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Fiscal Multipliers During Pandemics

Tidiane Kinda, Andras Lengyel, Kaustubh Chahande

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Prepared by Tidiane Kinda, Andras Lengyel and Kaustubh Chahande

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ABSTRACT:
Many countries have deployed substantial fiscal packages to cushion the economic fallout from the COVID-19 pandemic. A historical look at past pandemics and epidemics highlights concomitant public sector support in response to health crises. This paper assesses how fiscal multipliers could vary during health crises, particularly how factors such as social distancing and uncertainty could lower contemporaneous (T) multipliers and increase near-term (T+1 and T+2) multipliers as economies re-open, including due to pent-up demand. Based on Jorda's (2005) local projection methodology, the paper shows that cumulative fiscal multipliers one year after a health crisis is about twice larger than during normal times, particularly in advanced economies. These results suggest that large-scale fiscal support deployed at the onset of the COVID-19 pandemic could have larger than usual lingering impacts on economic activity, which need to be accounted for when calibrating policies.

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Author's E-Mail Address:	TKinda@imf.org; A.lengyel@uva.nl; KChahande@imf.org

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WORKING PAPERS

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Introduction

In early 2020, the world faced an exponential growth in cases and deaths resulting from a novel respiratory illness: the Coronavirus Disease 2019 (COVID-19). To slow down the spread of the disease, policymakers around the world closed borders, schools, and workplaces, and recommended social distancing. Episodes of health crises have often hampered economic activity (Ma, Rogers, and Zhou, 2021) and the recession resulting from the COVID-19 pandemic was not different. The pandemic led to an unprecedented loss in output, greater than during the global financial crisis.

Policmakers used a range of policy tools to lessen the adverse economic impact of the COVID-19 pandemic, among which fiscal policy was key and center. Many countries responded to the health crisis through subtantial countercyclical fiscal policy through support to the health care sector and assistance to businesses and households, in particular those impacted by the pandemic. With many parts of the world gradually moving from pandemic to endemic phase, a pertinent question is how impactful these expansionary fiscal policies have been and what could be their impact over time?

There is a large literature on state-dependent fiscal multipliers. In their seminal work, Auerbach and Gorodnichenko (2012) relied on a nonlinear empirical model for the US to show that fiscal multipliers are larger during recession or periods of economic slack. Numerous subsequent studies (Auerbach and Gorodnichenko, 2013; Fazzari, Morley, and Panovski, 2015; Caggiano, Castelnuovo, Colombo, and Nodari, 2015; Cohen-Setton, Gornostay, and Ladreit, 2019) corroborated these findings.[2] The literature also highlighted that fiscal multipliers tend to be larger when interest rates are near the zero lower bound or when monetary policy accommodates government spending (Farhi and Werning, 2016; Christiano, Eichenbaum, and Rebelo, 2011; Coenen et al., 2012).[3] Ilzetzki, Mendoza, and Végh (2013) show that fiscal multipliers are greater in industrial countries, in presence of fixed exchange rates and in closed economies.

A recent literature has emerged on macroeconomic policies during health crises, with a focus on fiscal policy. Eichenbaum, Rebelo and Trabandt (2020) and Glover et al. (2020) embedded epidemiology models in real business cycles models to study optimal health policy responses and find that severe recessions generated by agents' optimal decision to cut back on consumption and hours worked help reduce the severity of epidemics. Elenev, Landvoigt and Nieuwerburgh (2020) found that fiscal support to distressed firms during the pandemic were effective in preventing corporate bankruptcies, although the authors did not compute specific multipliers. Focusing on fiscal policy, Auerbach et al. (2021b) estimated larger employment multipliers during the 2020 lockdowns in US states, particularly in states with less stringent stay-at-home orders. Bayer et al. (2020) show that fiscal multipliers in the US were larger (around 1.5) for targeted transfers such as unemployment insurance compared to untargeted lump-sum transfers (around 0.25) during the COVID-19 pandemic. Drawing on similarities with the Great Recession, Wilson (2020) suggested that fiscal multipliers were around 1.5 during the health crisis. Using TANK model calibrated with the US data during the COVID-19 pandemic, Faria-e-Castro (2021) shows that lump-sum transfers have a multiplier of 0.65, while government consumption has a multiplier of about 1.25. Opposite to the main findings of most studies, Guerrieri et al. (2022) present a theory that

[2] Several studies found that the results could be sensitive to changes in specifications or estimation methods. Model-based studies find different results, including Canzoneri, Collard, Dellas, and Diba (2016) that show higher but relatively short-lived multipliers during recessions; and Sims and Wolff (2018) that highlight that multiplier can be mildly procyclical.

[3] For instance, recent empirical findings highlighted evidence of higher multipliers, ranging from 1.5 to 2.5 at the zero lower bound for Japan (Miyamoto, Nguyen, and Sergeyev, 2018) and around 1.5 for in the United States (Ramey and Zubairy, 2018).

illustrates lower fiscal multipliers (below one) in presence of COVID-19 type shocks that lead to a shutdown of specific sectors in the economy, compared to supply shocks that affect all segments of the economy and are associated with larger fiscal multipliers (above one).

This paper investigates fiscal multipliers during episodes of health crises, such as the COVID-19 pandemic. It contributes to the literature by *(i)* providing additional evidence on the state-dependent effects fiscal multipliers, and *(ii)* advancing the recent and growing literature on macroeconomic policies during health crises by providing cross-country estimates of fiscal multipliers and assessing potential transmission channels at play.

The paper shows that fiscal multipliers are larger in the near-term after a pandemic. Based on Jorda's (2005) local projection methodology, the results highlight that cumulative fiscal multipliers one year after a health crisis are about twice larger than during normal times, particularly in advanced economies. During health crises, multipliers associated with public investments are significantly larger than those associated with public consumption. While higher debt levels tend to decrease the effectiveness of fiscal policy in normal times, public debt seems to be less of a concern for an effective fiscal response during a health crisis. The presence of a fiscal rule can further enhance the output effect of a fiscal expansion at the onset of a pandemic, most likely due to the credibility channel. Potential factors or transmission channels underpinning the differences between pandemic and non-pandemic fiscal multipliers can be categorized into three groups: uncertainty, suppressed demand, and supply bottlenecks. Controlling for these channels, the results illustrate that fiscal multipliers in the pandemic and the non-pandemic regimes are no longer statistically different.

The rest of the paper is organized as follows. Section II discusses potential channels through which health crises could impact output and how fiscal policy could play a role in cushioning these effects. Section III presents the data, Section IV discusses the empirical strategy and Section V presents the baseline results. Section VI investigates the potential role of transmission channels through which the pandemic could impact output. Section VII presents some robustness checks and Section V concludes.

Health Crises and Economic Output: Potential Transmission Channels

The literature has highlighted various factors or transmission channels that can interfere with the effectiveness of fiscal policy during episodes of health crises. The section below focuses on three categories that came to the force during the COVID-19 pandemic: heightened uncertainty, supply bottlenecks, and suppressed demand.

A. Heightened Uncertainty

A rise in uncertainty could dampen the stimulative effect of fiscal policy. Economic agents tend to take a more cautious approach in the presence of increased uncertainty, including by postponing hiring and investment decisions, which in turn reduces the effect of a policy stimulus. While heightened uncertainty tends to dampen the impact of policies, some theoretical work suggest that policy stimulus becomes more effective once the uncertainty subsides (Bloom, 2014, Bloom et al., 2018). Empirical studies bring evidence both for and against these theoretical findings. Alloza (2017) finds that the response of output to fiscal stimulus is low or insignificant during periods of high uncertainty, defined as unusually high implied stock market volatility. Berg (2019) on the other hand derives a business uncertainty measure using firm-level data and finds that the response of output to fiscal stimulus increases with the level of uncertainty. The author argues that as uncertain times coincide with tight financial conditions, fiscal policy helps ease the latter.

