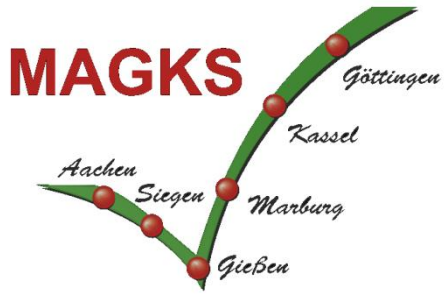

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Stock Market Response to Covid-19, Containment Measures and Stabilization Policies - The Case of Europe

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Abstract

Policymakers imposed constraints on public life in order to contain the Covid-19 pandemic. At the same time, fiscal and monetary policy implemented a large range of of expansionary measures to limit the economic consequences of the pandemic and stimulate the recovery. In this paper, we assess the response of the equity market as a high-frequency indicator of economic activity to containment and stabilization policies for 29 European economies. We construct indicators of containment and stabilization policies and estimate a range of panel VAR models. The main results are threefold: First, we find that stock markets are highly responsive to containment and stabilization policies. We show that domestic fiscal policy as well as monetary policy support the recovery as reflected in the stock market. Second, expansionary fiscal policy conducted at the European level reduces rather raises stock prices. Third, we estimate the model over subsamples and show that the counter-intuitive stock market response to EU policies is driven by the responses in medium- and high-debt countries. These countries' stock markets are also particularly susceptible to monetary policy announcements.

Keywords: Covid-19, Europe, stabilization policies, lockdown-measures, panel VAR

JEL classification: E44, E52, E62

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1 Introduction

In early 2020, the Covid-19 pandemic arrived in Europe. Across countries, authorities implemented a wide variety of containment measures designed to limit the spread of infections. The Covid-19 pandemic also caused the largest post-war recession in Europe. Policymakers in central banks, finance ministries and parliaments adopted stimulus packages in order to cushion the economic consequences of the pandemic and support the recovery.

The unprecedented fall in economic activity in the early months of the pandemic was reflected in a steep decline in stock prices.[1] After this sharp drop in value, the stock market recovered, thus anticipating future positive growth prospects. In this paper, we interpret the stock market as an indicator of current and future economic activity, that reflects both the containment policies to fight the virus and the stabilization policies to revive the economy. We use this indicator to assess the effectiveness of either branch of policy. The key advantage of stock prices over other indicators is its availability for all European economies on a daily frequency. We cannot use traditional business cycle variables such as GDP growth, inflation and unemployment as those are only available on a monthly or even quarterly frequency.

We estimate the effects of containment and stabilization policies on stock prices and proceed as follows. First, we collect dis-aggregate data on containment policies. We obtain this data from the University of Oxford COVID-19 government response tracker (Hale et al., 2021). In contrast to the literature (e.g. Deb et al., 2021; Chen and Tillmann, 2022) we do not use the aggregate Stringency Index provided by Hale et al. (2021), but construct three distinct indicator series that we refer to as closures, movement restrictions and health support. An increase in either of these indicators reflects a tougher policy stance with respect to fighting the pandemic. We use data from the European Systemic Risk Board (ESRB) to construct a country-specific indicator of national fiscal policy measures such as fiscal impulses, liquidity injections and deferrals. The use of the ESRB database guarantees a consistent definition and classification of policies across countries. Since fiscal policy steps have not just been implemented by national authorities but also at the level of the European Union (EU), we build an indicator of EU-wide fiscal policy based on data

[1] Baker et al. (2020) study historical infectious diseases since 1900 to establish the unprecedented nature of the decline in the U.S. stock market at the beginning of the Covid-19 pandemic. Alfaro et al. (2020) show that the evolution of new Covid-19 infections has strong real-time predictive power for the U.S. stock market. The results of Davis et al. (2022) suggest that stock prices and workplace mobility in daily data strongly co-move during the first wave of the pandemic. Their findings also emphasize the exceptional nature of the 2020 stock market decline. Rehman et al. (2021) establish a strong correlation between the stock markets in the G7 economies and the spread of the pandemic.

from the website of the European Commission. Finally, we visit the websites of the European Central Bank (ECB) and of other national central banks to construct an index of monetary stabilization measures.

Second, we estimate a series of panel Vector Autoregression (VAR) models for 29 European economies using daily data. We include the country-specific number of infections, the containment and stabilization indices and the national stock price index. The purpose is to estimate the market response to tighter containment policies and expansionary stabilization policies, respectively. We adopt a recursive identification of the VAR model. This identification scheme follows naturally from the fact that the stock market immediately responds to containment and stabilization policies. In contrast, there is no contemporaneous feedback from the stock market on the design of containment and stabilization policies, let alone the number of new Covid-19 infections.

As the panel VAR models assume common autoregressive coefficients across countries and, consequently, common impulse responses following containment and stabilization policies, they cannot shed light on cross-sectional heterogeneity. In order to address differences in the responses across countries, we split the sample along the lines of the size of the economies, the membership of the euro area, geographical classifications and the governments' debt-to-GDP ratio. We estimate panel VAR models on these subsamples.

We find that financial markets are highly responsive to containment and stabilization policies. Stocks fall after an increase in the number of infections and an announcement of closure measures. Restrictions on the movement of people, in contrast, are interpreted as effective means of limiting the fallout from the pandemic, such that stock prices increase. All these responses are highly statistically significant. We also show that domestic fiscal policy as well as monetary policy support the recovery as reflected in the stock market. An announcement of expansionary fiscal measures or a monetary easing lead to a strong increase in the valuation of the stock market.

We obtain a striking result with respect to the effectiveness of fiscal policy conducted at the European level. Policy steps which are meant to be expansionary reduce rather than raise the stock price. This response is consistent with the notion that the long-term fiscal costs of EU-wide support packages outweigh their short-term benefits. Alternatively, this finding could reflect that markets were disappointed by the size of the stimulus. Finally, this response can also be explained by the realization that national fiscal policies are unable to handle the crisis on their own due to limited fiscal space.

The sample splits reveal that the counter-intuitive stock market response to EU policies is driven by the responses in medium- and high-debt countries. These countries' stock markets are also particularly susceptible to monetary policy announcements. Furthermore, markets in highly indebted economies respond more strongly to news about Covid-19 infections than in low-debt economies. We also show that stock prices in member countries of the euro area are more sensitive to monetary stabilization policy than non-member countries.

Our paper contributes to the recent literature on the financial market effects of the Covid-19 pandemic. Heyden and Heyden (2020) provide one of the first analyses of the market response to the pandemic. In an event study framework, they show that the news about the first death from the virus has a strongly negative effect on the stock market. Announcements of monetary policy stimuli support the stock market, while national fiscal policy is associated with a negative market response. In Klose and Tillmann (2021), we construct a granular dataset with more than 400 policy announcements at the national and the European level. We use a battery of panel models to show the response of stock and bond markets to policy announcements since the start of the pandemic. As a key finding, we show that monetary policy conducted in terms of asset purchases is a particularly effective stabilization tool. Our evidence also corroborates the notion that EU-wide fiscal policy can lead to counter-intuitive market adjustments - a finding that is in line with the results from this paper.

