` remain supportive for the stock market. The only notable difference with respect to the baseline findings is that monetary announcements lead

[6]The row with the first policy measure is left blank if the first announcement was not associated with this category or when there is only one announcement in this category. Furthermore, there are no coefficients on the `Monetary-Rate` variable since the ECB did not change interest rates in the sample period.

to a drop in stock prices for particularly strongly affected economies. Fiscal policy, in particular a policy easing implemented through deferrals of tax payments, raises stock prices. The increase in activity at home due to the lockdown measures as reflected by the Google indicators now enters with the expected negative coefficient in all five specifications, thus contributing to the fall in stock prices.

The corresponding results for the change in bond yields are reported in Table (5). The results are consistent with the findings for stock prices: once we allow for interaction terms, domestic fiscal announcements lower bond yields, but less so for more affected countries. Fiscal policies announced at the level of the European Union, in particular the stimulus measures, raise bond yields. Markets seem to be aware that the relaxation of the constraints imposed through the SGP eventually lead to a larger fiscal burden, such that European bond yields increase. This stands in contrast to domestic stimulus announcements, which lower governments' borrowing costs.

Lastly, we estimate the model for relatively large economies only. Table (6) reports the estimated coefficients of the model when the stock market return is the dependent variable. Again, fiscal announcements contribute to a higher stock market valuation, with the effects falling in the growth rate of COVID-19 cases. The remaining coefficients do not change much with respect to the baseline results. Fiscal events reduce long-term bond yields, see Table (7). However, the effect depends on the growth rate of cases. The coefficient on the announcements is -0.02. The coefficient on the interaction between announcements and the growth rate of cases is 0.003. Hence, bond yields will rise rather than fall for countries with a growth rate of COVID-19 cases of more than 7%.

4.4 Simultaneous events

Finally, we turn to the issue of simultaneous policy events in two of our broad categories.[7] Therefore, we interact the monetary, fiscal and European events with each other. We end up with three interaction terms, `Monetary-Events` × `Fiscal-Events`, `Monetary-Events` × `Fiscal-EU` and `Fiscal-Events` × `Fiscal-EU`. For each of the three pairs, there are 14, 1 and 10 events, respectively, which occur simultaneously for our sample including all 29 countries.[8]

Table (8) presents the results for stock market returns, government bond yields and the three different selections of sample countries included. In general, the coefficients

[7] Please note, that there is not a single day where three events occurred for one country.

[8] For the sample including only euro area countries, there is no simultaneous event for `Monetary-Events` × `Fiscal-EU`. Therefore, no estimates can be presented in this case.

with respect to the COVID-19 cases and Google Mobility indices remain broadly unchanged compared to the results presented in the previous sections.
When it comes to the response of stock markets returns, it appears that simultaneous events indeed boost stock prices. This holds especially for fiscal-events occurring jointly with either monetary- or European-events. In this case, stock prices rise by about 2.5 percent. Since simultaneous events exhibit a positive influence on stock prices, it does not come as a surprise that single events are now found to have an even lower coefficient.
For government bond yields, the response is reversed compared to the stock reaction. For monetary-events which take place on the same day with either fiscal- or European-events, the yields are substantially lowered, meaning that if fiscal policies are accommodated by monetary policy, this lowers refinancing costs for governments. This being said, the estimates for the single events are now found to have larger coefficients compared to the previous tables.

5 Conclusions

Governments and central banks responded to the economic consequences of the Corona pandemic with a variety of policy measures. Fiscal policy, both at the national level and the European level, and monetary policy implemented stimulus packages and announced emergency assistance unprecedented in scope and size. In this paper, we study the response of financial markets to policy announcements following the outbreak of the pandemic. The key contribution of this paper is a broad, disaggregated set of policy announcements, which we use as explanatory variables in a panel model for European countries.
Markets respond to the evolution of COVID-19 cases with a drop in stock prices and an increase in government bond yields. We find that some, but not all, measures were effective in calming financial markets. Hence, investors distinguish between policy announcements. The effects of policy on asset prices depend on the exposure of countries to the Corona pandemic. A country which is afflicted with a high growth rate of Corona cases could experience an increase in bond yields on days of a fiscal policy announcement, while the same announcement leaves yields of less-affected countries unchanged.
At the time of writing, it appears that the economic costs of fighting the virus, i.e. the drop in income and employment, are different across countries. While this paper studied announcement effects on short-term financial variables only, it remains to be seen whether the policy measures are effective in stabilizing the real economy.