B. Supply Bottlenecks

The need to reduce in-person interactions and enhance social distancing at the beginning of the pandemic led to disruptions in the workplace. In addition, the pandemic also led to a large drop in employment and weaker investment, worsening supply capacities. While labor markets in most countries have started to recover after the initial shock, the pandemic caused longer lasting scarring and disruptions in the international supply chains, both in production and shipping. This had led to reduced availability of goods and services (Bonadio, et al., 2020; Zhang, 2020; Mahajan and Tomar, 2021; Lafrogne-Joussier, Martin and Mejean, 2021). Recent theoretical work on state-dependent fiscal policy shows that demand stimulating measures tend to be less effective when inadequate supply is the source of the prevailing economic downturn (Ghassibe and Zanetti, 2021; Jo and Zubairy, 2021). Auerbach, Gorodnichenko, and Murphy (2021) modelled the impact of pandemic containment measures, which constrained supply and the set of goods available for trade and found that fiscal stimulus has a reduced effect in presence of restrictions, reflecting a muted response of consumption. However, the re-opening of the economy is associated with a surge in consumption, output, and inflation due to pent-up demand. Recent empirical studies also show that fiscal stimulus has been less effective in presence of containment measures (Coibion, Gorodnichenko, and Weber, 2020c; Auerbach, et al., 2021b; Brunet, 2021).

C. Suppressed Demand

The COVID-19 pandemic and associated spike in unemployment led to a sharp decline in affected households' income, an increase of income at risk and higher uncertainty faced by households. Consumer confidence and household consumption expenditures also dropped rapidly at the onset of the health crisis. While fiscal measures such as cash transfers can be effective at stimulating demand and spurring economic activity (Eggertsson and Krugman, 2012; Kaplan and Violante, 2014; Ghassibe and Zanetti, 2021), their impact can be reduced in the presence of a health crisis. Guerrieri et al. (2020) highlight that fiscal transfers could be less effective in sectors that are impacted by health crises, in particular when these sectors are closed or significantly constrained by containment measures. Recent experience in the U.S. illustrates that fiscal expenditures did not significantly stimulate consumption or employment in areas with strict lockdown measures as cash transfers received in 2020 in form of stimulus checks were mostly saved (Coibion et al. 2020a). Regions with less stringent lockdowns however experienced significant increases in employment in response to higher fiscal spending (Auerbach et al. 2021b).

Data

The empirical analyses rely on a sample of 91 countries with annual data spanning from 1980 to 2020.[4] Output and fiscal related variables (total public expenditure, public consumption, and public investment) are from the IMF's World Economic Outlook (WEO) database and CEIC's Global Economic Monitor dataset.

Disease outbreak data are from the World Health Organization and encompass the following health crises: Ebola Virus Disease (EVD), Severe Acute Respiratory Syndrome (SARS), Influenza A (H1N1), Middle East Respiratory Syndrome Coronavirus (MERS-CoV), and Coronavirus Disease 2019 (COVID-19). The data of case numbers per thousand population were aggregated at annual frequencies for each of the health crises to create an epidemic/pandemic dummy variable, taking the value 1 when the case number per thousand population is greater than the median value, and the value of 0 otherwise. Therefore, we have health crisis specific case number thresholds.

The analyses on transmission channels uses the World Pandemic Uncertainty Index from Ahir, Bloom and Furceri (2018), gross private savings from the WEO, the number of air passengers from the International Civil Aviation Organization (ICAO) and container traffic in ports from the United Nations Conference on Trade and Development (UNCTAD) to construct measures of uncertainty, supply bottlenecks, and suppressed demand.5 A fiscal rule dummy captures the presence or not of the rule (Schaechter et al. 2012) to gauge the role of fiscal credibility. The paper also uses WEO forecast errors of public expenditures to identify unexpected expenditure shocks and provide an alternative method to estimate fiscal multipliers.[6]

Empirical Strategy

The paper captures the effect of fiscal policy on output through impulse responses produced by local projections (LP) as introduced by Jorda (2005). This method allows the estimation of impulse responses without specifying an approximation of the underlying multivariate dynamic system and is a solid alternative to the traditional method of vector autoregression (VAR). The LP method has recently emerged as one of the foremost ways of studying the transmission of structural shocks in macroeconomics (Miranda-Agrippino and Ricco, 2021). In this method, the weaker assumptions on data dynamics allow for more adaptable and robust impulse response estimations compared to those obtained from VARs (Ramey, 2016). In addition, the LP method: (1) is not constrained by the curse of dimensionality, which is an intrinsic feature of VARs (Ramey, 2016); (2) better captures nonlinearities (Auerbach and Gorodnichenko, 2012); (3) avoids misspecification

[4] The sample excludes small countries with a population of less than 1 million.

[5] The measure of uncertainty is derived from text mining methods (Ahir, Bloom, and Furceri,2018).

[6] For certain years in the past the WEO was released in September instead of October which were included.

errors and biases that can be compounded at each horizon when using VAR (Jorda 2005); and (4) facilitates the accommodation of state dependency (Auerbach and Gorodnichenko 2013).[7]

The paper estimates linear and state-dependent panel local projections in the form of:

$$Z_{i,t+h} = \alpha_i^h + c_t^h + \beta^h Shock_{i,t} + \gamma^h(L)\boldsymbol{X}_{i,t} + \varepsilon_{i,t+h} \quad (1)$$

where $Z_{i,t}$ is either real GDP or real government expenditure; α_i^h and c_i^h are country and time fixed-effects; $Shock_{i,t}$ is the fiscal shock; $\gamma^h(L)$ is a polynomial in the lag operator and $\boldsymbol{X}_{i,t}$ is a vector of control variables. Control variables include one lag of real GDP growth, one lag of government expenditure growth and the lagged output gap.[8] Driscoll and Kraay (1998) standard errors, which correct for potential heteroskedasticity, autocorrelation, or correlated errors across countries are reported.[9]

The state-dependent equivalent of equation (1):

$$Z_{i,t+h} = \alpha_i^h + c_t^h + I_{i,t}(\beta^{P,h} Shock_{i,t} + \gamma^{P,h}(L)\boldsymbol{X}_{i,t}) + (1 - I_{i,t})(\beta^{NP,h} Shock_{i,t} + \gamma^{NP,h}(L)\boldsymbol{X}_{i,t}) + \varepsilon_{i,t+h} \quad (2)$$

where $I_{i,t}$ is the pandemic indicator function. We use the variable definition of Hall (2009) and Owyang, Ramey, and Zubairy (2013) and scale our dependent variable by lagged real GDP, to convert both our dependent variables to the same units. Our two dependent variables $Z_{i,t}$ are $(Y_{i,t+h} - Y_{i,t-1})/Y_{i,t-1}$ and $(G_{i,t+h} - G_{i,t-1})/Y_{i,t-1}$, where $Y_{i,t}$ is real GDP and $G_{i,t}$ is real government expenditure.

Our baseline identification assumes no contemporaneous response of government expenditures to macroeconomic aggregates, following Blanchard and Perotti (2002). This identification scheme was proposed in the context of quarterly time-series data, as the assumption is more plausible at this frequency. Nevertheless, several authors applied it at an annual or semi-annual frequency (see Beetsma, Giuliodori and Klaasen 2006, Bénétrix and Lane 2009, Huidrom et al 2020 and others). The advantages of using annual data are that they allow for a wider country coverage (as noninterpolated fiscal data is not available historically for most countries) and identified shocks do not reflect changes in the timing of spending (see Auerbach and Gorodnichenko 2016). Furthermore, as Born and Müller (2012) shows, impulse responses obtained on annual data and on (annualized) quarterly data show high similarities. Nevertheless, we also show the robustness of our results when using forecasting errors to identify unpredictable innovations to government spending.

We rely on the one-step IV methodology proposed by Ramey and Zubairy (2018) to calculate cumulative fiscal multipliers and the corresponding confidence bands. Therefore, instead of estimating Equation (1) separately for GDP and government expenditure, we estimate the following equation:

[7] See Auerbach and Gorodnichenko (2013) and Ramey and Zubairy (2014) for a discussion of LP's use with state dependence and how it compares with smooth transition VARs.

[8] Obtained as deviation from the HP-filter extracted trend.

