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Abstract

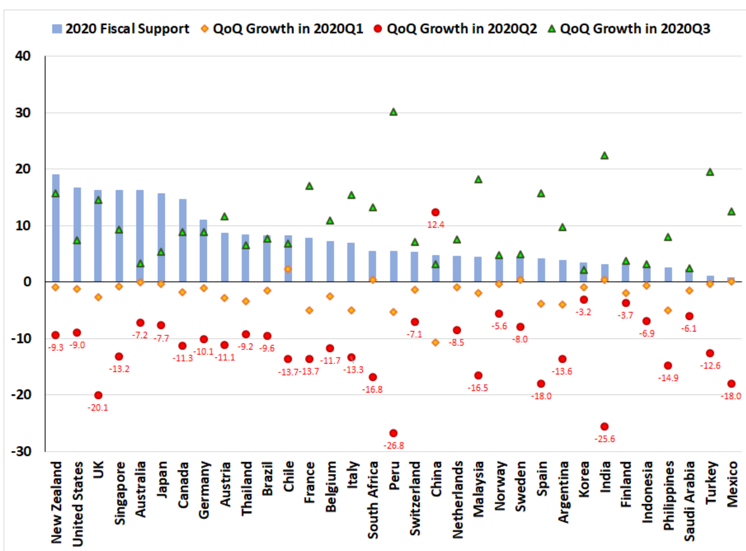
This paper uses a threshold-augmented Global VAR model to quantify the macro-economic effects of countries' discretionary fiscal actions in response to the Covid-19 pandemic and its fallout. Our results are threefold: (1) fiscal policy is playing a key role in mitigating the effects of the pandemic; (2) all else equal, countries that implemented larger fiscal support are expected to experience less output contractions; (3) emerging markets are also benefiting from the synchronized fiscal actions globally through the spillover channel and reduced financial market volatility.

Keywords: TGVAR, Covid-19, threshold effects, fiscal policy.
JEL Classifications: C32, E44, E62, F44.

1 Introduction

Covid-19 is a global shock ‘like no other’, involving simultaneous disruptions to supply and demand in an interconnected world economy. The pandemic led to a sharp tightening of global financial conditions at the acute phase of the crisis and has inflicted large economic losses across the world (see Figure 1) with potentially lasting effects (see Chudik et al. 2020 for details). In response, countries around the world have offered large fiscal support packages to save lives and protect households and viable firms (estimated by the IMF to reach $13.8 trillion globally—$7.8 trillion in additional spending and forgone revenues, and $6 trillion in equity injections, loans and guarantees). The size and form of such support varies across countries depending on the impact of shocks, access to low-cost borrowing, and pre-crisis fiscal conditions. Meanwhile, debt vulnerabilities are rising (particularly in emerging markets and developing countries) amid new pandemic waves/variants and reimposition of restrictions in some regions. Countries are therefore calling for a careful assessment of the effectiveness of the adopted fiscal measures before they embark on further easing or tailoring of measures. Assessing effectiveness is particularly important in emerging markets and developing countries where limited fiscal space should be used prudently considering the multiplicity of the shocks they face and generally weaker institutional quality.

Figure 1: Size of Fiscal Support (Percent of GDP) and QoQ Growth (Percent)



Sources: *Fiscal Monitor Database* of Country Fiscal Measures in Response to COVID-19; *Haver Analytics*.

This paper contributes to the literature by quantifying the macroeconomic effects of countries’ discretionary fiscal actions in response to Covid-19 in a coherent 33-country framework that is augmented with threshold effects (to capture the impact of excessive global volatility that arose from Covid-19). It builds on the model of Chudik et al. (2020)[1] and uses a novel database of discretionary fiscal measures by governments in response to Covid-19, complied by the IMF. The model takes into account both the temporal and cross-sectional dimensions of the data, real and financial drivers of economic activity, common factors such as oil prices and global volatility (especially beyond certain thresholds), and network effects (e.g., through trade linkages). This is crucial as the impact of shocks (and importantly that of Covid-19 and policy responses to mitigate its effects) cannot be reduced to a single country but rather involves multiple regions/countries, and this impact may be amplified or dampened depending on countries' economic structures. Country-specific models include output growth, the change in cyclically-adjusted primary balance, the real exchange rate, as well as real equity prices and long-term interest rates when available.

Our counterfactual results indicate that the quarter on quarter (QoQ) real GDP growth effects of discretionary spending and revenue measures in response to Covid-19 and its economic fallout vary across regions and countries, depending on country-specific factors, cross-border spillovers, and the size and composition of policy support. Among advanced economies, we estimate that the effects are particularly large in the United States, Germany, and Canada with QoQ growth impact in 2020Q2 being 7.1, 7, and 6.2 percentage points, respectively. In the United States, substantial assistance to households, firms, and state and local governments is estimated to have prevented worse economic outcomes in 2020 but the risk of fiscal drag this year remains in the absence of additional fiscal support. The large and data-dependent fiscal support in Canada is estimated to mitigate the negative growth effects of the pandemic and facilitate the post-Covid recovery. Germany's fiscal packages—focusing initially on healthcare infrastructure, households (through Kurzarbeit) and businesses, and subsequently on the recovery— is estimated to support growth and contain job losses.