References

[1] Alfaro, L. A. Chari, A. N. Greenland and P. K. Schott (2020): "Aggregate and firm-level stock returns during pandemics, in real time", *NBER Working Paper*, No. 26950, National Bureau of Economic Research.

[2] Baker, S. R., N. Bloom, S. J. Davis, K. Kost, M. Sammon and T. Viratyosin (2020): "The unprecedented stock market reaction to COVID-19", *unpublished*.

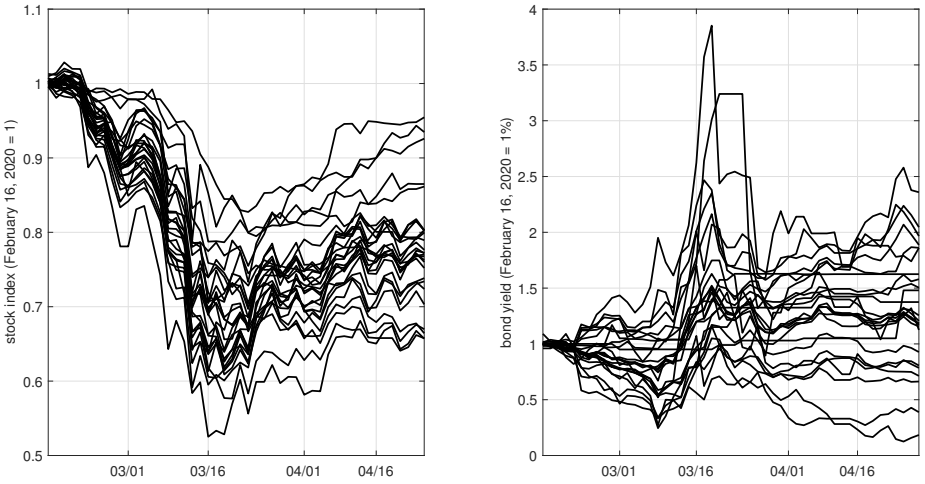
[3] Ettmeier, S., C. H. Kim and A. Kriwoluzky (2020): "Financial market participants expect the Coronavirus Pandemic to have long-lasting economic impact in Europe", *DIW Weekly Report* 19+20, 2020, Deutsches Institut für Wirtschaftsforschung.

[4] Heyden, K. J. and T. Heyden (2020): "Market reactions to the arrival and containment of COVID-19: an event study", *unpublished*, University of Giessen.

[5] Jarocinski, M. and P. Karadi (2020): "Deconstructing monetary policy surprises - the role of information shocks", *American Economic Journal: Macroeconomics* 12, 1-43.

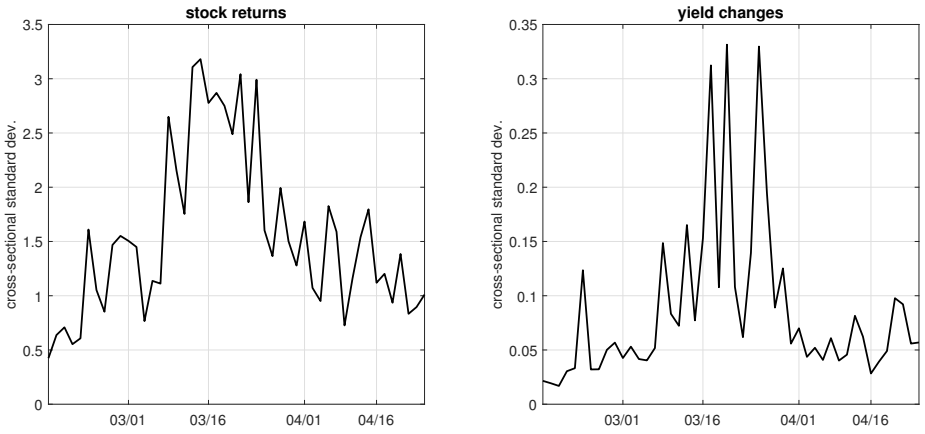
[6] Ramelli, S. and A. F. Wagner (2020): "Feverish stock price reactions to COVID-19", *Research Paper Series* No. 20-12, Swiss Finance Institute.