[9] Including a lagged depended variable and unit fixed effects can lead to biased estimates. However, our sample size (T=40) implies that this is quantitatively small.

$$\sum_{j=0}^{h} \frac{Y_{i,t+h}-Y_{i,t-1}}{Y_{i,t-1}} = \mu_i^h + \theta_t^h + m^h \sum_{j=0}^{h} \frac{G_{i,t+h}-G_{i,t-1}}{Y_{i,t-1}} + \delta^h(L)\boldsymbol{X}_{i,t} + \epsilon_{i,t+h} \quad (3)$$

where we instrument $\sum_{j=0}^{h} \frac{G_{i,t+h}-G_{i,t-1}}{Y_{i,t-1}}$ with current period government spending $G_{i,t}$. This isolates the variation in future government spendings that is due to the fiscal shock in the current period. The estimated coefficient m^h is the cumulative multiplier at horizon h, with the corresponding estimated standard error. The one-step IV version of Equation (2) is:

$$\sum_{j=0}^{h} \frac{Y_{i,t+h}-Y_{i,t-1}}{Y_{i,t-1}} = \mu_i^h + \theta_t^h + I_{i,t}\left(m^{P,h} \sum_{j=0}^{h} \frac{G_{i,t+h}-G_{i,t-1}}{Y_{i,t-1}} + \delta^{P,h}(L)\boldsymbol{X}_{i,t}\right) + \left(1 - I_{i,t}\right)\left(m^{NP,h} \sum_{j=0}^{h} \frac{G_{i,t+h}-G_{i,t-1}}{Y_{i,t-1}} + \delta^{NP,h}(L)\boldsymbol{X}_{i,t}\right) + \epsilon_{i,t+h} \quad (4)$$

Where we instrument the cumulative government spending growths in the pandemic and the non-pandemic regime by $I_{i,t} \times G_{i,t}$ and $(1 - I_{i,t}) \times G_{i,t}$ respectively. The estimated coefficient $m^{P,h}$ is the cumulative multiplier at horizon h in the pandemic regime, while $m^{NP,h}$ is the estimated cumulative multiplier at horizon h in the non-pandemic regime.

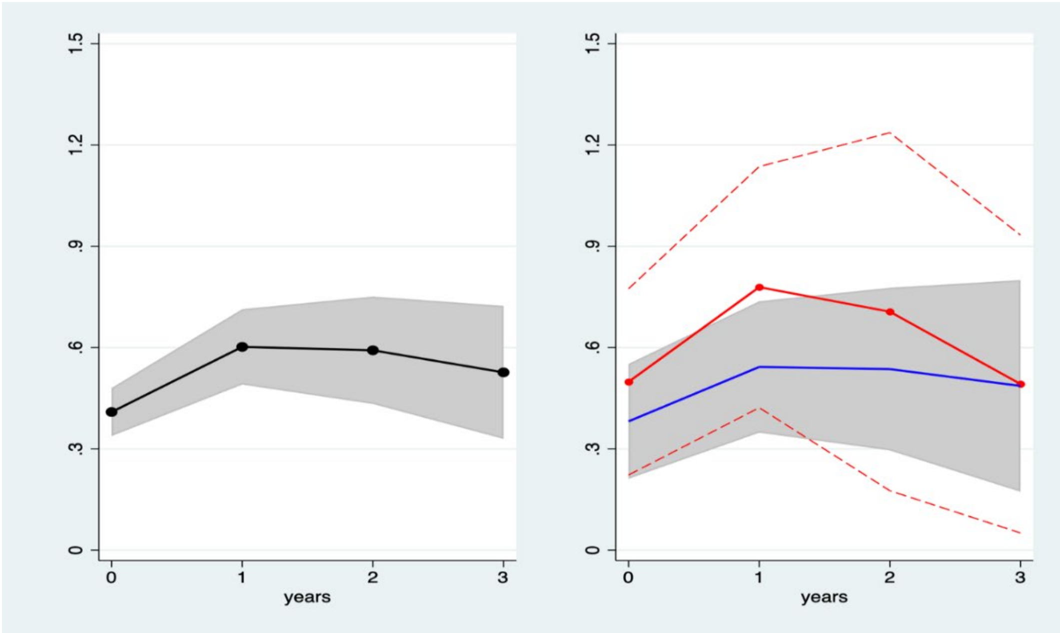
Main Results

This section first presents the main results, focusing first on total public expenditure, before breaking it down to public consumption and investment. Second, it analyzes advanced and developing countries separately. Last, it investigates the role of the three potential transmission channels discussed above: uncertainty, supply bottlenecks and suppressed demand. Our baseline sample excludes 2020, the year of COVID-19. However, as discussed below, the results are qualitatively and quantitatively similar when we include 2020 in the sample.

Figure 1 summarizes the baseline results using total public expenditure and the Blanchard and Perotti (2002) identification. The left panel shows the estimated m^h coefficients from Equation 3. In line with the literature, expansionary fiscal policy has a positive and significant effect on output. The estimated cumulative multiplier is 0.4 in the year of the shock, and 0.5-0.6 in the medium term. The right panel of Figure 1 shows the estimated $m^{P,h}$ in red and $m^{NP,h}$ in blue from Equation 4. The multipliers in the pandemic states are above the multipliers in the non-pandemic states up until the third year after the shock. In the pandemic state, the contemporaneous multiplier is 0.5, and cumulates to 0.7 in the first two years after the shock. In non-pandemic states, the contemporaneous multiplier is lower at 0.38, and cumulates to 0.55 in the first two years following the shock. Table 1 shows the p-value of the Chi-squared test for the difference between the estimated multipliers in the two states. The largest difference between the estimates is in $t = 1$, but the p-value of 0.12 suggests that the estimated fiscal multipliers between pandemic and non-pandemic states are not statistically different.

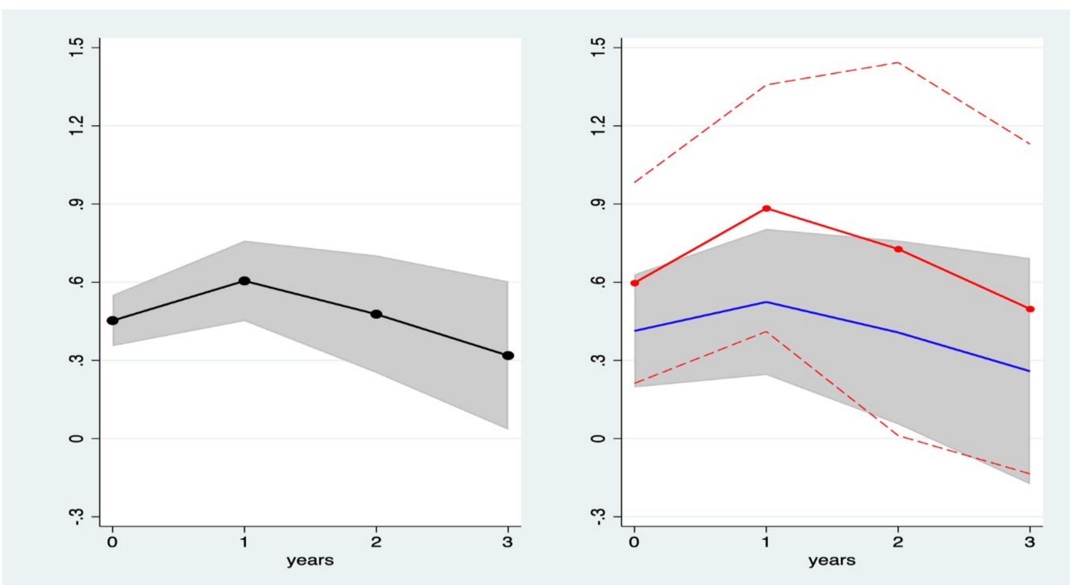
Figure 2 illustrates our baseline results when focusing only on public consumption, instead of total public expenditure. In this case, the fiscal multiplier is lower over the medium term and stands at 0.32 in the third year after the shock. Notably, the fiscal multipliers in the pandemic and non-pandemic states are statistically different, with the multiplier in the pandemic state reaching 0.9 in the first year after the shock. Focusing on investment highlights significantly larger multipliers in both pandemic and non-pandemic states, with the multipliers during pandemics exceeding 2 one year after shock, statistically higher than multipliers in non-pandemic states (Figure 3 and Table 1).

