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# Economic stimulus measures in the pandemic: the role of fiscal decentralisation

Ceyhun Elgin<sup>a,b</sup>, Abdullah Yalaman<sup>c,d</sup> and Sezer Yasar<sup>e,f</sup>

<sup>a</sup>Department of Economics, American University in Bulgaria, 1 Georgi Izmirliiev Square, Blagovgrad Pl 2700, Bulgaria, [celgin@aubg.edu](mailto:celgin@aubg.edu)

<sup>b</sup>Department of Economics, Bogazici University, Natuk Birkan, Kat 2, 34342 Bebek, Istanbul, Turkey

<sup>c</sup>Department of Finance, Eskisehir Osmangazi University, Meselik Yerleskesi, 26040 Eskisehir, Turkey, [abdullahy@ogu.edu.tr](mailto:abdullahy@ogu.edu.tr)

<sup>d</sup>Centre for Applied Macroeconomic Analysis, The Australian National University, Canberra ACT 2601, Australia

<sup>e</sup>Department of Economics, TED University, Ziya Gökalp Cd. 48/A, 06420 Çankaya/Ankara, Turkey, [sezer.yasar@tedu.edu.tr](mailto:sezer.yasar@tedu.edu.tr)

<sup>f</sup>Cardiff Business School, Cardiff University, Colum Drive, Cardiff CF10 3EU, UK

Is fiscal federalism associated with economic policy responses and stimulus measures adopted by national and sub-national governments to mitigate the adverse economic effects of the COVID-19 pandemic? In this paper, we provide empirical evidence that it indeed is. Our results indicate that even after controlling for various relevant factors, countries with fiscally federal (decentralised) governments have adopted larger fiscal and macro-financial policy packages (as a percent of GDP). However, there are no significant differences in monetary-policy responses between centralised and decentralised governments. We also show that these results are robust to using different federalism measures, including different sets of control variables and different econometric specifications that include an instrumental variable estimation.

**Keywords:** COVID-19, fiscal federalism, fiscal policy, monetary policy; pandemic

**JEL Classifications:** E50, E60, H70

## Introduction

The coronavirus, COVID-19, outbreak emerged in Wuhan, China, in December 2019 and spread to almost every country and territory globally, causing about 551 million cases and about 6.4 million deaths as of the end of June 2022 (Roser et al., 2021). In addition to the human suffering and a significant number of lost lives, the pandemic generated a significant global economic downturn globally, affecting every economy to different degrees (Baldwin and Weder di Mauro, 2020). To reduce the transmission rate of COVID-19, as well as the burden on healthcare and public health systems, governments adopted a wide range of stringent measures, including school and business closures, travel restrictions and city lockdowns (Atkeson, 2020). These measures, added to by vaccine development in later phases of the pandemic, have effectively slowed down the growth of new infections and allowed healthcare systems to manage better the flow of positive cases (Anderson et al., 2020). However, these non-pharmaceutical stringency measures

have also distorted economic activity by limiting human mobility and business operations, which has led to mass layoffs (Eichenbaum et al., 2020), rising unemployment rates and severe declines in national GDPs. To mitigate the adverse effects of public health controls on the economy and sustain public welfare, governments have generally adopted expansionary economic packages, including fiscal, monetary/financial and exchange rate policy measures (Elgin et al., 2020; Gourinchas, 2020). These economic measures targeting households, firms, health systems and banks significantly vary across countries in their type, breadth and scope (Weder di Mauro, 2020). Nevertheless, according to Elgin et al. (2020), the average size of the packages is unprecedented in the economic history of the world. Similarly, the decline in national GDPs in 2020 is also unprecedented for many countries (Elgin et al., 2020; IMF, 2021a). For example, the fiscal stimulus package adopted by Japan exceeds 50% of its GDP (IMF, 2021b). Similarly, central banks have responded to the pandemic

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with large cuts in policy rates and/or reserve requirement ratios. Moreover, in many countries, widespread macro-financial measures range from asset purchases by central banks and the provision of cheap credits through public or private banks. There is also preliminary evidence that the overall size of these measures was vital in determining the recovery path of national economies (IMF, 2021a). In this regard, we believe that it is crucial to understand the factors that are associated with, and account for the size of, these measures.

In order to understand and explain the variation in the size of the economic stimulus measures, this paper aims to investigate whether fiscal (de)centralisation plays a role in determining the size of the economic responses to the pandemic. We believe that this is an important empirical question to address. This is a novel question, and to the best of our knowledge, considering the existing literature, it is investigated for the first time in this paper. To this end, we utilise a unique and comprehensive panel database of economic policy measures, as is set out in detail in [Elgin et al., \(2020\)](#), which provides a comprehensive examination of the cross-country variation in economic policy enacted in response to the onset of the pandemic. The database contains four variables: (i) Fiscal stimulus, which contains all fiscal measures including additional fiscal expenditures after the pandemic, coded as a percentage of GDP; (ii) Percentage cut in the policy rate, as a measure of conventional monetary-policy response; (iii) Percentage cut in the reserve requirement, which is similarly taken as the main macro-prudential policy instrument; (iv) A measure of macro-financial responses, such as asset and bond purchases, provision of cheap credits, and liquidity injections, expressed again as a percentage of GDP. These series are available as panel data covering 168 countries at different time points from March 2020 until the end of May 2021. Moreover, for the benchmark analysis, we use two measures of fiscal centralisation: (i) Revenue centralisation, as measured by the ratio of central-administration revenue to total revenue (ii) Expenditure centralisation, as measured by the ratio of central-government spending to total spending. As additional control variables, we use infection and mortality rate due to COVID-19, an index of government stringency measures (all available as panel data) taken during the pandemic, time fixed-effects, region dummies, the level of public debt (% GDP) before the pandemic, real GDP per-capita, pre-pandemic level of the policy rate, and several institutional-quality variables. As a benchmark analysis, we then run panel regressions. Next, we also run a battery of robustness checks (i) with statutory measures of fiscal federalism instead of revenue or spending-based measures, (ii) with different sets of controls and (iii) an instrumental variable (IV) estimation, where we use several different instruments of fiscal decentralisation (as well as of some other independent variables) widely used in the existing literature. Overall,

our estimation results indicate that even after controlling for various relevant factors, countries with fiscally centralised governments have adopted smaller fiscal and macro-financial policy packages (as a percent of GDP). However, there are no significant differences in monetary-policy responses between centralised and decentralised governments. Assuming that the policy responses reflect the needs of the economies during the pandemic-induced crisis and will be effective in the recovery paths, we believe that fiscal federalism explains the divergent recovery paths of national economies out of the pandemic. To support the latter argument, we also present results of some systems estimations, where we show that the sizes of fiscal and macro-financial stimulus packages related to fiscal (de)centralisation were indeed helpful for better economic GDP growth performance of national economies both in 2020 and 2021.

The rest of the paper is organised as follows. The next section provides a review of the related literature and builds our hypothesis upon it. The third section includes a description of the data sources and the estimation methodology used. The fourth section presents benchmark regression results. Building upon these benchmark results, Finally, the final section draws together the implications of the findings.

## Related literature and theoretical framework

There is a vast literature on the economic impact of fiscal (de)centralisation or federalism. Dating back to [Oates \(1972\)](#), the benefits and costs of fiscal federalism have been spelled out extensively in the literature. Benefits generally take the form of having a more efficient fiscal or economic policy that also takes the needs and preferences of people into account in a better way. Conversely, it may also create some coordination costs, as well as costs related to the underutilisation of the scale advantages and/or externalities.