Figure 1: Stock prices and bond yields



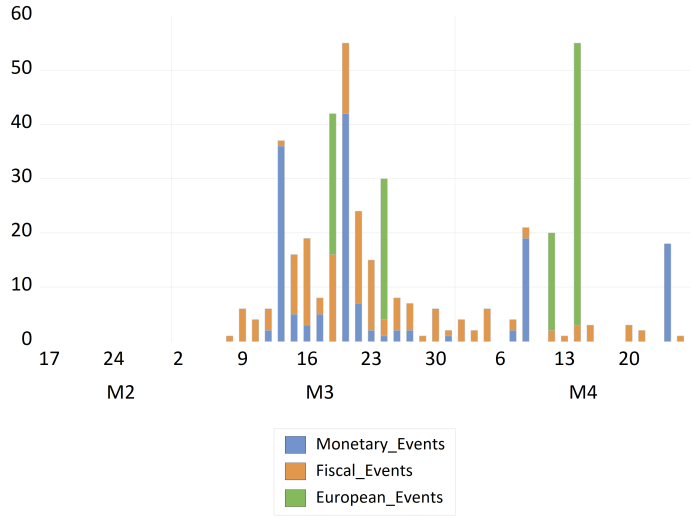
Notes: The figure shows the normalized stock prices indices and 10-year bond yields since February 17, 2020.

Figure 2: Cross-sectional variation of stock returns and yield changes



Notes: The figure shows the cross-sectional standard deviation of stock returns (in percent) and yield changes (in percentage points) since February 17, 2020.

Figure 3: Event dates



Notes: The figure shows the distribution of policy announcements over time. The vertical axis reports the number of policy events. The variables are explained in the main text.

Table 1: Policy events

	BE	DE	EST	IE	GR	ES	FR	IT	LT	LI	LU	MT	NL	AT	PT	SL	SK	FI	DK	SV	PO	CZ	HU	HR	BU	RO	UK	NO	CH	Σ
Monetary-Events	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	4	2	2	3	3	1	1	3	5	1	99
Monetary-Additional	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0	3	0	0	2	1	1	1	0	1	0	63
Monetary-Purchase	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	0	1	0	0	0	2	0	0	1	0	0	39
Monetary-Rate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	0	0	0	1	2	2	0	10
Monetary-Refinancing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	2	1	1	1	2	3	1	35
Fiscal-Events	4	4	4	4	3	3	5	2	1	2	1	2	3	2	4	2	2	2	3	4	1	4	3	2	5	2	4	6	4	88
Fiscal-Deferrals	3	1	0	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	1	2	1	0	1	1	0	0	0	1	1	29
Fiscal- Impulse	1	3	4	2	3	2	2	1	0	1	1	1	1	2	1	2	0	2	2	3	1	3	3	2	5	2	4	6	3	63
Fiscal-Liquidity	1	2	0	1	0	1	1	2	1	2	1	1	3	1	4	0	1	2	1	1	1	2	0	0	3	1	2	2	2	39
Fiscal-Shorttime	0	2	0	2	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	3	1	1	0	1	1	1	2	0	2	27
Fiscal-EU	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	0	0	0	96
Fiscal-EU-Impulse	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	52
Fiscal-EU-Other	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	0	0	0	44
Fiscal-EU-SGP	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	26
Σ	16	18	15	17	14	15	16	16	14	16	15	15	17	16	19	15	15	16	11	19	11	13	12	13	15	11	13	15	9	427

Notes: The table shows the policy announcements across countries and across policy categories. The variables are explained in the main text.