Figure 1. Cumulative Fiscal Multipliers – Total Expenditures, All Countries



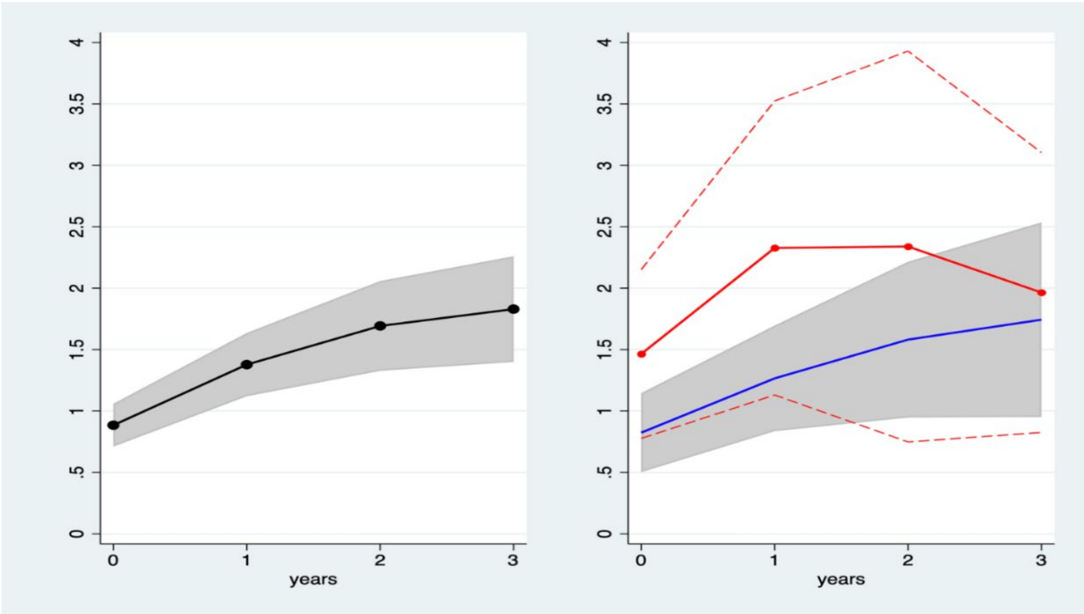
Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Figure 2. Cumulative Fiscal Multipliers – Public Consumption, All Countries



Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Figure 3. Cumulative Multipliers – Fixed Capital Formation, All Countries



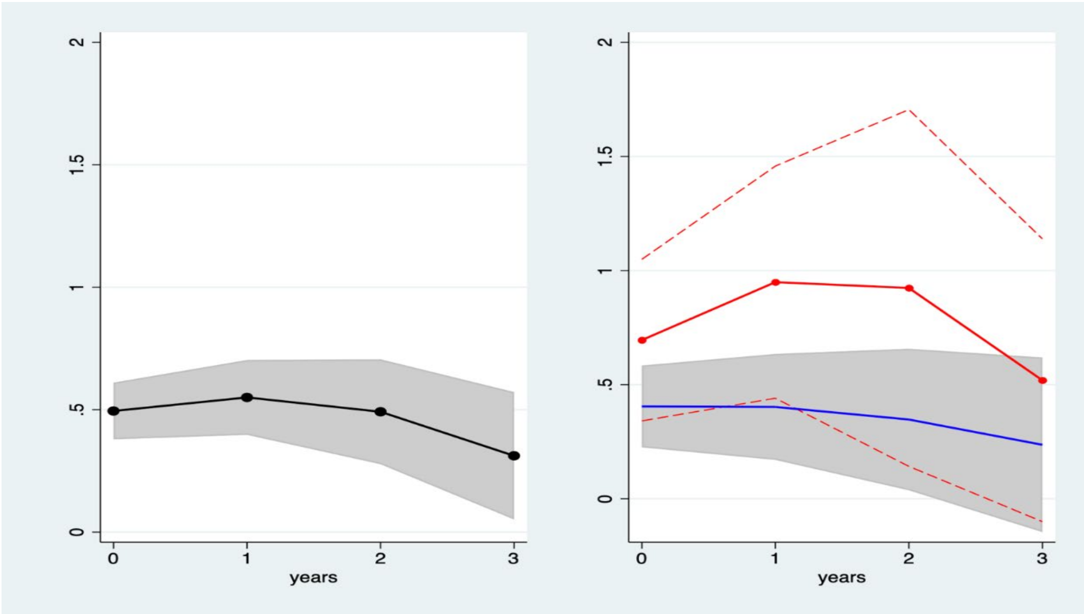
Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Table 1. P-values of the Chi-squared Test of the Difference between Cumulative Fiscal Multipliers in Pandemic and Non-Pandemic States

	T=0			T=1			T=2			T=3		
	Total	Cons.	Inv.	Total	Cons.	Inv.	Total	Cons.	Inv.	Total	Cons.	Inv.
All sample	0.370	0.277	0.102	0.129	0.092	0.069	0.364	0.302	0.244	0.684	0.400	0.396
Advanced	0.075	0.118	0.007	0.020	0.071	0.001	0.114	0.229	0.025	0.342	0.521	0.007
Non-Advanced	0.836	0.876	0.728	0.588	0.322	0.573	0.992	0.756	0.963	0.955	0.710	0.920

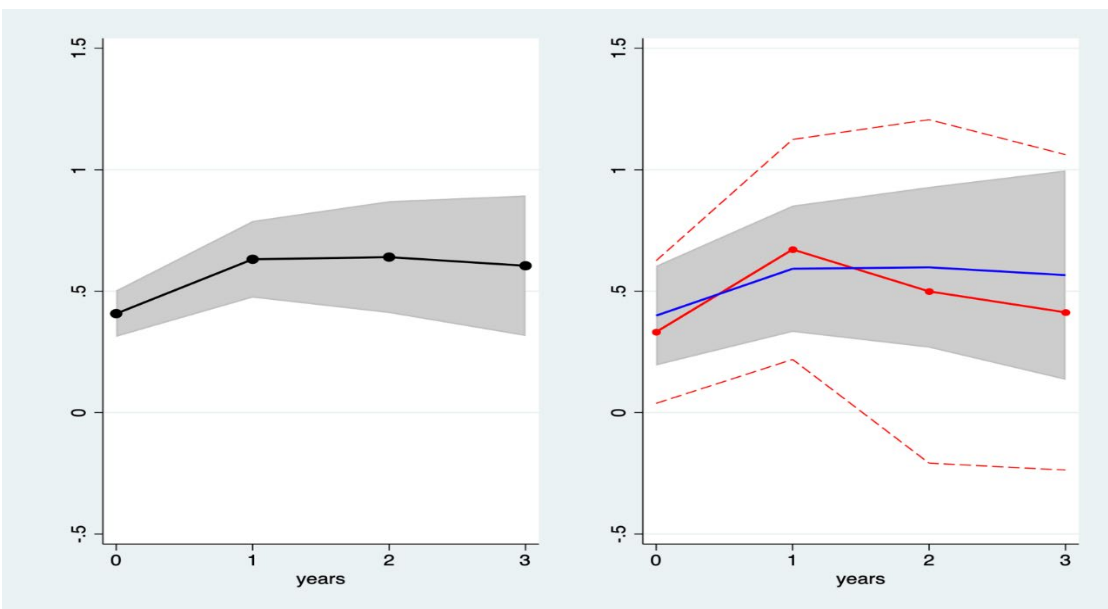
Focusing on advanced economies, illustrates that fiscal multipliers are significantly larger during pandemics, particular one year after the shock when the multiplier is close to 1, about double the multiplier in the non-pandemic state. In developing economies, fiscal multipliers reach about 0.6 one year after the shock and are not statistically different between the pandemic and non-pandemic states, possibly reflecting that spending inefficiencies could worsen during a pandemic and constraint the effectiveness of fiscal policy (Figure 5).

Figure 4. Cumulative Fiscal Multipliers – Total Expenditures, Advanced Economies



Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Figure 5. Cumulative Fiscal Multipliers – Total Expenditures, Developing Economies



Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Transmission Channels

This section investigates the role of potential transmission channels discussed in Section II: heightened uncertainty, supply chain disruptions, and suppressed demand. These channels could be amplified during pandemics, for instance social distancing can hamper the effectiveness of fiscal policy, and impact economic activity.

The paper relies on four proxies to capture these channels: an uncertainty index related to pandemic events, excess private savings, the number of air passengers and container traffic in ports. Deviations from their filtered trends are used for the last three variables. Excess private savings captures forgone consumption by households due to the pandemic and is a proxy for suppressed demand. The (detrended) number of air passengers, which proxy mobility trends, and below trend container traffic in ports can indicate impediments in transportation and production.