In a companion paper to this paper, see Klose and Tillmann (2022), we show the responses of stock prices and the emissions of NO_2, which we use as a high-frequency measure of industrial activity, to containment measures in a very large panel covering 92 countries worldwide. The analysis also reveals substantial cross-country variation in the responses, e.g. between rich and poor countries and across continents.[2]

Chen et al. (2020) use daily indicators of economic activity to trace the impact of the pandemic as well as the effectiveness of non-pharmaceutical interventions in advanced economies. Deb et al. (2021) study measures such as NO_2 emissions, container trade, the number of flights, mobility indicators and others to study the response of economic activity to a change of lockdowns as measured by the Stringency Index provided by Hale et al. (2021). They show that tighter containment measures lead to a strong drop in activity, while fiscal policy measures are mitigat-

[2]Kapar et al. (2021) show that the lockdown imposed in the Chinese city of Wuhan had spillover effects on stock markets in advanced economies. In addition, domestic containment policies further contribute to the decline in stock prices. Chen and Tillmann (2022) also investigate the cross-border effects of lockdowns and other containment policies.

ing the economic consequences of the pandemic. Feyen et al. (2021) set up a large database of financial sector responses to the pandemic. They study the determinants of policy interventions in a set of 155 jurisdictions. Likewise, Shafiullah et al. (2022) analyze the determinants of support packages adopted as a response to the Covid-19 pandemic. They show that a larger drop in stock prices predicts a larger stimulus package.

2 Data

In this section, we describe in detail the construction of the variables used in our VAR model. Moreover, we discuss the country splits performed in various forms in order to identify potential heterogeneity among European countries. All in all, we collected data for 29 European countries, which are the 27 member countries of the EU plus Norway and Iceland.[3] The sample period covers daily data (excluding weekends) for the years 2020 and 2021. Since we use the number of Covid infections as one explanatory variable, the sample starts for most countries in late January 2020 or February 2020 as the first cases in the sample countries were reported.

2.1 The construction of the variables

As an indicator of the state of the pandemic, we use the reported daily growth rate total infections. Since the reporting differs in the countries by the weekdays, we use five day averages to account for this effect. All other variables are matched to this procedure accordingly. This holds i.e. for the series of stock prices, for which we calculate the five-day moving average of the daily growth rates from the leading stock market index of each country.[4] With respect to the containment and stabilization indices we take the 5 day moving average of the change in the index as the indicator.

Containment measures: One of the main contributions of this paper is the construction of the containment and stabilization measures initiated in various policy areas. We retrieve our containment data from the University of Oxford COVID-19 government response tracker (Hale et al., 2021). This database contains ordinal values of various containment measures. We divide these measures into three groups:

[3]We restrict our sample to these 29 countries because of the use of a common database on fiscal policy published by the ESRB which provides data for those 29 countries plus Liechtenstein. However, the full set of data series is not available for Liechtenstein, which is why we exclude this country from our analysis.

[4]Initially, we also planned to study the responses of government bond yields. Unfortunately, however, daily data is not available for several of the smaller countries in our sample.

(1) closure measures, (2) measures to restrict the movement of people and (3) health system measures.

The first two jointly form the Stringency Index calculated by the University of Oxford. However, we follow Klose and Tillmann (2022) in the construction of this variable as they have shown that closure and movement restrictions may have very different effects on stock prices. More precisely, the closure subset consists of four different measures being school closures, workplace closures, cancellation of public events and restrictions on gatherings. Movement restrictions are also comprised out of four different measures, which are closing of public transport, stay-at-home requirements, restrictions on internal movement and international travel controls. Finally, the health system index is comprised out of six different measures being public information campaigns, testing policies, contact tracing, facial coverings, vaccination policies and protection of elderly people. The different measures and their ordinally steps are described in detail in Table (1).

For all three groups of measures, we compute an index strongly in line with the method described in Hale et al. (2021) in order to construct the Stringency Index. This means each indicator is transformed into a variable ranging from 0 (no measure taken) to 100 (strictest measure taken) using the following formula

$$x_{it} = 100 \times \frac{m_{it}}{M_i}. \tag{1}$$

Here, x_{it} is the transformed 0-100 variable of a measure i at day t, m_{it} is the ordinal value of the very same measure at the same time and M_i is the maximum ordinal value the measure can take. For most of the measures, moreover, a flag value is reported, signaling whether the measure taken applies generally or is targeted to certain groups only. Those targeted measures may be either focused geographically or with respect to who has to pay the associated costs of an action. Details are presented in Table (1).

In case a flag value exists, equation (1) changes to

$$x_{it} = 100 \times \frac{m_{it} - 0.5(1 - f_{it})}{M_i}. \tag{2}$$

In this equation, f_{it} is the flag variable of a certain measure i at day t. The flag value takes the value of 1 if the measure is generally introduced and 0 if it is targeted. This flag variable guarantees that, if the measure is only targeted, the ordinal value is lowered by the factor 0.5. In case of no actions taken (thus m_{it} being zero), the flag variable is always 1, so that the transformed variable cannot become negative. The transformed variables are finally merged together by taking the arithmetic mean of

the three different groups explained above, thus forming the closure, movement and health index. This being said, an increase in these indices signals a higher level of containment measures.

Stabilization measures: The second type of policy actions comprises stabilization measures taken in order to dampen the economic downturn associated with the Covid-crisis. These stabilization measures are divided into three different groups. The first one is national fiscal policy, the second monetary policy and third fiscal policy on the European level. Again, all three policy areas consist of different measures that can and have been taken by fiscal authorities and central banks. The different measures and the construction of the policy variables out of them, are described in detail in Table (2). It is important to note that we use the date of the announcement of a specific measure, not the data of its implementation, as the former is the key driver of market expectations and should thus trigger stock price changes.

The first group of national fiscal policies is comprised out of four different measures. In order to rely on a consistent database, we use the ESRB Covid-19 policy measures database.[5] First, fiscal impulse, comprising all direct capital injections by the federal government. In the ESRB database, those are recorded as either direct grants, tax reliefs, or equity participation. The second group consists of fiscal liquidity injections, thus measures that provide liquidity which has to be repaid at some future point in time or public guarantees. This measure is build as the sum of the positions public loans, public guarantees and public support for trade credit insurance in the ESRB-database. The third group are deferrals summarizing the positions tax deferrals as well as public or private moratoria in the database. The fourth category is other measures of fiscal nature. Since all of the policy actions in the ESRB database are measured in millions of national currency, we divide these volumes by the GDP in 2019 of the respective country in order to make the scale comparable across countries. The year 2019 is chosen because it is the last year which is not influenced by the Covid-crisis, which has hit the countries to a different extent.