Although COVID-19 increased the relative scale and role of central government to sub-central government in almost every country, depending on geography, social and political structure, history, culture and even climate, countries differ significantly in their fiscal federalism/centralisation levels. This variation across countries allowed empirical researchers to examine the effects of fiscal federalism, and as a result, there exists a vast literature on the economic impact of it. One strand of the literature focuses on the impact of fiscal federalism on different economic, political or social outcomes such as economic growth, political competition, inequality or fiscal efficiency. This literature is generally inconclusive because, depending on the dataset used, countries or regions studied or time-periods taken, different papers have obtained somewhat different results. For example, [Asatryan and Feld \(2015\)](#)

find no strong link between growth and fiscal federalism. However, there are also more optimistic findings. For instance, [Brehm \(2013\)](#) uses panel data from Chinese provinces, and indicate that both revenue and expenditure decentralisation are crucial in attaining allocative efficiency. Nevertheless, the authors also conclude that inequality significantly interacts with this relationship. Another beneficial effect of fiscal decentralisation is on the size of the shadow economy, according to [Buehn et al., \(2013\)](#), that is, fiscal federalism reduces the size of the shadow economy. In another paper, [Aray \(2019\)](#) uses regional panel data from Spain and shows that fiscal and administrative decentralisation creates positive, albeit bounded, effects on public infrastructure investment. As another benefit, [Shah \(2006\)](#) concludes that decentralised fiscal systems “offer a greater potential for improved macroeconomic governance.” Similarly, [Asatryan et al. \(2015\)](#) find strong empirical support for their hypothesis (resting upon recent theoretical research) that financing sub-national governments’ expenditure out of their own revenue sources, rather than central government revenue, is associated with more efficient and responsible budgeting. [Voigt and Blume \(2012\)](#) conducted a principal component analysis and incorporated several different federalism components and (de)centralisation. Their analysis indicates that fiscal federalism is indeed associated, albeit at different degrees, with better outcomes in terms of fiscal policy, government effectiveness, economic productivity and, finally, happiness in an economy. Similarly, [Blöchlinger \(2013\)](#) also finds evidence that fiscal decentralisation (as measured by spending or revenue shares) is positively associated with GDP per capita as well as with some educational outcomes. Similar findings are also obtained by [Blöchlinger and Eger \(2013\)](#), [Blöchlinger et al., \(2013\)](#) as well as by [Blöchlinger et al., \(2016\)](#) indicating positive effects of decentralisation on growth, productivity, education and regional convergence.

Another strand of the fiscal federalism literature focuses on the relationship between fiscal (de)centralisation and government size. For example, [Anderson and Van Den Berg \(1998\)](#) find no relationship between fiscal centralisation and government size. However, in another paper, [Cassette and Paty \(2010\)](#) conduct a panel data analysis using data from the EU-15 countries to analyze the effect of decentralisation on aggregate, national and subnational government sizes and show that fiscal federalism overall reduces central government spending; however, it increases—and even more than the reduction in the central government expenditures—subnational public spending. Somewhat different from this study, using panel data from 32 countries, [Jin and Zou \(2002\)](#) indicate that expenditure decentralisation leads to smaller national governments and larger subnational governments, and again, overall aggregate governments. However, contrary to expenditure decentralisation, revenue decentralisation increases subnational governments by less than it

reduces national governments, hence leading to smaller governments overall.

In addition to the effects of fiscal federalism on government spending, other studies also investigate its impact on other components of the government budget, such as public debt. [Baskaran \(2010\)](#) uses annual cross-country panel data from 17 OECD countries over the 1975–2001 period and illustrates that a higher level of expenditure decentralisation is associated with lower public debt; however, tax decentralisation and vertical fiscal imbalances are not related to debt. Contrary to this finding, in a different study, [Eichler and Hofmann \(2013\)](#) also use panel data, but now from 30 emerging markets in the period between 1993 and 2008 and show that higher levels of political and fiscal federalism are higher associated with higher sovereign default risk.

Yet another strand of the literature focusses on the relationship between fiscal federalism and corruption. One example is the paper by [Fisman and Gatti \(2002\)](#), who suggest that fiscal decentralisation in government expenditure is strongly and significantly associated with lower corruption. However, in a more recent paper, [Albornoz and Cabrales \(2013\)](#) find that fiscal decentralisation may or may not be associated with lower levels of corruption; as a result, it very much depends on the level of political competition and democracy.

Although all these three strands of the literature are somewhat associated with our paper, none, with a few exceptions, examine the behaviour of economic policy during the pandemic or an ordinary major economic downturn. In this regard, we also believe that the pandemic-induced crisis provides a laboratory-like exogenous shock, where the policy responses to mitigate it are unprecedented and have not been examined previously. One interesting exception is the paper by [Escaleras and Register \(2012\)](#). Whilst, in their paper, the authors do not look at the impact on economic policy, they investigate whether more decentralised countries respond to natural disasters better and find support that indeed they do, particularly in developing economies. Another paper, somewhat closely related to our research, also finds that local governments which are closer to people in identifying their needs (as opposed to the central governments) play a vital role in the implementation and design of economic policies during the pandemic ([Mainali et al., 2021](#)). One more closely related paper written during the pandemic is the one by [McCann et al., \(2021\)](#), which shows that excess deaths due to the COVID-19 were lower in countries with more decentralised governance.

In one highly relevant study, [Bartolini et al., \(2016\)](#) suggest that, if efficiently designed, decentralisation leads to better allocation of local resources and design of development promoting policies. The OECD has put much effort into effectively measuring and tracking fiscal federalism and quantifying its potential impacts (see [Dougherty et al. \(2019\)](#) for an excellent review and

descriptive study). OECD 2019 identifies ten guidelines that make decentralisation work best for regional economic development. Moreover, as for the design of decentralisation and its impact and role during the pandemic, OECD (2020) conducted a comprehensive study and provided various examples of how federalism, and the multi-level governance are associated with it. The report concludes that federalism can be effective in combatting the pandemic and its economics, fiscal, social and health-related effects.

Indeed, decentralisation is not challenge-free. (Boadway and Doughterty, 2018). In this regard, Blöchliger et al., (2010) emphasise the importance of good coordination between different levels of government to make decentralisation work best and most efficiently. Similarly, Forman et al., (2020) list several examples and recommendations for establishing this coordination.

Based on our reading of the existing literature, we conclude that the literature on fiscal federalism is far from complete, and no consensus has been established on its impacts. However, we also recognise that one major issue with the existing literature on the impact of fiscal federalism has been the lack of an exogenous change in the environment that provides a basis for research on the relationship between fiscal federalism and some outcome variable of interest. In this respect, the notably exogenous pandemic and the resulting economic downturn and designed/announced policy measures created such a basis for research. Therefore, it is worth investigating its relationship with economic policy outcomes, particularly during the pandemic, which has provided a laboratory-like environment for economic policy analysts. Building upon this, in this paper, we test the following two hypotheses:

*Hypothesis 1:* Controlling for different factors that might potentially be associated with fiscal stimulus, the larger the pre-pandemic level of fiscal centralisation size, the smaller is the fiscal stimulus package size. In this respect, we expect the sign of the estimated coefficient of the pre-pandemic level of centralisation measures to be negative. We also postulate and test whether this relationship is robust to a battery of tests and checks.