While these proxies can broadly capture the potential transmission channels, they do not necessarily match these perfectly. For instance, consumer may decide to postpone planned purchases of goods and resort to excess saving if goods and services they intended to purchase are not available because of production or shipping impediments (supply bottleneck channel). Lockdowns can constraint mobility and lead to lower consumption of goods and services (suppressed demand channel), and also result in higher excess savings. Similarly, container traffic in ports could be below trend due to subdued demand of goods or delays in production. Considering the intertwined relationships between the various proxies and transmission channels, the paper jointly includes all proxies together to control for likely correlations. In this regard, we extend the specifications in equations (1) and (2) by including the proxies and their interactions with the shock as illustrated in the following equations:

$$Z_{i,t+h} = \alpha_i^h + c_t^h + \beta^h Shock_{i,t} + \gamma^h(L)\boldsymbol{X}_{i,t} + +\theta^h \boldsymbol{W}_{i,t} + \vartheta^h \boldsymbol{W}_{i,t} Shock_{i,t} + \varepsilon_{i,t+h} \quad (5)$$

and

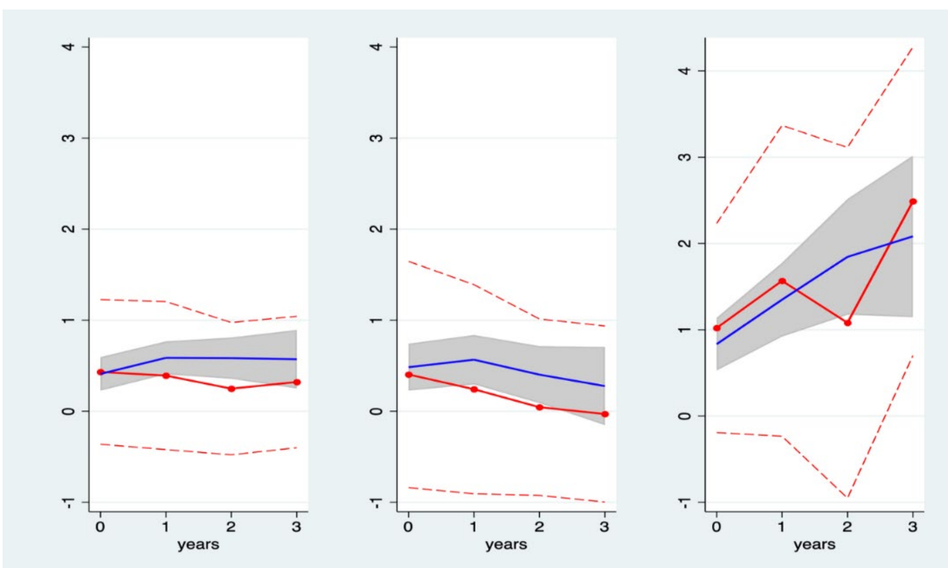
$$Z_{i,t+h} = \alpha_i^h + c_t^h + I_{i,t}(\beta^{P,h} Shock_{i,t} + \gamma^{P,h}(L)\boldsymbol{X}_{i,t} + \theta^{P,h}\boldsymbol{W}_{i,t} + \vartheta^{P,h}\boldsymbol{W}_{i,t} Shock_{i,t}) + (1 - I_{i,t})(\beta^{NP,h} Shock_{i,t} + \gamma^{NP,h}(L)\boldsymbol{X}_{i,t} + \theta^{NP,h}\boldsymbol{W}_{i,t} + \vartheta^{NP,h}\boldsymbol{W}_{i,t} Shock_{i,t}) + \varepsilon_{i,t+h} \quad (6)$$

Where $\boldsymbol{W}_{i,t}$ is a vector containing the proxies. We focus mostly on the p-values of the test of difference between the estimated multipliers in the two states (pandemic and non-pandemic) after including the proxies in the specification. If the differences in fiscal multipliers between pandemic and non-pandemic states are no longer present after the introduction of the proxies, we can attest that one or more of these proxies act as transmission channels. In addition, the statistical significance of the $\vartheta^{P,h}$ coefficients provide a sense of the relative importance of each channel.

The results are summarized in Figure 6 and Table 2. Figure 6 plots the unconditional multiplier for total expenditures, i.e., the multiplier when the uncertainty index is at zero, while private savings, air passengers and container traffic are at their trend value. The multipliers in the two states have visibly shifted closer to each other for all three expenditure statistics. This is also confirmed when looking at the statistical test of difference in fiscal multipliers in the two states for total public expenditures, consumption, and investment (Table 2). The p-values associated with the test of differences increase markedly. At $h = 0$ and $h = 1$, and the tests very confidently reject a statistical difference between the multipliers in the two states, including in cases where a statistical difference was previously established. This suggests that the tested transmission channels could underpin the larger fiscal multipliers during health crises.[10] An additional observation in Figure 6 is that the multipliers in the non-pandemic regime show virtually no differences compared to the normal regime multipliers estimated without the proxies (Figures 1-3).

Table A.3 in the Appendix illustrates the results of Equation 6, estimated via the one-step IV methodology of Equation 4., for $h = 1, 2, 3, 4$. The table only displays the estimated coefficients of the proxies. It shows that among the three transmission channels, uncertainty has the largest impact on the effectiveness of fiscal policy immediately at the onset of a health crisis. The positive coefficient implies that a high level of uncertainty is associated with a higher fiscal multiplier, in line with the findings of Berg (2019). This result suggests for instance that fiscal policy can be more effective when private activity (e.g., investment and consumption) is dampened by heightened uncertainty. The positive estimate of the excess savings' triple interaction suggests that (a given level of) fiscal policy is more effective when private consumption is impaired due to a health crisis. Above or below trend container traffic in ports also appears to have an important effect, with long lasting implications for the effectiveness of fiscal policy. The estimated positive coefficients on the triple interaction terms indicate that during and after pandemics, lower container traffic increases the multipliers. The result suggests that this proxy may be more prone at capturing deficiencies in demand, rather than supply bottlenecks.

Figure 6. Including Proxies to Capture Transmission Channels: Total Expenditures, Public Consumption and Public Investment, All Countries



Note: Cumulative fiscal multipliers from Equation (6).The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals. $\boldsymbol{W_t}$ includes the deviation of real private savings over GDP from its trend, the deviation of the number of air passengers from its trend and the deviation of the container traffic in ports over its trend. Trends obtained via the HP filter.

[10] It is worth noting that the wide confidence bands for the pandemic regime multipliers also influence the test statistics.

Table 1. P-Value of the Chi-Squared Test of the Difference between the Cumulative Multipliers in the Two States, after Adding Proxies for Transmission Channels

	Total expenditures		Gov. consumption		Gov. investment	
	Baseline	Proxies incl.	Baseline	Proxies incl.	Baseline	Proxies incl.
T=0	0.374	0.926	0.287	0.980	0.096	0.909
T=1	0.126	0.714	0.090	0.789	0.067	0.986
T=2	0.349	0.262	0.295	0.543	0.237	0.232
T=3	0.679	0.394	0.410	0.612	0.385	0.592

Note: Left columns are the baseline specifications, the right columns include the proxies.

Robustness and Additional Exercises

Several countries have implemented strict lockdowns and social distancing policies during the COVID-19 pandemic. In addition, the crisis has brought about long-lasting disruptions in the production of many goods and in international shipping. The analysis above suggests that fiscal multipliers would be relatively higher in this environment. To assess whether the results could apply to the current COVID-19 crisis, we extended the estimation period to include the year 2020. The estimated multipliers are both qualitatively and quantitatively similar to our baseline results (Figure A. 9). The main results are also robust to adding several control variables, such as additional lags of the existing control variables and further control variables (domestic credit growth and the current account balance).[11]

Fiscal multipliers tend to be low in countries with a weak fiscal position (Sutherland, 1997; Perotti, 1999; Nickel and Tudyka, 2014; Huidrom, et al., 2020). One reason behind this evidence is the interest rate channel: fiscal expenditure at an already high-level of debt or low fiscal credibility can further increase the credit risk and borrowing costs across the economy. This also limits a country's potential to fight a pandemic. To assess this, we first add the debt-to-GDP ratio to our baseline specification, in the form of Equation 6, estimated via the one-step IV method. Panel A of Table A.4 shows the estimated $\theta^{\bullet,h}$ and $\vartheta^{\bullet,h}$ coefficients. In line with the literature, a high level of debt tends to decrease the effectiveness of fiscal policy. Interestingly, we do not find this to be the case in the pandemic regime, supporting the priority given to health responses and immediate economic support by most countries at the onset of the COVID-19 pandemic. In Panel B, we introduce a dummy variable that takes the value one if the country had a fiscal rule in place at the given year (Schaechter et al. 2012; Davoodi, et al., 2022) and zero otherwise. The results highlight that fiscal spending is more effective at boosting aggregate activity in countries with at least one fiscal rule at the onset of the pandemic, suggesting that the rule could boost fiscal credibility and help anchor medium-term expectations. We do note, however, that many countries have relaxed their fiscal rules or activated escape clauses due to the pandemic.