Based on these four measures, we build an index using

$$x_{it}^{fiscal} = x_{it-1}^{fiscal} + \text{impulse}_{it} + 0.5 \times (\text{liquidity}_{it} + \text{deferral}_{it} + \text{other}_{it}). \tag{3}$$

Thus, the fiscal index of country i at day t is build by its lagged value plus the four different policy measures at day t. The weight of the fiscal impulses is twice as high

[5]The complete dataset can be retrieved from https://www.esrb.europa.eu/home/search/coronavirus/html/index.en.html.

as for the remaining measures as direct capital injections should have a larger effect than the other three measures.[6]

The second group are monetary policy measures. Those events are retrieved from the web pages of the the national central banks or from the ECB in case the country is a member of the euro area. Again, we divide the different policies into four subsets. The first are interest rate changes, i.e. conventional monetary policy steps. Those are measured in changes in percentage points of the key interest rate. The second measure are announcements of new refinancing operations. Since the actual uptake and, hence, the magnitude of the stimulus is unknown at the time of announcement, we measure this as a 0/1 variable, meaning with every new refinancing operation announced the variable takes the value of 1 and 0 otherwise. The third set of policy events are announcements of new purchase programs. Since the quantitative amount of those measures is precisely communicated by the central banks at the time of announcement, we again divide the volume by the GDP in 2019 to make the magnitudes comparable across countries. For the 19 countries forming the euro area, the volume for each country is, moreover, multiplied with the ECB-capital key, in order to break-down the effect on the country level.[7] In the fourth set of monetary policy measures we subsume all additional actions. These are e.g. changes in the minimum reserve requirements or changes in collateral standards. Since the nature of those policies differs, me measure them again as a 0/1 variable.

All four sets of monetary measures are added up to a monetary index as follows

$$x_{it}^{monetary} = x_{it-1}^{monetary} - 4 \times \text{rate}_{it} + \text{refinancing}_{it} + \text{purchase}_{it} + \text{additional}_{it}. \quad (4)$$

An increase in this index should reflect a more expansionary policy. Therefore, a reduction in the key interest rate is multiplied with the factor -4, so that a 0.25 percentage point decrease is comparable to an announcement of refinancing operations, additional measures or an increase in purchase programmes with a volume of 1 percent of GDP.[8]

As the last set of policy events, we collect data for EU fiscal policies from the homepage of the European Commission. We divide those into three different measures. In line with the national fiscal policies, the first measure is EU fiscal impulses.

[6]However, we also checked alternative weighting assumptions, i.e. an equal importance of all four measures or an even higher weight on impulses. The estimation results are almost equal to those from our most preferred weighting. The results are available upon request.

[7]This does, however, not hold for changes in the Asset Purchase Programme (APP) of the ECB as Greece is still excluded from this program. Therefore, the capital key has been adjusted to cover only the remaining 18 member countries.

[8]Again, we also altered the weighting allowing for higher or lower weights of all four measures. However, the estimation results are almost equal across all modifications.

Since 27 of the 29 countries in our sample are members of the EU, we weigh the impulse on a country level by the share of each country in nominal European GDP in 2019. The resulting national amount of stimulus is again divided by the GDP in 2019 to make it comparable across all countries. The same procedure is followed for the second measure, which are liquidity provisions. The third measure is the abandoning of the Stability and Growth Pact (SGP). This is measured as a 0/1 variable. In line with the national fiscal policy index, the EU fiscal policy index is build as

$$x_{it}^{EUfiscal} = x_{it-1}^{EUfiscal} + \text{impulse}_{it} + 0.5 \times (\text{liquidity}_{it} + \text{SGP}_{it}), \tag{5}$$

such that the impulse weight is again double the effect of the other two measures.[9]

Figure (1) presents the fiscal policy, monetary policy and EU-fiscal policy announcements aggregated across countries. It is obvious that most of the events took place in the first wave of the pandemic in early 2020. Moreover, the large majority of events are expansionary in nature. Only a few monetary policy events are restrictive and those mainly took place in the second half of 2021.

This can be also seen in Table (3) where we classify the number of all containment and stabilization events per country. In total, we have 2073 containment events, where the majority tends to be announcements of tighter containment policies. We identify 769 stabilization events. While all national and EU fiscal events are expansionary, only 23 out of 241 monetary policy events appear to be restrictive. An important caveat is warranted here: we classify announcements as expansionary or restrictive based on the nature of the policies released. It is conceivable, that an expansionary fiscal policy step falls short of what markets had anticipated. Such an announcement could effectively be restrictive in nature. Whether or not polices have the intended effects thus needs to be estimated. With the identified VAR model estimated below we are able to quantify the effective contribution of policies to the evolution of stock markets.

Finally, in Figure (2) we present the cross-country average index of all six containment and stabilization policies over time. For the containment indices closure and movement the waves of the pandemic are clearly visible as reflected in stricter policies in the different waves. In contrast, the health containment and the stabilization indices are almost steadily increasing.

[9] Analogously to the other two indices, we check for alternative weightings of the three measures. However, the estimation results remain stable with respect to those changes.

2.2 Sample splits

It may be argued that the response of stock markets to the number of Covid cases, the containment and the stabilization measures differs across countries. Therefore, we perform several robustness checks by grouping the countries according to certain selection criteria.

The first criterion is whether countries can be considered large or small. We define countries as large if nominal GDP in 2019 exceeds the level of 100 billion euro. This holds for Belgium, Germany, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal, Finland, Denmark, Sweden, Poland, the Czech Republic, Hungary, Romania and Norway. The remaining countries are defined as small countries.

The second split criterion is whether the countries are members of the euro area or not. So the 19 member countries of the euro area are grouped into one group and the remaining 10 countries in the other. Each member of the euro area faces a common monetary policy. Since ECB policy is tailored to the euro area as a whole, not to the need of individual countries, the response of the national stock market to common monetary policy might be different compared to the response to idiosyncratic monetary policy.

The third split is a geographical one. We divide the countries into three groups here: northern European countries, southern European countries and eastern European countries. Each country can belong to one group only. We define Belgium, Germany, Ireland, France, Luxembourg, the Netherlands, Austria, Finland, Denmark, Sweden, Iceland and Norway as northern European countries. Greece, Italy, Spain, Cyprus, Malta and Portugal form the group of southern European countries, while all others are eastern European countries.

The fourth and final split is done according to a country's government debt level. Higher indebted countries have less fiscal space to stimulate their economies. Hence, the impact of fiscal policy on financial markets should be different from more fiscally potent countries. Here, we divide the countries by the debt to GDP level in 2019 and distinguish between three groups. The first threshold is set at a debt to GDP ratio of 60 percent because this the Maastricht criterion of the stability and growth pact. The second threshold is set to 90 percent in accordance with the findings of Reinhart and Rogoff (2010), who identified countries exceeding this level as having lower economic growth. All countries with a lower debt to GDP ratio than 60 percent are named as low debt countries, all countries with a debt to GDP ratio between 60 and 90 percent are medium debt countries and all countries exceeding the 90 percent threshold are marked as high debt countries. According

to this classification Germany, Estonia, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Slovakia, Finland, Denmark, Sweden, Poland, the Czech Republic, Bulgaria, Romania and Norway are low debt countries. The group of medium debt countries consists of Austria, Slovenia, Hungary, Croatia and Iceland, while the remaining countries are classified as high debt countries.