While emerging markets and developing countries offered smaller fiscal packages to counter the health crisis and support the economy than advanced economies, our results show that the QoQ growth effects of such actions are sizable and magnified by policy spillovers. Specifically, monetary and financial sector policies in advanced economies have reduced global financial market volatility and eased capital outflow pressures in emerging markets, and synchronized fiscal actions globally have led to positive growth spillovers to emerging markets and developing economies through the trade channel. In contrast to single-country analyses, our global model is well suited to capture these financial and third-market effects. Since

[1] Chudik et al. (2020) deal with the following challenges in the empirical analysis of Covid-19: how to identify the shock, how to account for its nonlinear effects, how to consider its cross-country spillovers, and how to quantify the sample uncertainty.

China has been able to largely contain infections earlier and adopted a forceful public investment push to start a recovery, growth effects are showing up with a lag in our analysis. Finally, at the global level, countries fiscal actions and their spillovers are estimated to have mitigated the collapse in QoQ global growth in 2020Q2–Q3 by 2.7–2.8 percentage points.

While research on estimating the effectiveness of fiscal support in response to Covid-19 is scant, there is a vast literature on the GDP effects of fiscal policy, with a particular focus on identifying exogenous shifts in policy and estimating the size of fiscal multipliers (see Ramey 2019 for a survey). The Hutchins Center on Fiscal and Monetary Policy is an exception in estimating the growth effects of pandemic-related fiscal actions in the United States. Its latest estimates indicate that the local, state, and federal tax and spending policy in the United States boosted QoQ growth in second quarter of 2020 by 3.6 percentage points, a number which is lower than our estimates. More broadly, our paper is related to aggregate country-level time series or panel estimates of the GDP effects of exogenous shifts in fiscal policy. The leading approaches to identifying this exogenous variation are structural vector autoregressions (Blanchard and Perotti 2002) and narrative methods (Romer and Romer 2010 and Guajardo et al. 2014). However, there is an ongoing debate about the efficacy of these techniques in resolving the identification problem. In our approach, we rely on (i) IMF's database of discretionary fiscal measures in response to Covid-19 to calibrate the size of fiscal shocks in 2020; (ii) changes in cyclically-adjusted primary balances of countries over the past four decades to inform variations in fiscal stances; and (iii) generalized impulse response functions to estimate the growth effects of Covid-19 fiscal support. We are concerned about the overall growth impact of pandemic fiscal support (while accounting for policy spillovers) rather than whether historical changes in budget deficits were caused by pure discretion, automatic stabilizers, or other effects.

2 A Fiscal TGVAR Model

Before studying the macroeconomic effects of Covid-19 fiscal actions using the Threshold-augmented Global VAR (TGVAR) model of Chudik et al. (2020), we provide a short exposition of the methodology and data.

2.1 Data and Variables

We consider a world economy composed of $n+1$ interconnected countries and the following variables: the logarithm of real GDP (gdp_{it}), nominal long-term interest rate (lr_{it}), the logarithm of real equity prices (eq_{it}), the logarithm of the real exchange rate (ep_{it}), and the cyclically adjusted primary balance as a ratio of potential GDP ($capb_{it}$). The model includes 33 countries and covers the period 1979Q2 to 2019Q4, see Table 1. We denote the country-specific variables by $\mathbf{y}_{it} = (\Delta gdp_{it}, \Delta lr_{it}, \Delta eq_{it}, \Delta ep_{it}, \Delta capb_{it})'$.

The U.S. economy is denoted by $i = 0$, with the remaining economies are indexed by $i = 1, 2, ..., n$. We collect all the country-specific variables in a single $k \times 1$ vector $\mathbf{y}_t = (\mathbf{y}'_{0t}, \mathbf{y}'_{1t}, \mathbf{y}'_{2t}, ..., \mathbf{y}'_{nt})'$. We include changes in log oil prices, $\Delta poil_t$, and global realized volatility of equity returns, $grve_t$, as global observed factors in the vector $\mathbf{g}_t = (\Delta poil_t, grve_t)'$. To capture the effects of unobserved common factors (global and trade weighted), we include two sets of additional variables in the model: (i) PPP-GDP weighted averages of the country-specific variables, or $\tilde{\mathbf{y}}_t = \left(\Delta \widetilde{gdp}_t, \Delta \widetilde{lr}_t, \Delta \widetilde{eq}_t, \Delta \widetilde{ep}_t, \Delta \widetilde{capb}_t\right)'$, in which $\tilde{\mathbf{y}}_t = \tilde{\mathbf{W}}\mathbf{y}_t$, and $\tilde{\mathbf{W}}$ is a $k \times k$ PPP-GDP weights matrix; and (ii) trade-weighted averages of the country-specific variables, or $\mathbf{y}^*_t = (\Delta gdp^*_t, \Delta lr^*_t, \Delta eq^*_t, \Delta ep^*_t)'$, in which $\mathbf{y}^*_t = \mathbf{W}\mathbf{y}_t$, and $\mathbf{W}$ is a $k^* \times k$ trade weights matrix (constructed as three-year averages). The reason for considering both $\tilde{\mathbf{y}}_t$ and $\mathbf{y}^*_t$ in the model is to distinguish global factors from local (trade related) effects.