Furthermore, we test whether economic policy measures, when the association between them and fiscal federalism is taken into account, were helpful for economic growth in 2020 and 2021. Besides the sizes of fiscal support, the effectiveness of these supports in the recovery of economies is another concern. Fiscal federalism can affect the effectiveness of fiscal policies in two opposing directions. On the one hand, as Oates (2005) states compared to central governments local governments have better information about the preferences of the people in their jurisdictions and the circumstances of the local situation. Thus, they can use the fiscal resources more effectively

to support the local economy, which can aggregate to a faster recovery in the national economy. This argument leads us to test the following hypothesis using systems estimations:

*Hypothesis 2:* Controlling for different factors that might be associated with economic stimulus measures, we expect fiscal decentralisation to be associated with higher stimulus measures. In turn, these larger measures are associated with higher economic growth during the pandemic.

In this respect, we expect the sign of the estimated coefficient of the pre-pandemic level of fiscal centralisation to be negative in a system estimation when fiscal, or macro-financial stimulus are regressed on it and the sign of the estimated coefficients of fiscal or macro-financial measures to be positive when 2020 economic growth is regressed on them.

As for the potential theoretical mechanisms on how decentralisation might be associated with better outcomes, we can find several clues in and build upon the existing literature. First and foremost, as discussed above, there are findings that fiscal decentralisation is generally associated with fiscally more powerful and resourceful local or sub-national authorities, that are closer to the public and therefore are more aware of peoples' needs. In this regard, in fiscally more decentralised economies, maybe more importantly, spending is tailored better according to the needs of local people more efficiently. Second, rapid action, which can be done more effectively by local or regional authorities in public health, as well as in the implementation of economic policy measures, was especially crucial during the pandemic and local government could act much faster. (McCann et al., 2021) Third, there is also a politico-economic perspective, through which "federalism may preserve the efficient properties of market economies from the threat of overregulation and rent-seeking" (Weingast 1995) and therefore promote better economic outcomes. Fourth, similar to Tiebout (1956), some argue that sorting different types of individuals increases saving that promotes economic growth (see Brueckner, 1999, 2006 for example). Fifth, there are positive agglomeration effects (Baldwin and Martin 2004). Finally, last but not least, there is another politico-economic argument that fiscal federalism fosters political innovation (see Oates, 1990; 1999).

Out of these potential explanations that relate fiscal federalism to better economic outcomes, the third, fourth and the fifth may not seem to be directly relevant in the case of a rapidly developing pandemic, because there was no time for these three aspects of decentralisation to play out as the literature imagined, which is framed over long time period, not sudden shocks, like a pandemic.

However, some of the explanations are more relevant in the context of our paper. First, according to the established theories, fiscal federalism can affect fiscal policies

in response to COVID-19 via intergovernmental transfers and competition among local governments. As discussed in Oates (1999), in fiscal federalism, local governments rely on intergovernmental resource transfers, resource transfers from central to the local governments. Thus, fiscal decisions of the local governments take the form of a negotiation with the central governments rather than weighing costs and benefits. This situation gives local governments an incentive to increase their expenditure. Rodden (2003) describes this behavior as 'raiding the fiscal commons.' For COVID-19, similar incentives can increase local governments' fiscal support to the public. Besides, as discussed in Oates (2005), even though there is no agreement between the central and local governments on resource transfers, local governments believe that if they get into fiscal problems the central government will help them. This gives local governments an additional incentive to increase their spending, which is called the soft-budget-constraint problem. During COVID-19, in fiscally decentralised countries, the same incentives would lead local governments to increase their fiscal support to the public. Indeed, for example, Clemens et al., (2021) and Beland et al., (2020) state that transfers from federal to state governments are central to federalism in the USA and Canada. Lopez-Santana and Rocco (2021) and Alexeev and Yushkov (2022) show that various forms of transfers from federal to the local governments were also one of the main components of fiscal packages in response to COVID-19 in the USA and Russia, and Beland et al., (2020) discusses similar possibilities for Canada.

Second, there is plenty evidence in the literature that in fiscally federal countries, local or subnational governments are closer to voters and therefore would be more aware of their needs, which was particularly important during the COVID-19 pandemic when large-scale fiscal and macro-financial measures and policy implementations were needed.

Third, even if where governments design appropriate fiscal or macro-financial policies, these are hard to implement, again with limited government ability during the pandemic. Decentralisation might have played a significant role here by increasing the efficiency of policy design. Finally, according to all these arguments, we should not observe any effect on monetary-policy measures, as in most countries, the monetary policy is in the hands of an independent central bank which is part of the central government.

In addition to intergovernmental transfers, in fiscal federalism competition among local governments is another factor that affects government policies. In particular, as Oates (1999) explains, due to the possibility of the movement of local businesses and jobs to other areas, local governments tend to keep taxes low in their jurisdictions. As all local governments behave in the same way, this creates a race to the bottom among the local governments decreasing their locally collected tax revenue. Considering fiscal support and subsidies during COVID-19 as negative taxes, the same incentives create a competition among

the local governments to increase their fiscal support, that is, a race to the top. Thus, total fiscal support increases under fiscal federalism. However, the effectiveness of this channel might be constrained by the restrictions on the movement of people during the pandemic. However, as the US data shows, despite the decrease in daily mobility, permanent movement of people did not decrease compared to the pre-pandemic period, which gives local governments an incentive to support their residents to prevent the relocation of productive resources (Frost, 2021).

Finally, the last channel on fostering political and policy innovation may be relevant in the case of health and social care provision during the pandemic. In many countries during the pandemic, we have seen many examples of rapid design and implementation of previously used or unused policies towards the labour, goods and the money markets. Elgin et al., 2022 provides a list of examples of various new labour market measures announced and implemented during the pandemic. Many of these measures originated from the sub-national levels of the government, indicating the importance and relevancy of fiscal decentralisation.

Until now, we have discussed the relation of fiscal federalism with fiscal policies and growth, relying on benchmark theories of fiscal federalism. Yet, the pandemic presents some special circumstances that we need to consider. Specifically, the effect of federalism on measures against the spread of the pandemic, such as lockdowns and restrictions on mobility, can interact with its effect on fiscal policies. As discussed above, federalism creates coordination problems between governments in the formation of policies. Choutagunta et al., (2021), Schnabel and Hegele (2021), and Chattopadhyay et al., (2022) show that these weakened measures against the pandemic in many federal states. This situation might have increased the severity of the pandemic and forced federal states to adopt larger fiscal packages for the recovery of the economy later, which would support our Hypothesis 1. Yet, as again we discuss above local governments have better information about local situations, which would let them adopt more effective policies against the spread of the pandemic. McCann et al., (2022) provide some empirical support for this argument showing that decentralisation decreased excess deaths during the pandemic in Europe. Lower pandemic severity would require smaller fiscal packages to support the economy. This argument leads to a hypothesis opposite to Hypothesis 1. Our empirical results will show which argument is supported by the data.

## Data and methodology

### Data sources

We use a relatively large cross-country dataset of policy measures. To construct a comprehensive database of countries' policy measures, Elgin et al., (2020) use the

information provided by the International Monetary Fund (IMF, 2021b). To improve data validity, they also cross-check this information using different sources. When the reported information was not up-to-date, it is replaced with the most recent information gathered from various sources such as the ILO Policy Tracker,<sup>1</sup> national or international media or central bank and government websites. The economic policy package database used in this paper includes a measure of the fiscal stimulus package denominated as a percentage of GDP, including all adopted on- and off-budget fiscal measures taken towards mitigating the adverse economic impact of the pandemic. These are not regular components of fiscal policy but instead, here, the stimulus is defined as extra spending on top of that already projected in the budget before the pandemic. In addition to fiscal stimulus measures, we also use three other measures. One is the macro-financial stimulus package that includes measures such as asset and bond purchases, provision of cheap credits and liquidity injections, and are expressed again as a percentage of GDP. The two remaining ones are monetary-policy responses in the form of a percentage cut in the policy rate (from the ongoing rate in Feb 1st, 2020) and similarly, the percentage cut in the reserve requirement ratio. The first version of the whole dataset was reported in Elgin et al., (2020) in early April 2020. As governments announced revised or new packages in due course, the current version of our dataset in this paper uses all available information by February 2021. The dataset covers 168 economies and has 16 different versions reported on different dates, the first version on 25 March 2020 and the 16th version on 5 May 2021.