3 Model

Our analysis is based on an estimated panel VAR model. The cross-sectional dimension covers country $i = 1, ..., N$, while the time dimension is $t = s + 1, ..., T$. The VAR structure reflects the endogenous feedback between the state of the pandemic, the intensity of containment measures, the stance of monetary and fiscal policies and the dynamics on financial markets. The estimated model is

$$\mathbf{A}\mathbf{y}_{it} = \mathbf{d}_i + \mathbf{F}_1\mathbf{y}_{it-1} + ... + \mathbf{F}_s\mathbf{y}_{it-q} + \varepsilon_{it}, \tag{6}$$

with q lags, where the $n \times 1$ vector $\mathbf{y}_{it}$ contains the endogenous variables. We include an $n \times 1$ vector $\mathbf{d_i}$ with country fixed-effects. The $n \times n$ matrices $\mathbf{A}$ and $\mathbf{F_1}, ..., \mathbf{F_q}$ contain the VAR coefficients. The structural shocks, which eventually drive all the endogenous variables, are collected in $\boldsymbol{\varepsilon}_{it}$ with $\boldsymbol{\varepsilon}_{it} \sim N(0, \boldsymbol{\Sigma}\boldsymbol{\Sigma}')$.

We estimate the VAR model with the following 8×1 vector of endogenous variables

$$\mathbf{y}_{it} = [Cases_{it} \quad \mathbf{Contain_{it}} \quad \mathbf{Stab_{it}} \quad Stock_{it},]' \tag{7}$$

where $\mathbf{Contain_{it}}$ is a 3×1 vector of the three containment measures and the 3×1 vector $\mathbf{Stab_{it}}$ includes the three economic stabilization measures x_{it}^{fiscal}, $x_{it}^{monetary}$ and $x_{it}^{EUfiscal}$. We include $q = 2$ lags of the endogenous variables. In light of the large dimension of the data set across time and countries, the relatively large number of variables and parameters to be estimated should not be a concern.

We assume that $\mathbf{A}$ is lower-triangular such that the reduced-form model is

$$\mathbf{y}_{it} = \mathbf{c}_i + \mathbf{B}_1\mathbf{y}_{it-1} + ... + \mathbf{B}_s\mathbf{y}_{it-s} + \mathbf{A^{-1}}\boldsymbol{\Sigma}\varepsilon_{it}, \tag{8}$$

with $\boldsymbol{\varepsilon}_{it} \sim N(0, \mathbf{I}_k)$, where $\mathbf{c}_i = \mathbf{A^{-1}}\mathbf{d}_i$ and $\mathbf{B}_j = \mathbf{A^{-1}}\mathbf{F}_j$. $\boldsymbol{\Sigma}$ is an $n \times n$ matrix with standard deviations on the main diagonal.

This identification implies a restriction on the contemporaneous interaction of the endogenous variables. We posit that the stock market responds contemporaneously to all the other variables in the system. This is a plausible assumption given the

instantaneous response of financial markets to news. All the other variables are assumed to respond to the stock market, but with a delay of at least one day. This also seems to be a fair assumption: the number of Covid cases and the containment measures should be largely independent from the stock market. Monetary and fiscal policies might reflect the state of financial markets, but a lag of one day is an innocuous assumption given the long decision processes in central bank committees, finance ministries and parliaments.

As we estimate the VAR model on a panel of countries, we assume that the autoregressive coefficients are identical across countries. This implies that we obtain one set of impulse response functions summarizing the information from all countries. Hence, we cannot differentiate the stock market response across countries. However, to address potential heterogeneity in the cross-section, we split our country sample as described in the previous section.

4 Results

We report the results of the VAR model in terms of impulse response functions, which show the response of the equity market to a shock one standard deviation in size.

Baseline results: The baseline results are depicted in Figure (3). We find that almost all responses are statistically significant. The stock market is highly sensitive with respect to the spread of the pandemic: an increase in the number of Covid cases strongly reduces the valuation of the equity market. Stock market indices drop by 0.04% after about five days. This response appears small. However, with increases in the number of cases by several standard deviations on some days, the total effect is substantial. Stock prices should reflect the discounted market expectation of future real economic activity. Hence, a higher number of infections strongly reduces economic activity.

The different types of public policy responses to the pandemic also drive expectations as incorporated in the stock market. Closing public life has an immediate and strongly negative effect on stock prices. Markets appear to respond much faster to news about school closing and home office requirements than to news about the spread of the virus itself. In contrast, tighter restrictions on the movement of people are seen as an effective mean to combat the pandemic and restore economic activity in the future as stock prices increase and reach a maximum six or seven days after the announcement. An extension of public health measures is the only news that

leaves stock markets surprisingly unaffected.

Fiscal and monetary policy are effective tools to stabilize the market in light of the pandemic - with one important limitation. We find that domestic fiscal policy is expansionary: stock prices appreciate as a response to fiscal support from national governments. Likewise, a monetary stimulus has a large and immediate effect on the stock market. Hence, easing monetary conditions through conventional and unconventional policy contributes to the economic recovery. However, not all fiscal policy steps are equally effective: policies announced at the European level reduce rather than raise stock prices. There may be three reasons for this surprising result: First, financial markets weigh the long-term direct and indirect costs on a European level more than the short term benefits. While the direct costs associated with the rescue packages may be limited, the indirect costs of allowing the European Commission to take up debt on their own or to suspend the stability and growth pact may be seen that European fiscal policy will become less sustainable in the future. Second, the markets were simply disappointed by the size of the European fiscal support, i.e. they expected the rescue packages to be much larger. Third, the need for coordinated actions on the European made clear to the markets that certain countries cannot handle the crisis on their own, due to e.g. limited fiscal space. Therefore, European assistance is seen as a proof of the weakness of national fiscal policies, which deteriorates financial markets.

Large versus small countries: We now split the sample into large and small European countries. Figure (4) shows the resulting impulse responses. In comparison to the baseline findings, four observations stand out. First, the maximum response of large countries' stock prices to Covid-cases is delayed compared to the response of stock prices in small countries. In addition, the response in large countries is lasting longer with stock prices converging back to their mean after four weeks, while the effect in small countries dies out after two weeks. Second, the instant negative response of closing measures on stock prices is solely driven by large countries, while small countries' stock prices are unaffected by this containment measure. Third, small countries' stock prices do not respond to EU-wide fiscal policy. Hence, the significant response in the full sample of countries is driven by large countries only. It appears that supranational fiscal stimulus leaves stocks in small countries unaffected. In large countries, in contrast, markets anticipate the future fiscal burden associated with expansionary EU policies and reduce their valuations of equity. Fourth, monetary policy drives financial markets in large economies but to a much lesser extent in small economies. After an expansionary policy announcement, stock

prices increase three times as much in large countries compared to small countries.

Euro area countries vs. rest of Europe: A natural distinction between countries is based on the membership in the euro area. Figure (5) shows the impulse response functions from two separate panel models, one for the euro area and one for the remaining countries. Most of the responses are indistinguishable between the two models. In particular, both panels estimate very similar responses of stock prices to the containment measures and national as well as European fiscal policies. However, with respect to the number of Covid cases the negative response on stock prices seems to be more pronounced and long-lasting in euro area countries. But the most striking differences can be seen by the response to monetary impulses. Stock prices in the euro area increase strongly after a policy easing. In the remaining countries, however, the stock market response is delayed and much weaker. Markets appear to be particularly sensitive to actions taken by the ECB, while steps of other central banks designed to revive the economy seem to be much less effective.

Geographical differences: Figure (6) reports the responses for countries in different geographic regions of Europe. Surprisingly, there is no clear distinction between countries located in the north or the south of Europe, respectively. However, we find that stock markets in Eastern Europe are less susceptible to news about the number of infections. Their response is much more short-lived compared to other countries. The most notable difference across regions applies to the response of stock prices to monetary policy. In Eastern Europe, central bank actions have no impact on equity valuations.