Table 2: The response to stock prices

	I	II	III	IV	V
Covid-Cases	-0.02***	-0.01**	-0.01***	-0.01***	-0.01***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Δ Covid-Cases	-0.00	-0.00	-0.00	-0.01	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Covid-Cases-World	0.23***	0.22***	0.19***	0.18***	0.19***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Δ Covid-Cases-World	-1.14***	-1.15***	-1.00***	-0.84***	-0.94***
	(0.11)	(0.11)	(0.10)	(0.10)	(0.10)
Monetary-Events	-0.18	-0.07			
	(0.34)	(0.48)			
Monetary-Events*Covid-Cases		-0.01			
		(0.02)			
Monetary-Additional			1.63***	0.95**	1.04**
			(0.45)	(0.46)	(0.41)
Monetary-Additional-First				-1.16	-1.69
				(1.79)	(1.63)
Monetary-Purchase			0.22**	0.32***	0.01
			(0.10)	(0.10)	(0.09)
Monetary-Purchase-First				-6.93***	-6.20***
				(1.01)	(0.91)
Monetary-Rate			-3.35*	-1.42	-0.42
			(1.83)	(2.21)	(2.00)
Monetary-Rate-First				-0.39	-1.44
				(4.11)	(3.73)
Monetary-Refinancing			-4.26***	1.28	0.47
			(0.52)	(1.09)	(0.98)
Monetary-Refinancing-First				-2.12	-1.39
				(1.49)	(1.35)
Fiscal-Events	-0.33	0.96*			
	(0.36)	(0.51)			
Fiscal-Events*Covid-Cases		-0.06***			
		(0.02)			
Fiscal-Deferrals			1.11	1.75*	1.12
			(0.69)	(0.93)	(0.84)
Fiscal-Deferrals-First				-1.91	-2.62**
				(1.38)	(1.25)
Fiscal-Impulse			-0.43**	-0.44	-0.15
			(0.22)	(0.27)	(0.25)
Fiscal-Impulse-First				0.13	0.25
				(0.45)	(0.41)
Fiscal-Liquidity			-0.14*	-0.17*	-0.12
			(0.07)	(0.10)	(0.09)
Fiscal-Liquidity-First				0.10	0.21
				(0.15)	(0.13)
Fiscal-Shorttime			-0.04	-0.66	-0.25
			(0.72)	(0.96)	(0.87)
Fiscal-Shorttime-First				1.30	0.69
				(1.42)	(1.29)
Fiscal-EU	0.15	-0.55			
	(0.40)	(0.63)			
Fiscal-EU*Covid-Cases		0.05			
		(0.03)			
Fiscal-EU-Impulse			-6.69***	-7.25***	-6.62***
			(2.00)	(1.95)	(1.79)
Fiscal-EU-Liquidity			-12.42	-6.67	6.49
			(22.18)	(21.49)	(19.42)
Fiscal-EU-SGP			4.06***	4.01***	4.24***
			(0.63)	(0.61)	(0.56)
Google-Residential	-0.13**	-0.13**	-0.07	-0.09	-0.02
	(0.06)	(0.06)	(0.06)	(0.06)	(0.05)
Google-Transit	-0.03**	-0.03**	-0.02	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Google-Workplace	-0.01	-0.01	-0.01	-0.01**	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Monetary-US-Additional					-5.66***
					(0.54)
Monetary-US-Purchase					-2.26***
					(0.34)
Monetary-US-Rate					-7.00***
					(1.00)
Monetary-US-Refinancing					2.67***
					(0.27)
Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.17	0.18	0.25	0.30	0.43
N	1262	1262	1262	1262	1262

Notes: The dependent variable is the daily change in the leading stock market index (in percent). Standard errors in parentheses. A significance level of 1%, 5% and 10% is denoted by ***, ** and *.

Table 3: The response of bond yields

	I	II	III	IV	V
Covid-Cases	0.001***	0.001**	0.001***	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Covid-Cases	-0.000**	-0.000*	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Covid-Cases-World	-0.002*	-0.002*	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ Covid-Cases	-0.006	-0.007	-0.006	-0.011**	-0.015***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Monetary-Events	-0.034**	-0.038*			
	(0.015)	(0.022)			
Monetary-Events*Covid-Cases		0.000			
		(0.001)			
Monetary-Additional			-0.028	-0.008	-0.006
			(0.020)	(0.021)	(0.021)
Monetary-Additional-First				0.023	0.029
				(0.081)	(0.080)
Monetary-Purchase			-0.028***	-0.030***	-0.030***
			(0.005)	(0.005)	(0.005)
Monetary-Purchase-First				0.068	0.070
				(0.049)	(0.048)
Monetary-Rate			0.028	-0.138	-0.144
			(0.082)	(0.097)	(0.096)
Monetary-Rate-First				0.638***	0.663***
				(0.198)	(0.194)
Monetary-Refinancing			0.072***	-0.061	-0.062
			(0.024)	(0.048)	(0.047)
Monetary-Refinancing-First				0.159**	0.174***
				(0.066)	(0.065)
Fiscal-Events	0.027*	-0.022			
	(0.015)	(0.022)			
Fiscal-Events*Fiscal-Cases		0.002***			
		(0.001)			
Fiscal-Deferrals			0.028	0.029	0.034
			(0.030)	(0.039)	(0.039)
Fiscal-Deferrals-First				-0.022	-0.016
				(0.061)	(0.060)
Fiscal-Impulse			-0.014	-0.022*	-0.031**
			(0.010)	(0.013)	(0.013)
Fiscal-Impulse-First				0.035	0.033
				(0.021)	(0.021)
Fiscal-Liquidity			0.008**	0.004	0.005
			(0.003)	(0.004)	(0.004)
Fiscal-Liquidity-First				0.007	0.001
				(0.007)	(0.006)
Fiscal-Shorttime			0.032	0.018	0.034
			(0.033)	(0.043)	(0.043)
Fiscal-Shorttime-First				0.010	0.001
				(0.069)	(0.068)
Fiscal-EU	0.046***	0.023			
	(0.016)	(0.026)			
Fiscal-EU*Covid-Cases		0.002			
		(0.002)			
Fiscal-EU-Impulse			0.432***	0.428***	0.488***
			(0.090)	(0.089)	(0.089)
Fiscal-EU-Liquidity			-0.005	-0.005	-0.004
			(0.007)	(0.007)	(0.007)
Fiscal-EU-SGP			-0.000	0.002	0.007
			(0.028)	(0.028)	(0.028)
Google-Residential	0.006**	0.006 *	0.003	0.004	0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Google-Transit	0.000	0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Google-Workplace	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Monetary-US-Additional					-0.032
					(0.027)
Monetary-US-Purchase					0.071***
					(0.017)
Monetary-US-Rate					0.047
					(0.050)
Monetary-US-Refinancing					0.013
					(0.014)
Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.01	0.02	0.07	0.09	0.13
N	1190	1190	1190	1190	1190