Our baseline identification, the traditional Blanchard and Perotti (2002) identification has been criticized by the literature on two main grounds. First, fiscal policies are usually anticipated by the public long before their actual implementation, which can lead to inconsistent estimation of the effect of the shock (see Leeper, Todd and Yang, 2013). Second, as the Blanchard and Perotti (2002) shock can be forecasted by professional forecasters, it may include endogenous response of the government to economic conditions. To overcome these issues, an alternative identification has been proposed, namely, to identify unexpected expenditure

[11] These results are available upon request.

shocks through public expenditure forecasts errors (Auerbach and Gorodnichenko, 2013; Forni and Gambetti 2016; Abiad, Furceri, and Topalova, 2016; among others). We use the public expenditure forecasts for the upcoming year from the October edition of the IMF World Economic Outlook to compute forecast errors of public spending. To control for any change in expenditure due to change in output, we also include real GDP forecasts errors in the estimation. The estimation sample is restricted to 2002-2019 and 49 countries due to limited availability of forecast data. The results confirm our main findings, that is short- and medium-term fiscal multipliers are higher in the pandemic regime and the difference between the estimated multipliers in the two regimes are statistically significant (Figure A.9).[12]

Conclusion

This paper assessed how fiscal multipliers vary during health crises, particularly how factors such as social distancing and uncertainty could lower contemporaneous (T) multipliers and increase near-term (T+1 and T+2) multipliers.

It showed that fiscal multipliers are larger in the immediate years that follow the onset of a health crisis. The baseline results confirm that an expansionary fiscal policy has a positive and significant effect on output with an estimated multiplier of 0.4 in year T and a cumulative multiplier of 0.5-0.6 in the medium term. Comparing pandemic and non-pandemic states highlights significantly larger multipliers during pandemics, especially in advanced economies. The cumulative multiplier in the pandemic rises to almost 1 one year after the pandemic shock in advanced economies, compared to about 0.4 in the non-pandemic regime. The paper also showed that the differences in the pandemic and non-pandemic fiscal multipliers can be explained by three main factors: uncertainty, suppressed demand and supply bottlenecks. These results are supported by a variety of robustness checks such as (i) including 2020, the height of the COVID-19 pandemic, in the estimation period; (ii) controlling for additional variables such domestic credit growth, the current account balance, and the debt-to-GDP ratio; and (iii) testing for a fiscal credibility channel by controlling for the presence of fiscal rule in the country. In addition, the results are also confirmed with use of an alternative identification strategy that capture unexpected expenditure shocks through public expenditure forecasts errors.

The findings in the paper suggest that the growth impact of fiscal stimulus packages during health crises and pandemics could be larger and longer lasting than often assumed. As such, the large fiscal support deployed at the onset of the COVID-19 pandemic could have a larger impact than in non-pandemic times. Notably, the impact could be at least 50 percent larger one year after the large-scale fiscal stimulus, a noticeable difference when compared to expectations based on more traditional (non-pandemic) fiscal multipliers.

[12] The bottom panel of Figure A.9 illustrates the results using the baseline Blanchard and Perotti (2002) method, while constraining the estimation sample to match the sample of the forecast error estimation sample for comparison.

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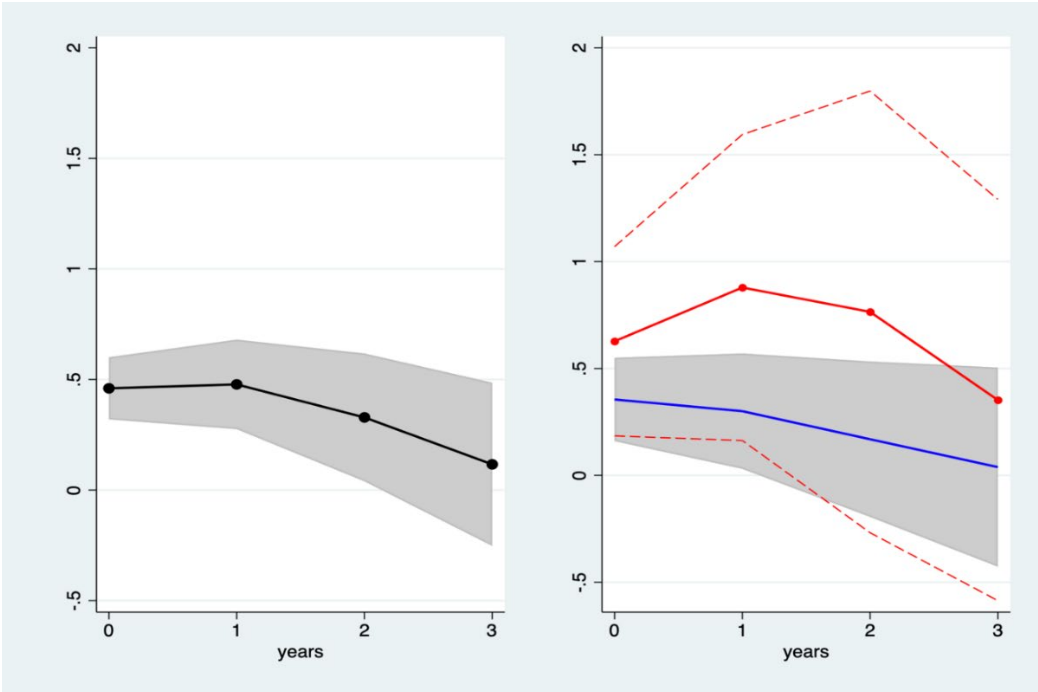
Annex