High and low debt levels: The final set of samples compares countries with different levels of government debt relative to GDP, see Figure (7). The debt level affects the stock prices response to the number of Covid infections and to the different stabilization policies. In indebted countries, an increase in infections has a very strong negative effect on stocks. For low- and medium-debt countries, this response is much smaller. Hence, financial markets anticipate that high-debt countries have limited financial resources to combat the pandemic, such that the expected drop in economic activity is particularly pronounced.

The tight constraints on fiscal space in high-debt countries are also reflected in the responses of stocks to monetary policies. A surprise monetary easing predominantly benefits stock prices in highly indebted countries, while the response is low-debt economies is smallest. This is consistent with the notion that a monetary

easing relieves the pressure from domestic fiscal authorities in indebted countries, which is honored by domestic stock markets.

5 Conclusions

Policymakers across Europe responded to the Covid-19 pandemic with a wide range of policies directed towards containing the virus and measures designed to stabilize the business cycle. In this paper, we studied the response of stock prices in a large panel of European countries to these types of polices. For that purpose, we constructed indicators that reflect the full set of different policies and estimate a recursively identified panel-VAR model.

Our key findings can be summarized as follows. First, we show that the stock market is very sensitive to both the containment as well as the stabilization policies. For example, announcements of lockdowns via closing measures reduce the valuation of the equity market, while the reverse is true with respect to movement restrictions. Monetary and domestic fiscal policy are effective in stimulating economic activity as reflected in stock prices. Announcements of expansionary monetary and fiscal policy strongly support the stock market.

Second, we find a sharp contrast in the effects of EU-wide fiscal policy compared to national fiscal policy. While the latter is conducive to economic stabilization, the former is not. In fact, stock prices fall after announcements of expansionary fiscal policy at the EU level. It appears that markets have either be disappointed by the size of the newly announced policy, consider the long-run fiscal burden outweighing the short-term expansionary impact or realize that national fiscal policies cannot handle the crisis on their own.

Third, our analysis reveals a substantial degree of cross-country heterogeneity in the stock price responses and the effectiveness of stabilization policies, i.e. with respect to monetary policy. We estimate the model separately for several subsets of countries and show that the results differ e.g. between member countries of the euro area and the remaining countries or between high-debt and low-debt economies.

This paper offers a number of policy implications. First, the Covid pandemic is clearly a threat to the economy. But political authorities have the measures at hand to dampen those deteriorating effects by means of containment and stabilization measures. Second, we have shown that monetary policy stabilization has different effects on the countries' financial markets. This has i.e. consequences for the ECB being responsible for the monetary policy in 19 European countries. This being said, the common monetary policy is favoring some countries more than others. The ECB

needs to take into account the potentially different effects its policies have on the financial markets in the member countries. Third, while monetary policy effects are different, for the other stabilizing as well as containment measures the responses are rather similar across countries. Since this is the case, countries should learn from each other which policies worked well and which did not in order to stabilize the financial market in a pandemic. Fourth and finally, financial markets are not everything policy makers should take into account when fighting the pandemic. The ultimate target should be to safe lives. Therefore, e.g. health system measures, although unimportant for financial market stabilization, are very important.

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Tables

Table 1: Containment indicators

Indicator	Description	Ordinal Steps	General or Targeted Measure
Closure measures			
School closing	Closing of schools and universities	0 = No measure 1 = Recommend closing, or all schools open with alterations 2 = Require closing some levels 3 = Require closing all levels	Geographical 0 = Targeted 1 = General
Workplace closing	Closings of workplaces	0 = No measure 1 = Recommend closing, or work from home 2 = Require closing some sectors 3 = Require closing all but essential sectors	Geographical 0 = Targeted 1 = General
Cancel public events	Canceling public events	0 = No measure 1 = Recommend canceling 2 = Require canceling	Geographical 0 = Targeted 1 = General
Restrictions on gatherings	Cut-off size for bans on gatherings	0 = No restrictions 1 = Restrictions > 1000 people 2 = Restrictions 101-1000 people 3 = Restrictions 11-100 people 4 = Restrictions < 10 people	Geographical 0 = Targeted 1 = General
Movement measures			
Close public transport	Closing of public transport	0 = No measure 1 = Recommend closing or reduced volume, route, availability 2 = Require closing	Geographical 0 = Targeted 1 = General
Stay at home requirements	Orders to "shelter in place" and otherwise confine at house	0 = No measure 1 = Recommend not leaving home 2 = Require not leaving house with exceptions 3 = Require not leaving house with minimal exceptions	Geographical 0 = Targeted 1 = General
Restrictions on internal movement	Restrictions on internal movement	0 = No measure 1 = Recommend not to travel between regions and cities 2 = Internal movement restrictions in place	Geographical 0 = Targeted 1 = General
International travel controls	Restrictions on international travel	0 = No measure 1 = Screening 2 = Quarantine arrivals from high-risk regions 3 = Ban of arrivals from some regions 4 = Ban on all regions or total border closure	
Health systems measures			
Public information campaigns	Presence of public information campaigns	0 = No campaign 1 = Public officials urging caution about COVID-19 2 = Coordinated public information campaign	Geographical 0 = Targeted 1 = General
Testing policy	Testing strategies	0 = No testing policy 1 = Only to those who have symptoms and meet specific criteria 2 = Anyone with symptoms 3 = Testing for everyone	
Contact tracing	Use of measure to trace contacts	0 = No contact tracing 1 = Limited contact tracing (not for all cases) 2 = Comprehensive contact tracing (for all cases)	
Facial coverings	Policies of facial coverings outside home	0 = No policy 1 = Recommended 2 = Required in some situations 3 = Required all public places with other people present or all situations when social distancing is impossible 4 = Required outside home	Geographical 0 = Targeted 1 = General
Vaccination policy	Policies for vaccine delivery to different groups	0 = No availability 1 = Available to one of the following groups: Key workers, vulnerable groups, elderly groups 2 = Available to two of the following groups: Key workers, vulnerable groups, elderly groups 3 = Available to all of the following groups: Key workers, vulnerable groups, elderly groups 4 = Available to the three groups above plus partial additional availability 5 = Universal availability	Costs 0 = individual cost 1 = no or minimal individual costs
Protection of elderly people	Policies to protect elderly people	0 = No measure 1 = Recommended isolation, hygiene and visitor restrictions in Long Term Care Facilities (LTCF) or elderly people to stay at home 2 = Narrow restrictions for isolation, hygiene and visitor restrictions in LTCF or elderly people to stay at home 3 = Extensive restrictions for isolation, hygiene and visitor restrictions in LTCF or elderly people to stay at home	

Notes: Indicators and description based on Hale et al. (2021).