As the relevant measure of the pre-pandemic level of fiscal (de)centralisation, for the benchmark analysis we use two different measures. One of them is the revenue-centralisation series that measures the ratio of central-government revenue to the total government revenue, the denominator also including revenue raised by subnational and local governments. The second indicator is the expenditure-centralisation series which is defined in a similar fashion to the revenue centralisation. Both series are obtained from the World Development indicators. Moreover, we also use two additional statutory measures of fiscal federalism that are constructed for the most recent year using the methodology of Arzagli and Henderson (2005). These are not measures based on actual spending or collection of revenue, instead aim to measure the institutional and statutory level of fiscal federalism in a country. These two measures are defined to measure the degree of decentralisation as opposed to the benchmark measures that measure centralisation.

Anticipating that fiscal (de)centralisation is not the only factor associated with policy responses, we also control for several variables that might be associated with the size of the fiscal or monetary stimulus measures. These are infection rate (defined by the ratio of total COVID-19 cases to population), death rate (the ratio of confirmed COVID-19

deaths to total cases), real GDP per-capita in 2019, total public debt (as % of GDP), bureaucracy quality, democratic accountability (obtained from the International Country Risk Guide, ICRG, of the PRS Group), 2020 growth forecast of the IMF (forecast made in April 2020 by the World Economic Outlook), as well as dummies for six different country groups, namely OECD-EU, Latin American and Caribbean, MENA, Sub-Saharan Africa, post-socialist transition economies, and Australia - Asia. Finally, we also control for the degree of stringency measures (such as curfews and school closures) taken by the governments. Hale et al., (2020) provide such a measure that is updated weekly since the beginning of the pandemic.

Moreover, considering that several independent variables, most importantly real GDP per-capita and fiscal-(de)centralisation size might be endogenous, in addition to the benchmark estimations we also adopt an instrumental-variable (IV) estimation strategy. To this end, following Estrin and Mickiewicz (2012) we assume that the fiscal (de)centralisation, as an embedded institution, is an outcome of a long-run equilibrium. This necessitates using instruments that can explain variation in the longer-term institutions but uncorrelated with the short-run policy responses to the pandemic. A similar argument can also be made for cross-country income differences. That is why as instruments for fiscal federalism, we use latitude, and legal-regime dummies (British, French, German, Scandinavian and post-socialist) as instruments. We test for the relevancy and exogeneity of the instruments using a number of tests when reporting the results of the IV regressions. Finally, in systems estimation, we use real GDP growth rates in 2020 and 2021 as dependents variables in one of the equations of the system. These data series are obtained from the April 2021 and April 2022 editions of the IMF's World Economic Outlook, respectively.

Table 1 presents descriptive summary statistics of all variables used in the empirical analysis as well as their sources. Note that our policy-measures series are available as a panel data, whereas the rest of the variables, including the federalism measures, are cross-sectional (country). From an econometric point of view, this is not a problem but we should also emphasise that utilising the panel nature of the policy measures, we also use other controls that are available as panel data such as the infection and death rates, as well as the extent of the government stringency measures. Moreover, as we will discuss in the next subsection, we also control for time fixed effects.

## Methodology

Utilizing the panel nature of our stimulus measures in our benchmark regressions, we estimate the following panel equation:

$$Policy_{it} = \alpha_0 + \alpha_1 Centralization_i + \alpha_k \sum_{k=2}^n X_{ki} + \alpha_j \sum_{j=n+1}^m Z_{ji} + \gamma_t + \epsilon_{it}$$

Table 1. Descriptive summary statistics.

	Mean	Median	Std. Dev	Min.	Max.	Source
Revenue centralisation (%)	65.65	65.18	20.79	9.99	97.95	World Development Indicators
Expenditure centralisation (%)	53.84	54.96	23.60	13.66	98.67	World Development Indicators
Fiscal stimulus (panel) (% GDP)	4.88	2.80	5.97	-12.80	54.90	Elgin et al. (2020)
Macro financial stimulus (% GDP)	4.55	1.00	7.81	0.00	64.64	Elgin et al. (2020)
Rate cut (%)	20.35	11.90	27.50	-105.56	100.00	Elgin et al. (2020)
Cut in reserve requirements (%)	19.28	0.00	31.38	-8.33	100.00	Elgin et al. (2020)
Real GDP per-capita (000 USD)	14.28	5.21	19.69	0.25	116.92	World Development Indicators
Government stringency (0–100 scale)	65.78	69.44	20.03	6.48	100.00	Hale et al. (2020)
Infection rate (%)	1.60	0.05	29.34	0.00	22.85	Johns Hopkins University
Death rate (%)	0.04	0.009	0.43	0.00	1.86	Johns Hopkins University
Public debt (% GDP)	57.96	50.90	33.34	2.50	237.10	World Development Indicators
Bureaucracy quality	2.30	2.00	1.06	0.00	4.00	International Country Risk Guide
Democratic accountability	4.25	4.46	1.41	0.50	6.00	International Country Risk Guide
2020 Growth forecast (%)	-3.42	-3.74	3.63	-12.17	4.52	IMF WEO April 2020
Pre-pandemic policy rate (%)	4.89	3.25	6.49	-0.75	36.00	World Development Indicators
2020 GDP growth (%)	-4.63	-3.89	5.32	-32.24	6.06	IMF WEO April 2021
2021 GDP growth	5.80	5.10	3.44	-4.00	15.90	IMF WEO April 2022
Statutory decentralisation 1	2.03	2.33	1.27	0.00	4.00	Authors' calculations using Arrazghi and Henderson (2005).
Statutory decentralisation 1	1.75	2.00	1.08	0.00	3.56	Authors' calculations using Arrazghi and Henderson (2005).

Here, for country  $i$ ,  $Policy_{it}$  denotes the panel stimulus-data series,  $Centralisation_i$  denotes the measure for fiscal-centralisation (either expenditure or revenue) size (2019, pre-pandemic level<sup>2</sup>),  $X_k$  denotes other control variables, and  $\epsilon_i$  is the error term.

Here, different to the cross-country regressions  $X_k$  and  $Z_{jt}$  denote the control variables available as a panel and cross-sectional data, respectively. Lastly,  $\gamma_i$  stands for the version fixed effects.

We should note here that the main independent variable, fiscal centralisation, is available in a cross-sectional form only, however, since the policy variable is a panel data series, additionally, we are still able to use various independent variables available in panel or cross-sectional format.

*A priori*, we expect to have a negative value for the estimate of  $\alpha_1$ . In addition to our benchmark regressions, we also use an IV estimation strategy to control for the potential endogeneity of fiscal centralisation and GDP per capita. In this regard, we use the two-stage least squares estimator. For all IV estimations, we also report the results of the under-identification (using the Kleibergen-Paap rk LM statistic), weak identification (Cragg-Donald Wald F statistic), overidentification tests (Hansen J statistic), as well as the F-test of the first-stage regressions.