Notes: The dependent variable is the daily change in the yield on 10-year government bonds (in percentage points). Standard errors in parentheses. A significance level of 1%, 5% and 10% is denoted by ***, ** and *.

Table 4: The response to stock prices: the euro area

	I	II	III	IV	V
Covid-Cases	-0.02**	-0.01	-0.01**	-0.01*	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ Covid-Cases	-0.01	-0.01	-0.01**	-0.02***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Covid-Cases-World	0.25***	0.24***	0.18***	0.18***	0.19***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Δ Covid-Cases-World	-1.04***	-0.99***	-0.59***	-0.59***	-0.62***
	(0.15)	(0.15)	(0.14)	(0.14)	(0.13)
Monetary-Events	-0.72*	0.18			
	(0.43)	(0.56)			
Monetary-Events*Covid-Cases		-0.09**			
		(0.03)			
Monetary-Additional			1.01**	1.04**	1.14**
			(0.49)	(0.49)	(0.44)
Monetary-Additional-First					
Monetary-Purchase			0.25**	0.26**	-0.08
			(0.11)	(0.11)	(0.10)
Monetary-Purchase-First				-1.96	-1.51
				(1.66)	(1.50)
Monetary-Rate					
Monetary-Rate-First					
Monetary-Refinancing			-9.71***	-7.55***	-7.43
			(0.73)	(1.96)	(1.77)
Monetary-Refinancing-First					
Fiscal-Events	-0.51	1.77**			
	(0.50)	(0.72)			
Fiscal-Events*Covid-Cases		-0.09***			
		(0.02)			
Fiscal-Deferrals			1.38*	1.88**	1.32
			(0.82)	(1.02)	(0.92)
Fiscal-Deferrals-First				-1.17	-3.47**
				(1.81)	(1.64)
Fiscal-Impulse			-0.49*	-0.28	-0.21
			(0.27)	(0.32)	(0.29)
Fiscal-Impulse-First				-0.76	0.16
				(0.62)	(0.57)
Fiscal-Liquidity			-0.09	-0.15	-0.05
			(0.08)	(0.12)	(0.11)
Fiscal-Liquidity-First				0.14	0.22
				(0.17)	(0.16)
Fiscal-Shorttime			-1.35	-1.46	-0.65
			(0.91)	(1.15)	(1.05)
Fiscal-Shorttime-First				0.36	0.71
				(1.98)	(1.79)
Fiscal-EU	0.10	-0.84			
	(0.51)	(0.78)			
Fiscal-EU*Covid-Cases		0.06			
		(0.04)			
Fiscal-EU-Impulse			-7.18***	-7.48***	-6.81***
			(2.35)	(2.36)	(2.17)
Fiscal-EU-Liquidity			-19.28	-17.85	-1.32
			(25.94)	(25.97)	(23.42)
Fiscal-EU-SGP			4.36***	4.30***	4.62***
			(0.75)	(0.75)	(0.68)
Google-Residential	-0.23***	-0.26***	-0.20***	-0.20***	-0.13**
	(0.08)	(0.08)	(0.07)	(0.07)	(0.06)
Google-Transit	-0.04**	-0.04***	-0.02*	-0.02*	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Google-Workplace	-0.01	-0.01	-0.01**	-0.01**	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Monetary-US-Additional					-5.66***
					(0.69)
Monetary-US-Purchase					-2.13***
					(0.43)
Monetary-US-Rate					-5.65***
					(1.25)
Monetary-US-Refinancing					2.69***
					(0.36)
Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.18	0.20	0.38	0.38	0.50
N	765	765	765	765	765

Notes: The dependent variable is the daily change in the leading stock market index (in percent). Standard errors in parentheses. The sample includes member countries of the euro area only. A significance level of 1%, 5% and 10% is denoted by ***, ** and *.