Table A1. Summary Statistics

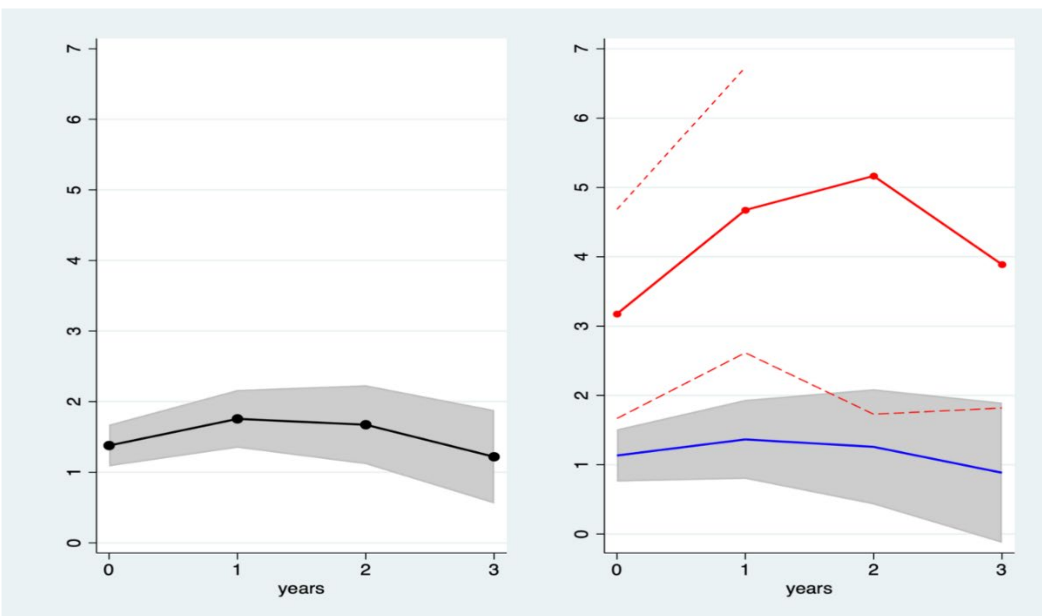
	Mean	Std. Dev.	Minimum	Maximum	Observations
Dummy Variable for Deaths Above Median	0.01	0.11	0.00	1.00	3380
Gross Domestic Product at 2014p (mn. USD)	904760.80	2188649	3411.64	19700000	1947
Gross Domestic Product at current prices (mn. USD)	568781.20	1688126	568.21	21400000	2756
Log of GDP at current prices	4.55	0.20	1.84	6.18	2321
Log of GDP at 2014p	12.36	1.67	8.13	16.80	1947
Total Government Expenditure	142167.30	406480.50	136.84	4625097	2295
Gov. Gross Nominal Fixed Capital Formation (mn. USD)	32935.11	130854.70	-30393.35	2229804	2538
Gov. Consumption Expenditure, current price (mn. USD)	94461.13	266176.30	0.00	2973918	2789
Tax revenue (mn. USD)	125604.40	329061.70	15.86	3411509	1957
Consolidated Fiscal Balance (mn. USD)	-18773.35	90847.98	-1471297	254848	2050
Government Debt (% of GDP)	0.51	0.34	0.02	2.01	1943
Government Debt (mn. USD)	548445.70	1853147	293.59	23200000	1787
Private Consumption Expenditure, current price (mn. USD)	325973.80	1045287	0.00	14400000	2771
Private Nominal Saving and Investment Saving (mn. USD)	40800000	315000000	-1041097	6530000000	2845
Total Imports (mn. USD)	123085.10	260540.80	478.26	2537730	2484
Current Account Balance (mn. USD)	247.95	57578.74	-816646.00	420568.50	2769
Domestic Credit, Y-o-Y growth (%)	17.55	142.29	-4079.33	4093.33	1961
Unemployment Rate (%)	7.98	5.56	0.05	38.40	2389
Consumer Price Index, Period Avg., Y-o-Y growth (%)	38.03	359.28	-8.53	11749.63	2937
Population (mn. persons)	59.90	176.54	1.31	1410.08	3322
Tourist arrival (persons)	10100000	15600000	700.00	190000000	2220
GDP Deflator	96.68	19.08	6.29	482.49	2321
GDP Deflator, Y-o-Y growth (%)	11.36	52.55	-26.87	1489.50	2321

Figure A1. Cumulative Multipliers – Public Consumption, Advanced Countries



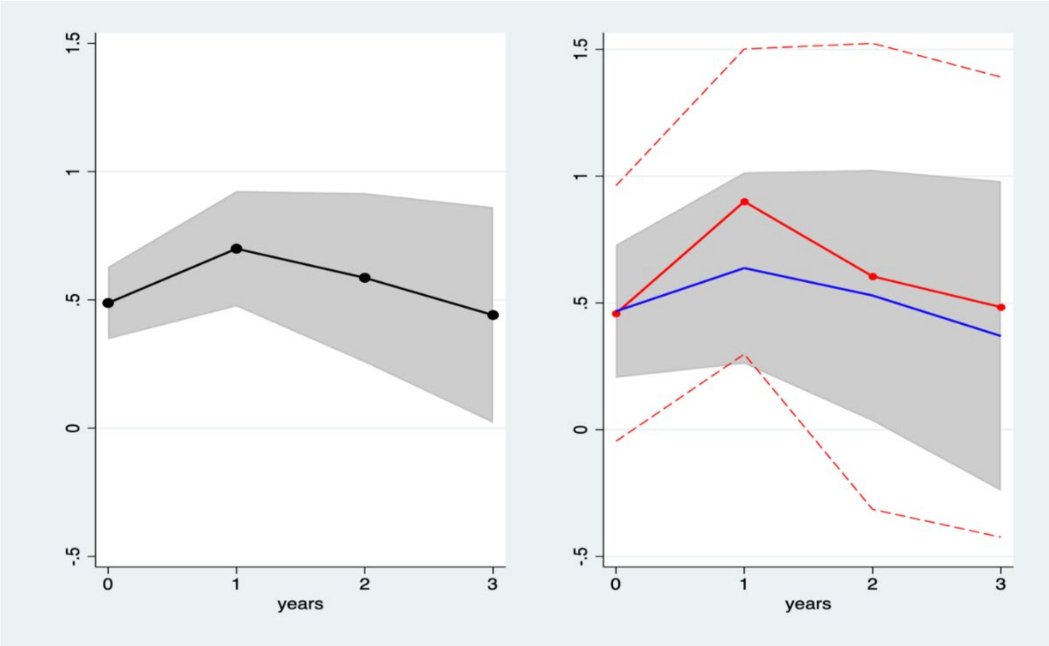
Note: Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Figure A2. Cumulative Multipliers – Fixed Capital Formation, Advanced Countries



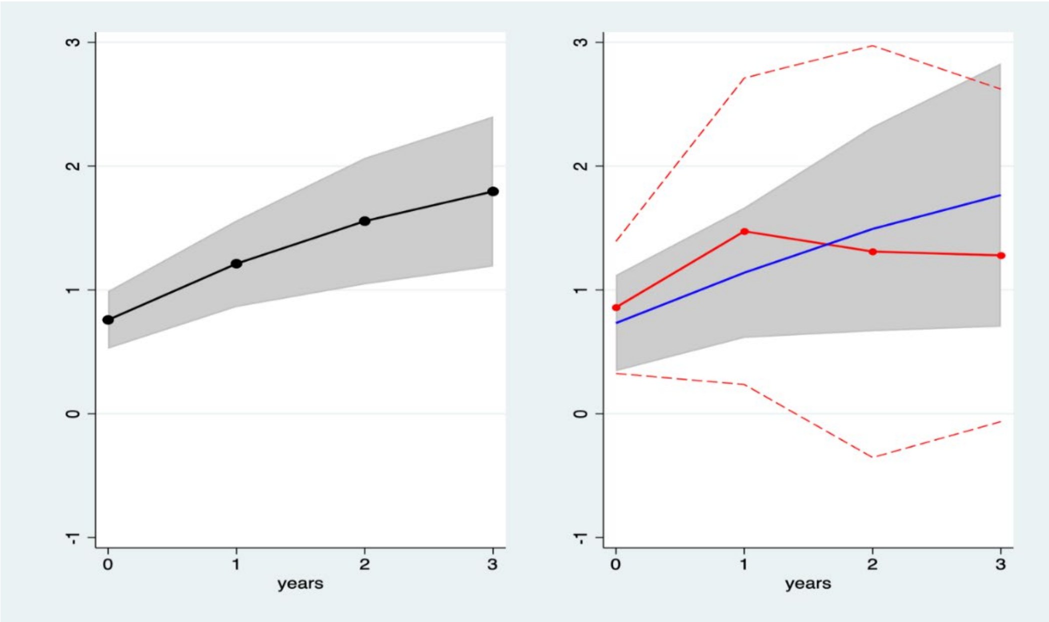
Note: The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Figure A3. Cumulative Multipliers – Public Consumption, Non-advanced Countries