Moreover, to see whether the link between fiscal (de) centralisation and policy responses are relevant for the relationship between policy responses and economic-growth performance in 2020, we also present the results of the following systems estimation using three-staged least squares:

$$Growth_i = a_0 + \alpha_1 Policy_i + u_i$$

$$Policy_i = b_0 + b_1 Centralization_i + v_i$$

Here,  $Policy_i$  and  $Centralization_i$  are again defined similar to above;  $Growth_i$  refers to the percentage GDP growth in 2020 for country  $i$ . Finally,  $u_i$  and  $v_i$  are the error terms.

## Benchmark results

Before proceeding with the estimation results, we present visualisations of our data series first. To this end, Figure 1 illustrates the simple correlations between the fiscal and macro-financial stimulus size and pre-pandemic level of centralisation (expenditure and revenue). In panel a, the correlation between average fiscal stimulus and expenditure centralisation is  $-0.46$ , whereas in panel b the correlation between macro-financial stimulus and expenditure centralisation is  $0.37$ , and both are significant. Similarly, Panel c and d, plot the same correlations for revenue centralisation. In this case, the correlations are  $-0.36$  and  $-0.38$ , respectively. These figures are included here to provide a visual illustration of the negative correlation that will be complemented with a fully-fledged empirical analysis below.

Figure 2 presents the evolutions of three series between March 2020 and May 2021. These are the average fiscal and macro-financial stimulus packages of the whole data series for 168 countries and then two additional series that report the average packages for countries having a pre-pandemic expenditure or revenue centralisation size above (high-centralisation) and below (low-centralisation)

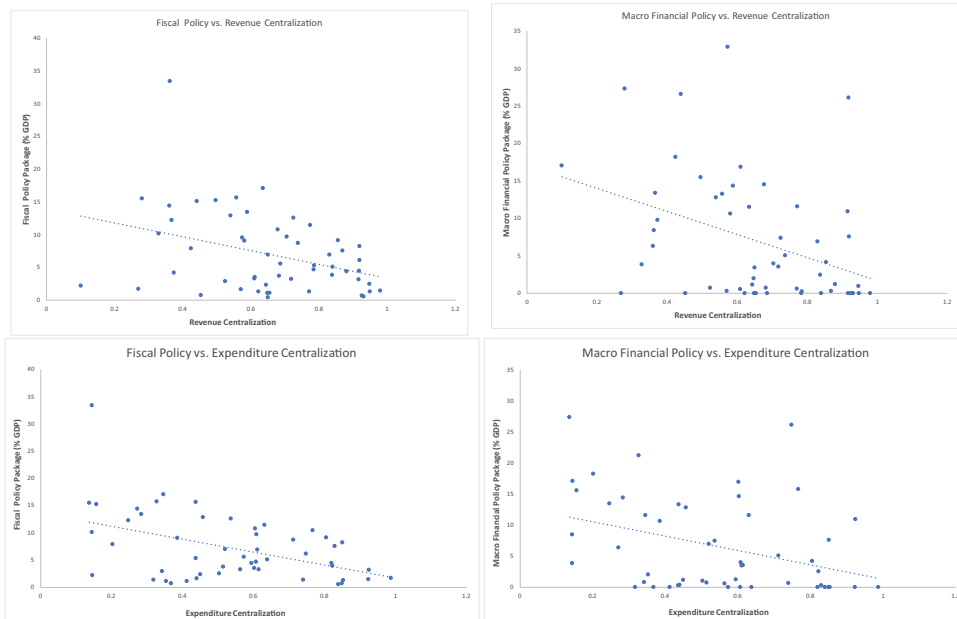
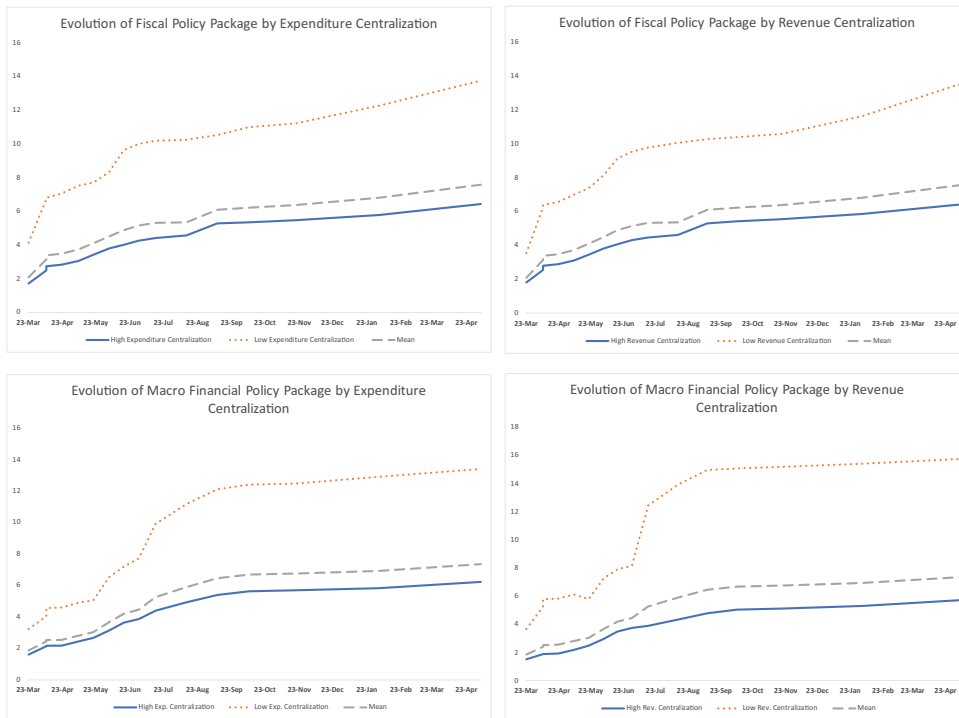


Figure 1. Stimulus Packages vs. Centralization.



**Figure 2.** Evolutions of Stimulus Packages by Centralization.

the median of all countries (65.18% and 54.96%, respectively). As revealed by both figures, countries with a below median centralisation size have not only announced larger fiscal and macro-financial packages in the beginning of the pandemic but the difference between them and countries with larger centralisation size (both expenditure and revenue) got even wider through the course of the pandemic.

Table 2 presents the benchmark panel regressions with the size of the fiscal stimulus package as the dependent variable and revenue centralisation as the key independent variable. Here, we report seven regressions in total, where we stepwise add additional control variables on top of the revenue centralisation. In all the regressions, the estimated coefficient of revenue centralisation is significantly negative, albeit the level of the coefficient changes significantly across different regressions. A one percentage point increase in revenue centralisation is associated with a reduction of 2.64 to 10.52 percentage points in the size of the fiscal stimulus policy package.

In addition to the fiscal centralisation, other variables that consistently have a significant coefficient are the infection rate, public debt, GDP per-capita, bureaucracy quality and the 2020 growth forecast of the IMF. Accordingly, countries with a higher level COVID-19 infection rate, GDP per-capita, public debt, bureaucracy quality, and those who in April 2020 were expected to be affected

more adversely by the pandemic (manifested by a lower growth forecast according to the IMF), have announced large fiscal stimulus packages. GDP per-capita and bureaucracy quality are indicators of the level of income and government capacity, respectively. Moreover, the negative coefficient of the growth forecast of the IMF suggests that economies which were predicted to experience a larger negative impact have responded to this prediction and announced larger packages. The positive coefficient of the infection rate suggests that countries with a higher infection rate are associated with a larger fiscal package, most likely because the economic crisis during the pandemic very much depends on the extent of the public-health crisis. Finally, the positive estimated coefficient of public debt might be somewhat surprising. However, this indicates that government spending was not limited by higher level of public debt during the pandemic. We interpret this result with the high level of borrowing capacity, especially the ones of the European Monetary Union, of these economies.