Table 5: The response of bond yields: the euro area

	I	II	III	IV	V
Covid-Cases	0.001***	0.001*	0.001***	0.001**	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Covid-Cases	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Covid-Cases-World	-0.003**	-0.003**	-0.002	-0.002	-0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ Covid-Cases	-0.014**	-0.016**	-0.018***	-0.019***	-0.023***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Monetary-Events	-0.028	-0.031			
	(0.017)	(0.024)			
Monetary-Events*Covid-Cases		0.001			
		(0.002)			
Monetary-Additional			-0.013	-0.011	-0.011
			(0.021)	(0.021)	(0.020)
Monetary-Additional-First					
Monetary-Purchase			-0.030***	-0.030***	-0.030***
			(0.005)	(0.005)	(0.005)
Monetary-Purchase-First				0.002	0.005
				(0.077)	(0.075)
Monetary-Rate					
Monetary-Rate-First					
Monetary-Refinancing			0.200***	0.195**	0.210**
			(0.032)	(0.088)	(0.086)
Monetary-Refinancing-First					
Fiscal-Events	0.016	-0.047*			
	(0.020)	(0.028)			
Fiscal-Events*Fiscal-Cases		0.003***			
		(0.001)			
Fiscal-Deferrals			0.058*	0.040	0.046
			(0.032)	(0.039)	(0.038)
Fiscal-Deferrals-First				0.047	0.075
				(0.074)	(0.072)
Fiscal-Impulse			-0.028**	-0.047***	-0.047***
			(0.012)	(0.015)	(0.015)
Fiscal-Impulse-First				0.064**	0.036
				(0.027)	(0.027)
Fiscal-Liquidity			0.008**	0.004	0.005
			(0.003)	(0.005)	(0.004)
Fiscal-Liquidity-First				-0.010	0.004
				(0.007)	(0.007)
Fiscal-Shorttime			0.011	0.038	0.054
			(0.038)	(0.047)	(0.046)
Fiscal-Shorttime-First				-0.137	-0.161*
				(0.087)	(0.084)
Fiscal-EU	0.049***	0.009			
	(0.018)	(0.028)			
Fiscal-EU*Covid-Cases		0.004**			
		(0.002)			
Fiscal-EU-Impulse			0.421***	0.464***	0.507***
			(0.101)	(0.101)	(0.100)
Fiscal-EU-Liquidity			-0.005	-0.005	-0.004
			(0.007)	(0.007)	(0.006)
Fiscal-EU-SGP			0.067**	0.072**	0.071**
			(0.032)	(0.032)	(0.032)
Google-Residential	0.007*	0.006*	0.005	0.005	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Google-Transit	0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Google-Workplace	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Monetary-US-Additional					-0.047
					(0.032)
Monetary-US-Purchase					0.089***
					(0.020)
Monetary-US-Rate					0.093
					(0.058)
Monetary-US-Refinancing					0.018
					(0.016)
Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.02	0.04	0.17	0.18	0.23
N	691	691	691	691	691

Notes: The dependent variable is the daily change in the yield on 10-year government bonds (in percentage points). Standard errors in parentheses. The sample includes member countries of the euro area only. A significance level of 1%, 5% and 10% is denoted by ***, ** and *.