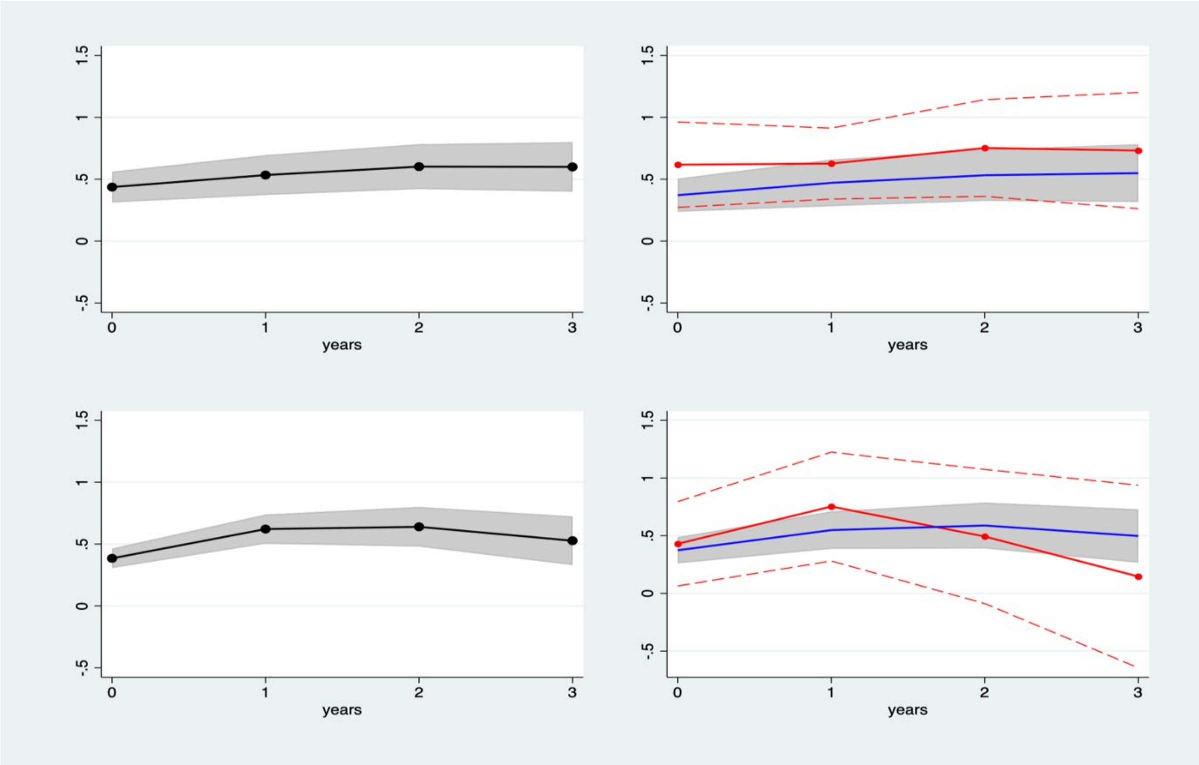
Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Figure A4. Cumulative Multipliers – Fixed Capital Formation, Non-advanced Countries



Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals.

Figure A5. Multipliers with the Forecast Error Identification



Note: Cumulative fiscal multipliers from Equation (3) (Left panel) and Equation (4) (Right panel). The black line represents the average (non-state dependent) fiscal multiplier. The redline and blue lines represent multipliers in pandemic and non-pandemic states respectively. The shaded areas and dashed lines are corresponding 95% Driscoll and Kraay confidence intervals. The top panel shows the results of the forecast error identification, while the bottom panel shows the results of the baseline specification, with constraining the sample to match the forecast error identification sample.

Table A2. Mean Values, Standard Deviations, and P-Value T-Tests of Difference in Mean of Transmission Channel Proxies in Pandemic and Non-pandemic States

	Pandemic		Non-pandemic		P-value
	Mean	Std. Dev.	Mean	Std. Dev.	
Uncertainty	5.247	10.210	0.182	2.110	0.000
Excess private saving (mill.)	-0.40	0.154	0.003	0.093	0.000
Air passengers (detrended)	-0.928	0.019	0.001	0.014	0.000
Container traffic (detrended)	-3.780	4.132	0.300	5.111	0.000

Note: Uncertainty is the World Pandemic Uncertainty index. Excess private savings is the deviation of real private savings over GDP from its trend. Air passengers is the deviation of the number of air passengers over population from its trend. Container traffic is the deviation of the container traffic in ports in one hundred thousand over its trend. Trends obtained via the HP filter.

Table A3. Transmission Channels Regressions, Total Expenditure, All Countries

	(1) h=0	(2) h=1	(3) h=2	(4) h=3
Uncert.$*$ I_t	0.001*	0.002**	0.002**	0.003**
	(0.000)	(0.001)	(0.001)	(0.001)
Uncert.$*$ $(1-I_t)$	-0.000	0.000	0.001	0.001**
	(0.000)	(0.000)	(0.001)	(0.001)
Exc. Save*I_t	0.051**	0.063**	0.064	0.067
	(0.026)	(0.030)	(0.040)	(0.056)
Exc. Save*$(1-I_t)$	0.019	0.037**	0.040*	0.037
	(0.012)	(0.018)	(0.022)	(0.048)
Psgr.*I_t	0.055	0.346	0.138	-0.081
	(0.181)	(0.290)	(0.368)	(0.459)
Psgr.*$(1-I_t)$	-0.098	-0.025	0.037	-0.002
	(0.136)	(0.181)	(0.236)	(0.341)
Cont. traff.*I_t	0.000	-0.003	-0.004	-0.003
	(0.002)	(0.003)	(0.004)	(0.005)
Cont. traff.*$(1-I_t)$	0.000	-0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.003)
Shock´Uncert.*I_t	0.113***	0.011	-0.054	-0.158
	(0.032)	(0.063)	(0.089)	(0.129)
Shock´Uncert.*$(1-I_t)$	0.243	0.298	0.234	0.205
	(0.263)	(0.315)	(0.326)	(0.347)
Shock*Exc. Save*I_t	0.854	0.877*	1.653**	0.812
	(0.776)	(0.496)	(0.690)	(0.802)
Shock*Exc. Save*$(1-I_t)$	-0.559	-0.341	-0.336	-0.739
	(0.639)	(0.837)	(1.037)	(1.246)
Shock*Psgr.*I_t	19.884	20.466	13.388	33.084**
	(15.317)	(24.344)	(17.177)	(16.073)
Shock*Psgr*$(1-I_t)$	-3.922	-8.219	-11.414	-12.275
	(3.986)	(5.794)	(7.177)	(8.868)
Shock*Contain. traffic*I_t	- 0.199***	-0.284**	- 0.274***	- 0.348***
	(0.069)	(0.117)	(0.088)	(0.086)
Shock*Contain. traffic*$(1-I_t)$	0.001	0.015	0.022	0.041
	(0.018)	(0.025)	(0.028)	(0.038)
R-squared	0.707	0.783	0.817	0.842

Note: Output tables of Equation 6, estimated via the 1-step IV method of Equation 4. Fixed-effects and control variables omitted. I_t is the pandemic dummy, shock is the fiscal policy shock, Uncert. Is the Pandemic Uncertainty Index, Exc. Save is detrended private savings, Cont. Traff. Is detrended container traffic, Psgr is the detrended number of air passengers. Robust standard errors in parenthesis, stars denote statistical significance at 1, 5 and 10%.

Table A4. The Role of Fiscal Position and Credibility

Panel (A): Debt-to-GDP ratio

	T=0	T=1	T=2	T=3
Debt * $\boldsymbol{I_t}$	0.006	0.038***	0.056***	0.080***
	(-0.006)	(-0.011)	(-0.014)	(-0.017)
Debt * $(\mathbf{1}-\boldsymbol{I_t})$	0.009	0.039***	0.070***	0.096***
	(-0.006)	(-0.012)	(-0.016)	(-0.019)
Shock * Debt * $\boldsymbol{I_t}$	0.012	-0.122	-0.285	-0.11
	(-0.313)	(-0.433)	(-0.538)	(-0.485)
Shock * Debt * $(\mathbf{1}-\boldsymbol{I_t})$	-0.302***	-0.095	0.010	-0.087
	(-0.109)	(-0.152)	(-0.165)	(-0.213)

Panel (B): Fiscal Rule

	T=0	T=1	T=2	T=3
FiscalRule * $\boldsymbol{I_t}$	-0.002	-0.003	-0.002	0.004
	(-0.007)	(-0.009)	(-0.012)	(-0.014)
FiscalRule * $(\mathbf{1}-\boldsymbol{I_t})$	-0.003	-0.004	-0.005	-0.002
	(-0.004)	(-0.006)	(-0.007)	(-0.008)
Shock * FiscalRule * $\boldsymbol{I_t}$	0.522**	0.119	-0.019	-0.2
	(-0.260)	(-0.421)	(-0.425)	(-0.375)
Shock * FiscalRule * $(\mathbf{1}-\boldsymbol{I_t})$	0.198	0.233	0.395	0.336
	(-0.179)	(-0.266)	(-0.292)	(-0.392)

Note: Output tables of Equation 6, estimated via the 1-step IV method of Equation 4. Fixed-effects and control variables omitted. Shock is the fiscal policy shock, Debt is the debt-to-GDP ratio, Fiscal Rule is a dummy variable equal to one if a country has a fiscal rule in place at a given year.

PUBLICATIONS