Next, Table 3 presents six regressions with expenditure centralisation as the measure for fiscal centralisation. A quick comparison between the two tables indicates that they are strikingly similar. Accordingly, a one percentage point increase in expenditure centralisation is associated with a reduction of 1.98 to 11.86 percentage points in the size of the fiscal stimulus policy package.

**Table 2.** Panel regressions of fiscal stimulus package on revenue centralisation.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Fiscal	Fiscal	Fiscal	Fiscal	Fiscal	Fiscal	Fiscal
Revenue centralisation	-10.52*** (1.33)	-8.82*** (1.62)	-7.20*** (1.58)	-3.87*** (1.00)	-2.64*** (0.94)	-3.51*** (0.87)	-3.45*** (0.90)
Infection rate			86.82*** (24.56)	88.38*** (22.00)	62.27*** (20.56)	50.84*** (19.86)	43.85*** (19.21)
Death rate			-571.30 (469.77)	-1267.35** (602.52)	-482.85 (463.07)	-902.69** (449.27)	-713.37 (421.17)
Stringency			-0.07*** (0.01)	-0.05*** (0.01)	-0.03** (0.01)	0.00 (0.01)	-0.00 (0.01)
Public debt				0.07*** (0.01)	0.07*** (0.01)	0.06*** (0.01)	0.05*** (0.01)
GDP per-capita (real)					0.00*** (0.00)	0.00*** (0.00)	0.00* (0.00)
Democratic accountability							-0.55 (0.39)
Bureaucracy quality							3.77*** (0.34)
2020 Growth forecast							-0.72*** (0.07)
Constant	13.92*** (1.03)	14.26*** (1.95)	14.11*** (2.57)	6.66*** (1.63)	3.94*** (1.49)	3.12** (1.44)	-0.54 (1.63)
Observations	864	864ss	831	831	831	831	735
Version fixed-effects	NO	YES	YES	YES	YES	YES	YES
R-squared	0.10	0.34	0.36	0.49	0.56	0.59	0.66

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Robust standard errors in parentheses. All regressions, except the first one, also include regional dummies for the following regions: Australia-Asia, Latin America and Caribbean Economies, Middle East and North Africa, OECD-EU and Post-Socialist transition economies, respectively. The dependent variable is the fiscal stimulus package (% GDP) as a panel data series. All independent variables are explained in the text.

**Table 3.** Panel regressions of fiscal stimulus package on expenditure centralisation.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Fiscal	Fiscal	Fiscal	Fiscal	Fiscal	Fiscal
Expenditure centralisation	-11.86*** (1.15)	-9.05*** (1.31)	-8.35*** (1.37)	-5.34*** (0.81)	-1.98** (0.84)	-4.96*** (0.96)
Infection rate			101.38*** (23.52)	95.53*** (21.12)	62.16*** (20.23)	64.07*** (19.58)
Death rate			-1406.51*** (423.36)	-1225.25*** (464.33)	-854.28** (402.23)	-1077.25 (688.62)
Stringency index			-0.06*** (0.01)	-0.05*** (0.01)	0.00 (0.01)	0.01 (0.01)
Pre-pandemic public debt (% GDP)				0.07*** (0.01)	0.06*** (0.01)	0.05*** (0.01)
GDP per-capita (real)					0.00*** (0.00)	0.00* (0.00)
Democratic accountability						-0.64 (0.40)
Bureaucracy quality						3.83*** (0.36)
2020 Growth forecast						-0.67*** (0.07)
Constant	13.60*** (0.78)	13.37*** (1.60)	13.58*** (2.38)	6.70*** (1.52)	0.88 (1.43)	-0.39 (1.62)
Observations	832	832	799	799	799	703
Version fixed-effects	NO	YES	YES	YES	YES	YES
R-squared	0.16	0.39	0.41	0.52	0.60	0.66

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Robust standard errors in parentheses. All regressions, except the first one, also include regional dummies for the following regions: Australia-Asia, Latin America and Caribbean Economies, Middle East and North Africa, OECD-EU and Post-Socialist transition economies, respectively. The dependent variable is the fiscal stimulus package (% GDP) as a panel data series. All independent variables are explained in the text.

**Table 4.** Regressions of other policy measures on fiscal centralisation.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Revenue centralisation	Macro-fin -10.15*** (2.11)	Rate Cut 33.86*** (7.77)	Res. Req. Cut -3.36 (8.75)	Macro-fin -32.16 (31.26)	Rate Cut -144.81 (146.01)	Res. Req. Cut 241.27* (133.37)
Infection rate	-90.13** (38.98)	-56.77 (139.73)	144.28 (128.68)	2827.23** (1176.71)	20,526.09** (4618.61)	-3118.14 (4461.39)
Death rate	5248.38** (1735.89)	17,213.64** (3842.08)	-5561.14* (3219.86)			
Stringency index	0.02 (0.02)	-0.07 (0.08)	-0.42** (0.09)	0.02 (0.02)	-0.05 (0.08)	-0.49** (0.09)
Pre-pandemic public debt (% GDP)	0.01 (0.01)	-0.17*** (0.03)	-0.40*** (0.03)	-0.00 (0.01)	-0.22** (0.03)	-0.44** (0.04)
GDP per-capita (real)	-0.00*** (0.00)	0.00** (0.00)	-0.00*** (0.00)	-0.00*** (0.00)	0.00 (0.00)	-0.00 (0.00)
Democratic accountability	0.52** (0.23)	3.82*** (1.07)	3.42*** (1.13)	0.30 (0.21)	5.81*** (1.00)	4.44*** (0.99)
Bureaucracy quality	2.61*** (0.77)	-1.97 (2.41)	12.45*** (2.30)	4.20*** (0.58)	-3.41 (2.40)	8.69*** (2.28)
Pre-pandemic policy rate	-0.48*** (0.13)	-1.59*** (0.20)	0.59** (0.26)		-2.43*** (0.22)	0.17 (0.27)
2020 Growth forecast		-0.50 (0.51)	0.16 (0.48)	-0.43*** (0.10)	-0.14 (0.54)	0.46 (0.48)
Expenditure centralisation				-4.19** (2.05)	0.02 (6.77)	-2.34 (8.59)
Constant	4.32 (2.93)	-5.54 (10.09)	17.59 (11.21)	-4.10 (2.55)	25.95** (10.31)	21.96** (10.40)
Observations	735	719	673	703	687	643
Version fixed-effects	YES	YES	YES	YES	YES	YES
R-squared	0.46	0.33	0.30	0.51	0.34	0.29

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Robust standard errors in parentheses. All panel regressions also include regional dummies for the following regions: Australia-Asia, Latin America and Caribbean Economies, Middle East and North Africa, OECD-EU and Post-Socialist transition economies, respectively. The dependent variable is macro-financial policy package (% GDP) in regressions 1 and 4, percentage cut in the policy rate in regressions 2 and 5 and the percentage cut in the reserve requirement ratio for domestic currencies in regressions 3 and 6. All independent variables are explained in the text.

Table 5. Instrumental-variable regressions.