Table 6: The response to stock prices: large countries

	I	II	III	IV	V
Covid-Cases	-0.01*	-0.01	-0.01*	-0.01**	-0.01**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ Covid-Cases	-0.00	-0.00	-0.01	-0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Covid-Cases-World	0.26***	0.25***	0.21***	0.21***	0.20***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Δ Covid-Cases-World	-1.28***	-1.30***	-1.16***	-0.95***	-1.09***
	(0.13)	(0.13)	(0.13)	(0.13)	(0.12)
Monetary-Events	0.11	0.13			
	(0.42)	(0.62)			
Monetary-Events*Covid-Cases		-0.01			
		(0.03)			
Monetary-Additional			2.18***	1.46**	1.41***
			(0.57)	(0.59)	(0.52)
Monetary-Additional-First				-1.49	-0.85
				(2.26)	(2.02)
Monetary-Purchase			0.32**	0.40***	0.05
			(0.13)	(0.13)	(0.12)
Monetary-Purchase-First				-7.30***	-6.67***
				(1.38)	(1.21)
Monetary-Rate			-3.02	-1.13	-0.09
			(1.90)	(2.29)	(2.02)
Monetary-Rate-First				-2.59	-2.31
				(4.58)	(4.07)
Monetary-Refinancing			-4.32***	0.52	-0.34
			(0.62)	(1.13)	(1.00)
Monetary-Refinancing-First				-2.59	-1.43
				(4.58)	(1.48)
Fiscal-Events	-0.42	1.24*			
	(0.43)	(0.63)			
Fiscal-Events*Covid-Cases		-0.08***			
		(0.02)			
Fiscal-Deferrals			0.96	1.82*	0.86
			(0.80)	(1.01)	(0.89)
Fiscal-Deferrals-First				-2.92*	-3.24**
				(1.61)	(1.42)
Fiscal-Impulse			-0.34	-0.44	0.05
			(0.28)	(0.37)	(0.33)
Fiscal-Impulse-First				0.59	0.30
				(0.58)	(0.51)
Fiscal-Liquidity			-0.14*	-0.19*	-0.13
			(0.08)	(0.10)	(0.09)
Fiscal-Liquidity-First				0.16	0.29**
				(0.16)	(0.14)
Fiscal-Shorttime			-0.15	-0.96	-0.70
			(0.88)	(1.18)	(1.05)
Fiscal-Shorttime-First				1.60	0.72
				(1.79)	(1.58)
Fiscal-EU	0.29	0.03			
	(0.51)	(0.89)			
Fiscal-EU*Covid-Cases		0.02			
		(0.06)			
Fiscal-EU-Impulse			-10.02***	-10.84***	-9.79***
			(2.56)	(2.50)	(2.24)
Fiscal-EU-Liquidity			-13.49	-8.14	5.45
			(27.80)	(26.94)	(23.77)
Fiscal-EU-SGP			5.69***	5.50***	5.92***
			(0.79)	(0.77)	(0.68)
Google-Residential	-0.05	-0.05	0.07	0.01	0.09
	(0.09)	(0.09)	(0.08)	(0.08)	(0.07)
Google-Transit	-0.02	-0.02	-0.01	-0.01	0.00
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Google-Workplace	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Monetary-US-Additional					-6.23***
					(0.65)
Monetary-US-Purchase					-2.70***
					(0.41)
Monetary-US-Rate					-8.61***
					(1.21)
Monetary-US-Refinancing					3.16***
					(0.32)
Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.18	0.19	0.29	0.34	0.49
N	902	902	902	902	902

Notes: The dependent variable is the daily change in the leading stock market index (in percent). Standard errors in parentheses. The sample includes relatively large countries only. A significance level of 1%, 5% and 10% is denoted by ***, ** and *.

Table 7: The response of bond yields: large countries

	I	II	III	IV	V
Covid-Cases	0.001**	0.000	0.001**	0.001**	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Δ Covid-Cases	-0.000*	-0.000	-0.000	-0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Covid-Cases-World	-0.002	-0.002	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Δ Covid-Cases	-0.006	-0.006	-0.004	-0.011*	-0.017***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Monetary-Events	-0.047**	-0.045			
	(0.019)	(0.027)			
Monetary-Events*Covid-Cases		-0.000			
		(0.001)			
Monetary-Additional			-0.038	-0.012	-0.011
			(0.026)	(0.027)	(0.026)
Monetary-Additional-First				0.065	0.082
				(0.107)	(0.106)
Monetary-Purchase			-0.038***	-0.040***	-0.039***
			(0.006)	(0.006)	(0.006)
Monetary-Purchase-First				0.133**	0.130**
				(0.064)	(0.062)
Monetary-Rate			0.021	-0.144	-0.152
			(0.089)	(0.106)	(0.103)
Monetary-Rate-First				0.638***	0.687***
				(0.231)	(0.226)
Monetary-Refinancing			0.080***	-0.043	-0.047
			(0.028)	(0.047)	(0.051)
Monetary-Refinancing-First				0.133*	0.155**
				(0.077)	(0.076)
Fiscal-Events	0.034*	-0.020			
	(0.019)	(0.027)			
Fiscal-Events*Fiscal-Cases		0.003***			
		(0.001)			
Fiscal-Deferrals			0.045	0.043	0.056
			(0.036)	(0.047)	(0.046)
Fiscal-Deferrals-First				-0.000	0.004
				(0.075)	(0.073)
Fiscal-Impulse			-0.028**	-0.035**	-0.051***
			(0.013)	(0.017)	(0.017)
Fiscal-Impulse-First				0.035	0.045*
				(0.027)	(0.026)
Fiscal-Liquidity			0.007**	0.005	0.006
			(0.004)	(0.005)	(0.004)
Fiscal-Liquidity-First				0.001	-0.006
				(0.008)	(0.007)
Fiscal-Shorttime			0.062	0.037	0.061
			(0.042)	(0.054)	(0.053)
Fiscal-Shorttime-First				0.063	0.050
				(0.088)	(0.086)
Fiscal-EU	0.050**	0.026			
	(0.021)	(0.034)			
Fiscal-EU*Covid-Cases		0.002			
		(0.002)			
Fiscal-EU-Impulse			0.526***	0.501***	0.577***
			(0.116)	(0.115)	(0.114)
Fiscal-EU-Liquidity			-0.008	-0.007	-0.006
			(0.009)	(0.009)	(0.009)
Fiscal-EU-SGP			-0.023	-0.020	-0.017
			(0.036)	(0.035)	(0.035)
Google-Residential	0.008**	0.008**	0.004	0.005	0.003
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Google-Transit	0.000	0.000	-0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Google-Workplace	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Monetary-US-Additional					-0.024
					(0.034)
Monetary-US-Purchase					0.086***
					(0.021)
Monetary-US-Rate					0.062
					(0.062)
Monetary-US-Refinancing					0.014
					(0.017)
Fixed-Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.01	0.02	0.09	0.12	0.16
N	924	924	924	924	924