Table 2: Stabilization indicators

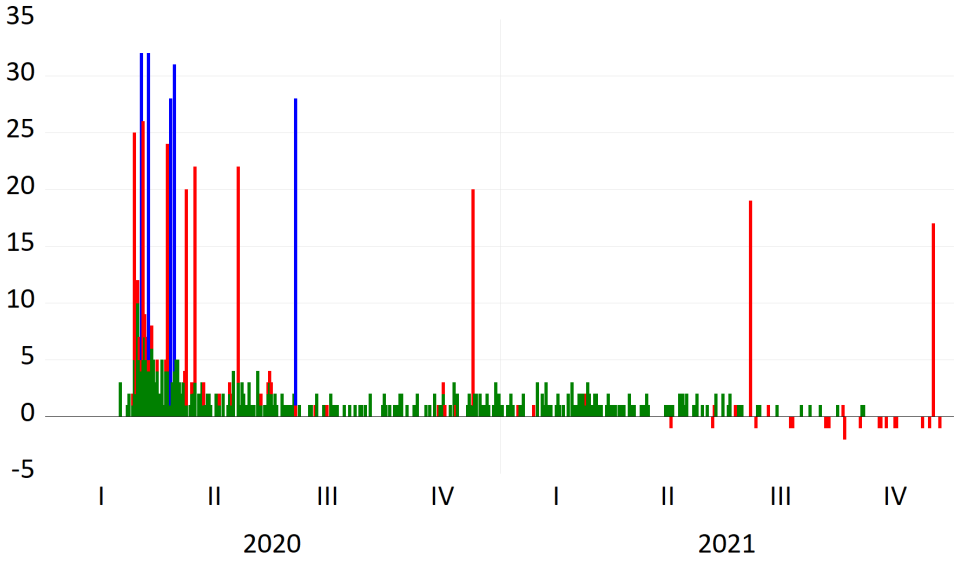
Indicator	Description	Measurement
Fiscal measures		
Impulse	Announcement of direct grants, tax reliefs and equity participation	Impulse as percent of national GDP 2019
Liquidity	Announcement of public loans, public guarantees public support for trade credit insurance	Liquidity as percent of national GDP 2019
Deferral	Announcement of tax deferrals, public or private moratoria	Deferral as percent of national GDP 2019
Other	Announcement of other measures of fiscal nature	Other measures as percent of national GDP 2019
Monetary measures		
Rate	Changes in the key policy rate	Change in percentage points
Refinancing	Announcement of additional and extraordinary refinancing operations	0 = No additional refinancing operation 1 = Additional refinancing operation
Purchase	Announcement of new or increases in purchase programs	Purchases as percent of national GDP 2019
Additional	Additional monetary policy measures, like e.g. changes in minimum reserve rate or changes in collateral standards	0 = No additional measures 1 = Additional measures
EU fiscal measures		
Impulse	Announcement of direct grants	Impulse as percent of national GDP 2019
Liquidity	Announcement of European loans or guarantees	Liquidity as percent of national GDP 2019
Stability and Growth Pact	Announcement of abandoning of the European Stability and Growth Pact	0 = No abandoning communicated 1 = Abandoning communicated

Table 3: Number of events in the sample countries

	BE	DE	EST	IE	GR	ES	FR	IT	CY	LT	LI	LU	MT	NL	AT	PT	SL	SK	FI	DK	SV	PO	CZ	HU	HR	BU	RO	IC	NO	Sum
Contain. closure	23	33	30	24	37	28	25	37	37	22	28	22	23	23	38	24	26	41	24	27	14	28	34	19	24	26	28	21	29	795
Stricter policies	11	20	11	13	23	13	11	20	17	10	15	12	14	13	20	12	13	22	12	11	7	12	17	9	13	14	15	9	14	403
Laxer policies	12	13	19	11	14	15	14	17	20	12	13	10	9	10	18	12	13	19	12	16	7	16	17	10	11	12	13	12	15	392
Contain. movement	18	24	13	19	24	20	21	23	28	21	22	12	13	16	26	57	27	20	13	18	9	18	24	20	26	23	32	10	17	614
Stricter policies	10	14	8	10	12	11	11	15	13	9	10	7	9	8	13	30	13	10	5	9	6	8	12	11	12	13	19	6	8	322
Laxer policies	8	10	5	9	12	9	10	8	15	12	12	5	4	8	13	27	14	10	8	9	3	10	12	9	14	10	13	4	9	292
Contain. health	26	21	24	19	26	18	25	19	22	34	23	24	17	23	21	19	30	31	17	21	19	21	26	23	27	29	21	14	24	664
Stricter policies	22	16	15	16	19	15	19	15	16	22	16	15	14	17	18	16	18	21	16	16	13	15	17	16	17	19	17	10	18	484
Laxer policies	4	5	9	3	7	3	6	4	6	12	7	9	3	6	3	3	12	10	1	5	6	6	9	7	10	10	4	4	6	180
Sum contain. pol.	67	78	67	62	87	66	71	79	87	77	73	58	53	62	85	100	83	92	54	66	42	67	84	62	77	78	81	45	70	2073
Fiscal-events	5	21	10	29	46	23	4	5	11	9	17	5	16	10	2	11	5	8	11	8	10	5	29	38	18	11	7	11	8	393
Expansionary policies	5	21	10	29	46	23	4	5	11	9	17	5	16	10	2	11	5	8	11	8	10	5	29	38	18	11	7	11	8	393
Restrictive policies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monetary-events	9	9	9	9	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	4	7	6	8	12	7	2	7	9	9	241
Expansionary policies	9	9	9	9	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	4	7	3	5	5	7	2	5	5	7	218
Restrictive policies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7	3	0	2	4	2	23
EU-fiscal events	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	135
Expansionary policies	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0	0	135
Restrictive policies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum stabil. pol.	19	35	24	43	59	37	18	19	25	23	31	19	30	24	16	25	19	22	25	17	22	16	42	55	30	18	19	20	17	769