VARIABLES	Fiscal	Fiscal	Fiscal	Fiscal	Macro-fin
Expenditure centralisation	-11.94*** (3.40)		-21.87*** (5.56)		-30.15*** (11.33)
Infection rate	75.31*** (22.49)	50.07* (29.48)	38.25 (28.82)	113.06*** (38.29)	-14.72 (31.01)
Death rate	-1934.86*** (459.27)	-1294.68* (708.41)	-1627.52** (642.37)	-3062.50** (1397.74)	835.26 (1417.50)
Stringency index	-0.00 (0.02)	0.07** (0.03)	0.07** (0.03)	-0.07* (0.04)	0.08*** (0.03)
2020 Growth forecast	-0.77*** (0.07)	-0.98*** (0.09)	-0.34** (0.15)	-1.24*** (0.22)	-0.61*** (0.16)
Revenue centralisation		-34.12*** (9.53)		-6.08** (2.42)	
GDP per-capita (real)		29.80*** (7.32)	0.00*** (0.00)	-0.00* (0.00)	
Constant	12.66*** (3.20)		16.61*** (4.43)	12.60*** (4.07)	23.70*** (8.38)
Observations	799	831	799	831	799
J-test ( <i>p</i> -value)	0.44	0.37	0.32	0.33	0.21
Under-id. test ( <i>p</i> -value)	0.00	0.00	0.00	0.00	0.01
Weak-id. test ( <i>p</i> -value)	0.00	0.01	0.00	0.00	0.00
First stage F-test ( <i>p</i> -value)	0.00	0.00	0.00	0.00	0.00

\*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1. Robust standard errors in parentheses. All regressions also include version fixed effects and regional dummies for the following regions: Australia-Asia, Latin America and Caribbean Economies, Middle East and North Africa, OECD-EU and Post-Socialist transition economies, respectively. The dependent variable is the fiscal stimulus package (% GDP) as a panel data series in the first four regressions and macro-financial policy package (% GDP) in the last regression. All independent variables are explained in the text. We also report the results of the under-identification (using the Kleibergen-Paap rk LM statistic), weak identification (Cragg-Donald Wald F statistic), overidentification tests (Hansen J statistic), as well as the F-test of the first-stage regressions.

Table 6. Further instrumental-variable regressions.

VARIABLES	Macro-fin	Macro-fin	Macro-fin	Rate Cut	Rate Cut
Expenditure centralisation		-36.82*** (13.19)		18.43 (56.96)	
Infection rate	-69.58* (37.96)	-47.24 (44.93)	-72.79* (38.18)	399.98 (287.18)	-1254.02** (565.17)
Death rate	4798.97*** (1621.05)	1251.65 (1517.26)	5088.54*** (1678.21)	6587.35 (8361.61)	59,520.66** (23,254.55)
Stringency index	0.08** (0.04)	0.14** (0.06)	0.06** (0.03)	-0.69*** (0.25)	1.34** (0.54)
2020 Growth forecast	-0.90*** (0.10)	-0.24 (0.30)	-0.84*** (0.17)	-5.90*** (1.31)	7.35*** (2.69)
Revenue centralisation	-27.08** (11.53)		-19.24*** (6.37)		26.48 (26.01)
GDP per-capita (real)		0.00* (0.00)	0.00 (0.00)	-0.00*** (0.00)	0.01*** (0.00)
Constant	23.82*** (8.89)	25.73*** (8.69)	17.71*** (5.31)	39.65 (46.49)	-85.93 (53.87)
Observations	831	799	831	799	831
Under-id. test ( <i>p</i> -value)	0.00	0.01	0.00	0.00	0.01
Weak-id. test ( <i>p</i> -value)	0.00	0.01	0.00	0.00	0.00
J-Test	0.15	0.74	0.78	0.78	0.36
First stage F-test ( <i>p</i> -value)	0.00	0.00	0.00	0.00	0.00

\*\*\**p* < 0.01, \*\**p* < 0.05, \**p* < 0.1. Robust standard errors in parentheses. All regressions also include version fixed effects and regional dummies for the following regions: Australia-Asia, Latin America and Caribbean Economies, Middle East and North Africa, OECD-EU and Post-Socialist transition economies, respectively. The dependent variable is the macro-financial stimulus package (% GDP) as a panel data series in the first three regressions and percentage cut in the policy rate in the last two regressions. All independent variables are explained in the text. We also report the results of the under-identification (using the Kleibergen-Paap rk LM statistic), weak identification (Cragg-Donald Wald F statistic), overidentification tests (Hansen J statistic), as well as the F-test of the first-stage regressions.

**Table 7.** Panel regressions of stimulus packages on statutory decentralisation measures.

	(1)	(2)	(3)	(4)
VARIABLES	Fiscal	Fiscal	Macro-fin	Macro-fin
Decentralisation 1	0.31** (0.13)		1.02*** (0.29)	
Decentralisation 2		0.26** (0.14)		1.35*** (0.33)
Infection rate	0.0001*** (0.00002)	0.0001*** (0.00002)	-0.00004 (0.00004)	-0.00004 (0.00004)
Death rate	-0.001 (0.001)	-0.001 (0.001)	0.005*** (0.002)	0.005*** (0.002)
Stringency index	-0.03** (0.01)	-0.03** (0.01)	-0.02 (0.02)	-0.03 (0.02)
Pre-pandemic public debt (% GDP)	0.07*** (0.01)	0.06*** (0.01)	0.02** (0.01)	0.02** (0.01)
GDP per-capita (real)	0.0002*** (0.00002)	0.0002*** (0.00002)	0.00004 (0.00004)	0.00003 (0.00004)
Democratic accountability	-0.49** (0.19)	-0.47** (0.19)	0.63** (0.28)	0.69** (0.28)
Bureaucracy quality	1.28*** (0.40)	1.34*** (0.40)	-0.27 (1.09)	-0.26 (1.08)
2020 Growth forecast	-0.34*** (0.05)	-0.34*** (0.05)	0.06 (0.10)	0.03 (0.10)
Constant	0.48 (1.23)	0.33 (0.22)	-0.47 (2.17)	-0.55 (2.14)
Observations	686	686	686	686
Version fixed-effects	YES	YES	YES	YES
R-squared	0.69	0.69	0.54	0.54

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Robust standard errors in parentheses. Decentralisation 1 and 2 refer to the two statutory measures of fiscal decentralisation we use in these regressions. All regressions also include regional dummies for the following regions: Australia-Asia, Latin America and Caribbean Economies, Middle East and North Africa, OECD-EU and Post-Socialist transition economies, respectively. The dependent variable is the fiscal stimulus package (% GDP) as a panel data series. All independent variables are explained in the text.

Table 4 reports results of six panel regressions with three other policy measures as dependent variables. These are macro-financial stimulus package, policy-rate cut and reserve-requirement cut, respectively. The first three columns present the estimations with revenue centralisation and the remaining three columns use the expenditure centralisation as the key independent variable. According to Table 4, a higher level of both revenue and expenditure centralisation is associated with a smaller macro-financial package. As for the cut in the policy rate, a higher level of revenue centralisation is associated with a larger cut in the policy rate. Finally, the relationship between the two centralisation measures and cut in the reserve requirements is not significant.