Notes: The dependent variable is the daily change in the yield on 10-year government bonds (in percentage points). Standard errors in parentheses. The sample includes relatively large countries only. A significance level of 1%, 5% and 10% is denoted by ***, ** and *.

Table 8: The response including simultaneous events

	all countries		euro area		large countries	
Dependent variable:	Stock	Bond-yield	Stock	Bond-yield	Stock	Bond-yield
	I	II	III	IV	V	VI
Covid-Cases	-0.013*	0.001***	-0.017**	0.001***	-0.013*	0.001**
	(0.007)	(0.000)	(0.007)	(0.000)	(0.007)	(0.000)
Δ Covid-Cases	-0.002	-0.000*	-0.006	-0.000	-0.002	-0.000*
	(0.005)	(0.000)	(0.007)	(0.000)	(0.006)	(0.000)
Covid-Cases-World	0.233***	-0.002*	0.249***	-0.003**	0.265***	-0.002
	(0.026)	(0.001)	(0.034)	(0.001)	(0.032)	(0.001)
Δ Covid-Cases	-1.132***	-0.008*	-1.054***	-0.014**	-1.277***	-0.008
	(0.106)	(0.005)	(0.147)	(0.006)	(0.133)	(0.006)
Monetary-Events	-0.557	-0.014	-0.893**	-0.005	-0.330	-0.021
	(0.362)	(0.016)	(0.442)	(0.018)	(0.467)	(0.021)
Fiscal-Events	-0.992**	0.037**	-1.170**	0.045**	-1.114**	0.046**
	(0.412)	(0.018)	(0.573)	(0.022)	(0.505)	(0.022)
Fiscal-EU	-0.211	0.053***	-0.204	0.042**	-0.131	0.059***
	(0.428)	(0.017)	(0.545)	(0.019)	(0.555)	(0.022)
Monetary-Events*Fiscal-Events	2.551***	-0.084**	2.430*	-0.285***	2.396**	-0.086*
	(0.970)	(0.042)	(1.467)	(0.060)	(1.108)	(0.048)
Monetary-Events*Fiscal-EU	4.571	-0.578***			3.710	-0.580***
	(3.098)	(0.130)			(3.297)	(0.144)
Fiscal-Events*Fiscal-EU	2.570***	0.000	2.765*	0.026	2.636*	-0.004
	(1.158)	(0.047)	(1.495)	(0.053)	(1.405)	(0.058)
Google-Residential	-0.131**	0.006**	-0.224***	0.006*	-0.046	0.009**
	(0.063)	(0.003)	(0.076)	(0.003)	(0.085)	(0.004)
Google-Transit	-0.025**	0.000	-0.035**	-0.000	-0.021	0.000
	(0.011)	(0.001)	(0.014)	(0.001)	(0.016)	(0.001)
Google-Workplace	-0.007	0.000	-0.007	0.000	-0.007	0.000
	(0.006)	(0.000)	(0.008)	(0.000)	(0.008)	(0.000)
Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.17	0.03	0.18	0.06	0.18	0.03
N	1262	1190	765	691	902	924

Notes: The dependent variable is the daily change in the leading stock market index (in percent) or the yield on 10-year government bonds (in percentage points). Standard errors in parentheses. A significance level of 1%, 5% and 10% is denoted by ***, ** and *.