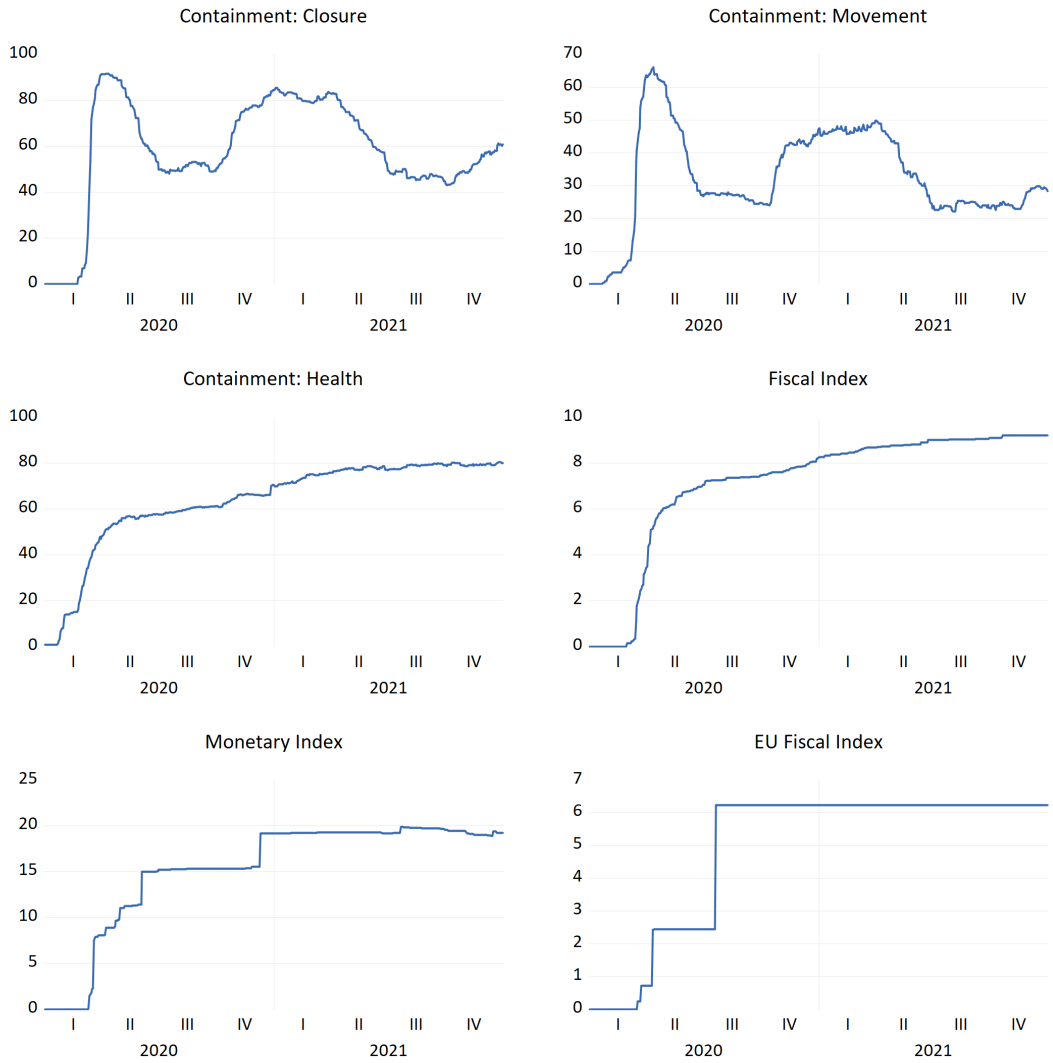
Notes: The table shows the policy announcements across countries and across the different containment and stabilization policy categories.

Figure 1: Number of fiscal and monetary policy events



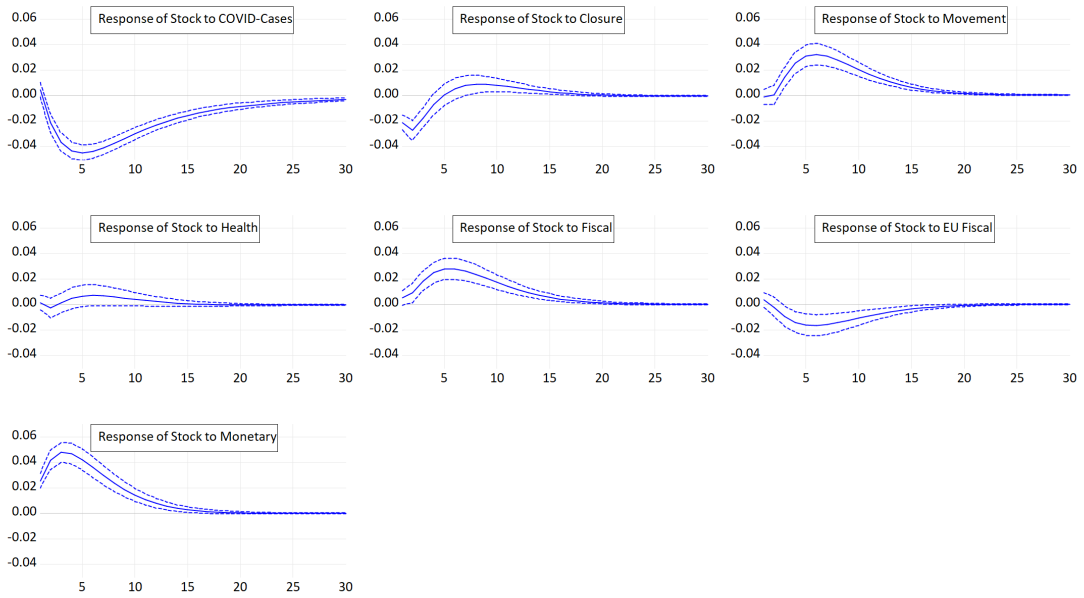
Notes: The graph shows the number of policy events. The green bar indicates fiscal events, red bars signal monetary events and blue bars stand for EU fiscal events. Positive (negative) bars indicate expansionary (restrictive) policy announcements.

Figure 2: Average containment and stabilization policies



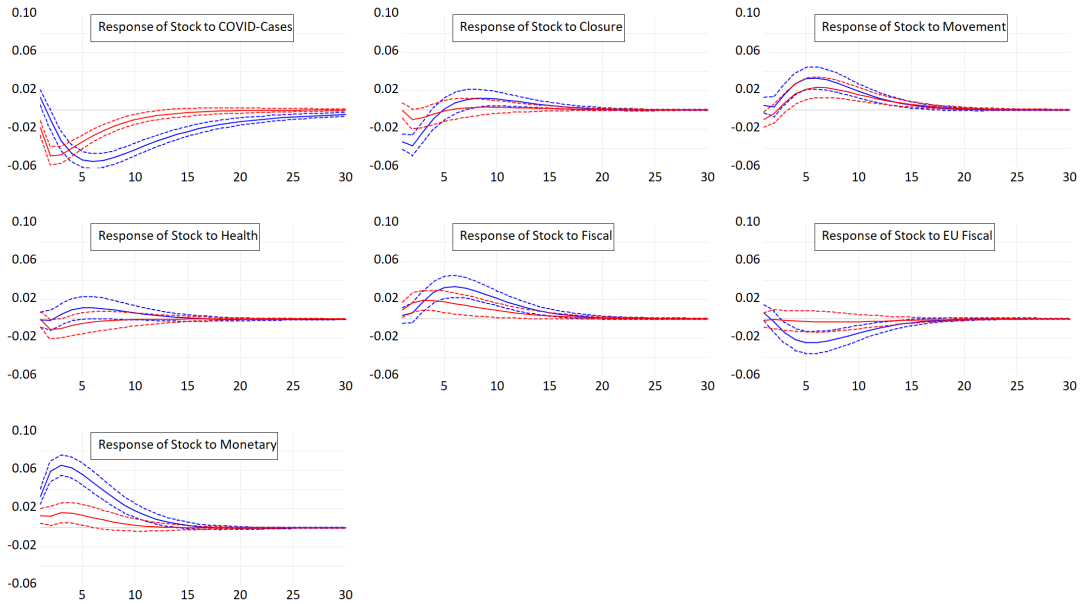
Notes: The graph shows the average over all 29 European countries of the different policy indices.