Tables 5 and 6 both report the IV regressions with fiscal and macro-financial stimulus packages as well as the policy rate cut as the dependent variables. We present a total of ten regressions in two tables. The first four of them in Table 5 report regressions of the fiscal stimulus package. In the first two, we only instrument the two centralisation variables, respectively, and in the next two, we also instrument GDP per-capita on the instruments. The last column of Table 4 and the first three columns of Table 5 repeat the same for the macro-financial stimulus package. Finally, for policy-rate cut, we only report two regressions, where we instrument both the centralisation measures and GDP per-capita.<sup>3</sup> Here, we use several different instruments for the two fiscal-centralisation variables. We argue that our instruments are highly correlated with a country's current level of fiscal centralisation (or

GDP per-capita), but they do not have a direct effect on the country's policy response to COVID-19. In addition to these two instrumented variables, we only control for variables that are potentially exogenous by nature. These are the pandemic-related variables, that is, the infection and death rates, the 2020 growth forecast of the IMF, and the government stringency measures. For all regressions, we report results of weak, under- and over-identification tests, as well as the F-test associated with the first stage regressions. Overall, all these tests provide support for the relevance and exogeneity of our instruments.

In all the IV regressions of fiscal and macro-financial stimulus packages, the estimated coefficients of both centralisation measures are significantly negative. No other variable is consistently significant across all the regressions. However, in the last two regressions, where we use the policy-rate cut as the dependent variable, the centralisation measures do not have a significant coefficient.

Next, in Table 7 we report additional regressions with the two statutory measures of fiscal decentralisation defined following Arzaghi and Henderson (2005). Table 7 reports four regressions in total, two with the fiscal stimulus package as the dependent variable and yet another two with the macro-financial package. We use the two statutory measures of fiscal decentralisation in two separate regressions for each dependent variable. Since the two variables here are measuring decentralisation here as opposed to the centralisation measuring benchmark measures, the sign is switched here as expected and results are highly in line with the benchmark results.

Table 8. Systems estimations.

VARIABLES	2020 Growth	Fiscal	2020 Growth	Fiscal	2020 Growth	Macro-fin	2020 Growth	Macro-fin	2020 Growth	Macro-fin
Fiscal stimulus package	1.99** (2.07)		2.71*** (2.80)							
Macro-financial package		-0.80** (2.27)			1.70** (2.47)	-1.30*** (-2.96)	2.49*** (2.92)			
Revenue centralisation										
Expenditure centralisation										
Growth in 2019	0.37 (0.21)		0.59 (0.34)		-0.28 (-1.48)		-0.23 (-1.18)			
Infection rate		1.65 (1.02)		1.71 (1.12)						
Death rate		-2.70 (-0.78)		-3.76 (-1.13)						
Growth forecast		-0.90*** (-3.62)		-0.73*** (-2.97)						
Region dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	52	52	51	51	52	52	51	52	51	51
R-squared	0.64	0.49	0.59	0.51	0.26	0.39	0.24	0.39	0.24	0.32

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Robust t-statistics in parentheses. All regressions also include a constant. In the first two systems (first two pairs of columns) the dependent variable in the first equation of the system is growth rate of GDP in 2020 and the dependent variable in the second equation is the fiscal stimulus package. In the last two systems (last two pairs of columns) the dependent variable in the first equation of the system is growth rate of GDP in 2020 and the dependent variable in the second equation is the macro-financial stimulus package.

Table 9. Systems estimations.

VARIABLES	2021 Growth	Fiscal	2021 Growth	Fiscal	2021 Growth	Macro-fin	2021 Growth	Macro-fin	2021 Growth	Macro-fin
Fiscal stimulus package	1.09** (2.19)		1.11** (2.18)							
Macro-financial package		-0.81** (2.26)			0.95** (2.24)	-1.30*** (-2.96)	0.94*** (2.22)			
Revenue centralisation										
Expenditure centralisation										
Growth in 2020	-0.54* (1.87)		-0.53* (1.86)		-0.58* (-1.87)		-0.58* (-1.86)			
Infection rate		1.62 (1.04)		1.71 (1.09)						
Death rate		-2.70 (-0.74)		-3.74 (-1.13)						
Growth forecast		-0.90*** (-3.62)		-0.72*** (-2.97)						
Region dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	52	52	51	51	52	52	51	52	51	51
R-squared	0.65	0.50	0.64	0.51	0.29	0.39	0.30	0.39	0.30	0.32

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ . Robust t-statistics in parentheses. All regressions also include a constant. In the first two systems (first two pairs of columns) the dependent variable in the first equation of the system is growth rate of GDP in 2020 and the dependent variable in the second equation is the fiscal stimulus package. In the last two systems (last two pairs of columns) the dependent variable in the first equation of the system is growth rate of GDP in 2020 and the dependent variable in the second equation is the macro-financial stimulus package.

Finally, Tables 8 and 9 present results of systems estimations. Here, we run four systems in each table. Table 8 uses GDP growth in 2020, whereas in Table 9 we have GDP growth in 2021 as the dependent variable of the first equation of the system. In the first two systems in each table, the first equations regress growth in 2020 and 2021 on fiscal-policy package and growth in 2019 and 2020, and the second equations regress the fiscal package on revenue and expenditure centralisation, respectively. The remaining two systems repeat the same with the macro-financial package as the main independent variable of the first equation. In all systems, we observe that lower levels both centralisation measures are associated with larger fiscal or macro-financial stimulus packages, which in turn are associated with higher economic growth performance in 2020 and 2021.

## Concluding remarks

The COVID-19 pandemic has direct adverse effects on the economy in several different ways. Infected workers who are isolated or hospitalised cannot join the workforce, which has several supply and demand-side implications. Furthermore, the psychological effect of the pandemic leads to withdrawal from economic activity by agents who prefer to adopt the “wait and see” approach. Elgin et al., (2020) conducted a comprehensive review of different economic policy measures adopted by 168 countries in response to the COVID-19 pandemic and created a large database including fiscal, monetary, and exchange rate measures.

In this paper, our aim has been to investigate the relationship between the size of fiscal centralisation and economic policy responses to the economic crisis induced by the COVID-19 pandemic. The results show that fiscally more centralised countries adopted a substantially smaller fiscal and macro-financial policy package. Moreover, the instrumental variable estimations also support a robust relationship between fiscal centralisation and a smaller fiscal and macro-financial stimulus-package size. This suggests that fiscal (de)centralisation constitutes a strong factor for governments’ (in)ability to conduct countercyclical economic policy.

Moreover, about the question of whether the expansionary policies were useful or not, we presented several estimation results using systems estimations. Here, we particularly have showed that fiscal decentralisation was associated with more expansionary policies, which in turn implied higher GDP growth rates during 2020 and 2021. These results further underscore the importance of fiscal decentralisation in achieving “better” outcomes during the pandemic. Surely, another outcome could be measures of public health, such as the infection or the mortality/death rates to and from Covid-19. However, as we believe that the focus of this paper is on the economy rather than public health, we have not explored the relationship between these public health related variables and fiscal federalism.

Even though robust results are provided with respect to the effect of fiscal centralisation on economic policy and several potential mechanisms are suggested in the second section of the paper, as it is, this paper is largely silent about the exact mechanisms leading to this result. These are all testable explanations for our reported results, provided that one can find the relevant data series. We intend to investigate this further in future research.

## Endnotes

- 1 See <https://www.ilo.org/global/topics/coronavirus/regional-country/country-responses/lang-en/index.htm>.
- 2 Since we use the pre-pandemic level of the fiscal centralisation as the relevant independent variable here, we assume that there is no issue of a reverse-causality here.
- 3 For the sake of saving space, we do not report additional results with policy rate cut and reserve requirement cut, as the estimated coefficients of the centralisation measures are not significant in any of these regressions. These additional results are available upon request from the corresponding author.

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