Figure 3: The response of stock prices: full sample



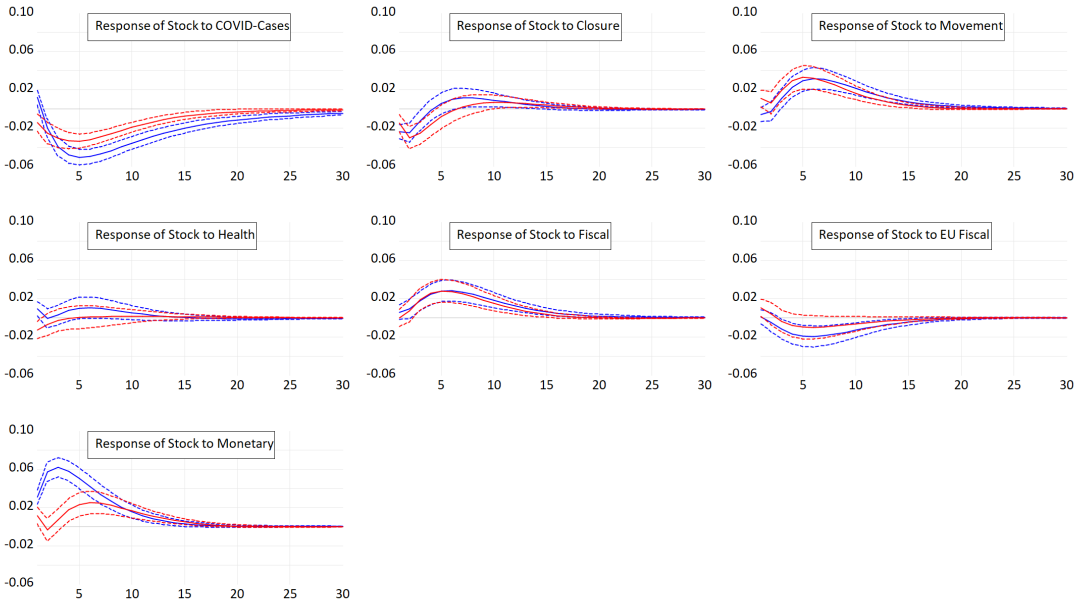
Notes: Impulse responses of stock prices to a one standard deviation shock in Covid cases, the three containment measures and the three areas of stabilization policies. The dashed lines indicate the 95% confidence interval.

Figure 4: The response of stock prices: large versus small countries



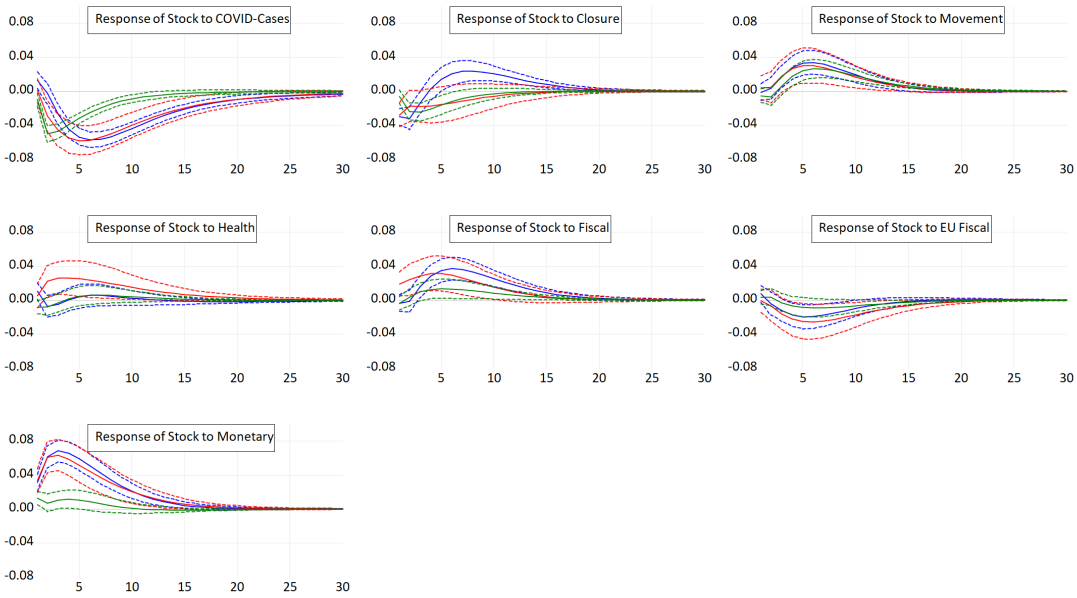
Notes: Impulse responses of stock prices to a one standard deviation shock in Covid cases, the three containment measures and the three areas of stabilization policies. The dashed lines indicate the 95% confidence interval. Blue lines indicate large country estimates while red lines represent small country estimates.

Figure 5: The response of stock prices: euro area versus rest of Europe



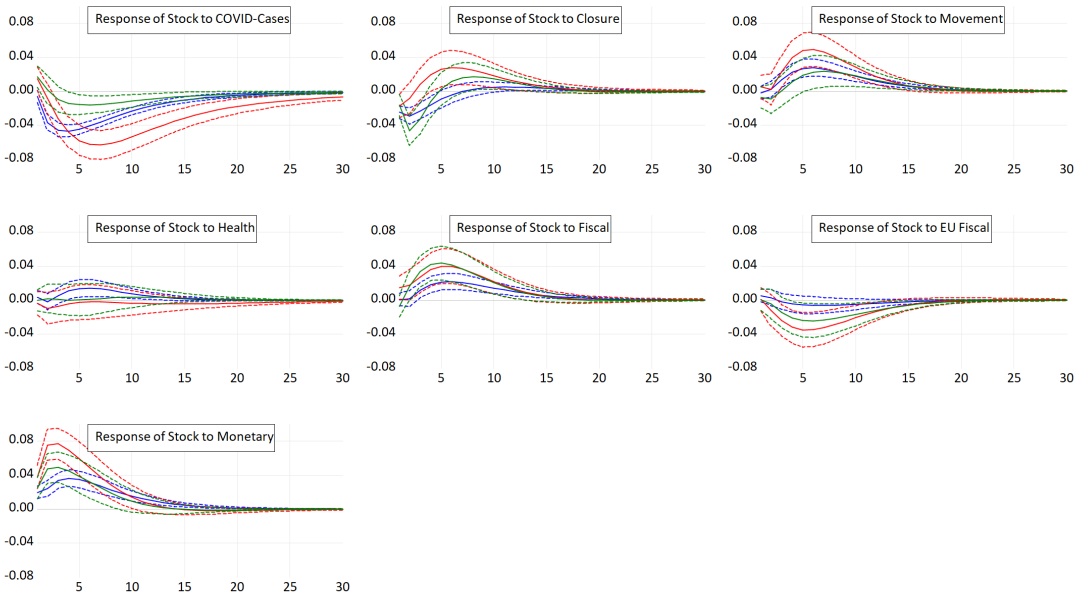
Notes: Impulse responses of stock prices to a one standard deviation shock in Covid cases, the three containment measures and the three areas of stabilization policies. The dashed lines indicate the 95% confidence interval. Blue lines indicate estimates for Euro area member countries while red lines represent estimates for the remaining European countries.

Figure 6: The response of stock prices: geographic differences



Notes: Impulse responses of stock prices to a one standard deviation shock in Covid cases, the three containment measures and the three areas of stabilization policies. The dashed lines indicate the 95% confidence interval. Blue lines indicate estimates for northern European countries, red lines for southern European countries and green lines for eastern European countries.

Figure 7: The response of stock prices: different debt levels



Notes: Impulse responses of stock prices to a one standard deviation shock in Covid cases, the three containment measures and the three areas of stabilization policies. The dashed lines indicate the 95% confidence interval. Blue lines indicate estimates for low-debt countries, green lines for medium-debt countries and red lines for high-debt countries.