Table 1: Countries and Regions in the TGVAR Model

Advanced Economies	**Euro Area**	**Emerging Economies (excl. China)**	**Emerging Asia (excl. China)**
Australia	Austria	Argentina	India
Austria	Belgium	Brazil	Indonesia
Belgium	Finland	Chile	Malaysia
Canada	France	India	Philippines
Finland	Germany	Indonesia	Thailand
France	Italy	Malaysia	
Germany	Netherlands	Mexico	**Latin America**
Japan	Spain	Peru	Argentina
Korea		Philippines	Brazil
Netherlands		South Africa	Chile
Norway		Saudi Arabia	Mexico
New Zealand		Thailand	Peru
Singapore		Turkey	
Spain			
Sweden			
Switzerland			
United Kingdom		**China**	
United States			

2.2 Country-Specific Models and Global Factors

We specify the country-specific threshold-augmented models as:

$$\mathbf{y}_{it} = \mathbf{c}_{y,i} + \mathbf{\Phi}_i \mathbf{y}_{i,t-1} + \mathbf{B}_i \mathbf{y}^*_{i,t-1} + \mathbf{A}_{0,i}\mathbf{f}_t + \mathbf{A}_{1,i}\mathbf{f}_{t-1} + \boldsymbol{\lambda}_i z_{t-1}(\boldsymbol{\gamma}_i) + \mathbf{u}_{it}, \quad (1)$$

for $i = 0, 1, ..., n$, where the threshold indicator, $z_{t-1}(\gamma_i)$, is defined by

$$z_{t-1}(\gamma_i) = I\left[(0,1)'\mathbf{g}_{t-1} > \gamma_i\right] = I\left(grve_{t-1} > \gamma_i\right). \tag{2}$$

We allow the country-specific error vectors, $\mathbf{u}_{it}$, to be cross-sectionally weakly correlated and do not include the contemporaneous values of $\mathbf{y}_{it}^*$ in (1). Moreover, we model the global observed and unobserved factors as

$$\mathbf{f}_t = \mathbf{c}_f + \mathbf{\Theta}\mathbf{f}_{t-1} + \mathbf{v}_t, \tag{3}$$

where $\mathbf{f}_t = (\mathbf{g}_t', \tilde{\mathbf{y}}_t')'$ and $\mathbf{v}_t$ is a vector of reduced form global shocks.

2.3 The TGVAR Representation

Substituting (3) for $\mathbf{f}_t$ in (1) and stacking for $i = 0, 1, 2, ..., n$, we obtain

$$\mathbf{y}_t = \mathbf{d} + \mathbf{\Phi}\mathbf{y}_{t-1} + \mathbf{B}_y\mathbf{y}_{t-1}^* + \mathbf{B}_f\mathbf{f}_{t-1} + \mathbf{\Lambda}_y\mathbf{z}_{t-1}(\boldsymbol{\gamma}) + \mathbf{A}_0\mathbf{v}_t + \mathbf{u}_t, \tag{4}$$

where $\mathbf{d}$, $\mathbf{\Phi}$, $\mathbf{B}_y$, $\mathbf{B}_f$, $\mathbf{\Lambda}_y$, $\mathbf{A}_0$ contain the corresponding parameters in (1) for $i = 0, 1, 2, ..., n$ or a combinations of those using $\mathbf{d}_i = \mathbf{c}_{y,i} + \mathbf{A}_{0,i}\mathbf{c}_f$ and $\mathbf{B}_{f,i} = \mathbf{A}_{1,i} + \mathbf{A}_{0,i}\mathbf{\Theta}$. Important for our analysis is $\mathbf{z}_{t-1}(\boldsymbol{\gamma}) = \left[z_{t-1}(\gamma_1), z_{t-1}(\gamma_2), ..., z_{t-1}(\gamma_n)\right]'$ as an $(n+1) \times 1$ vector of threshold indicators. Using $\mathbf{y}_{t-1}^* = \mathbf{W}\mathbf{y}_{t-1}$ and $\tilde{\mathbf{y}}_t = \tilde{\mathbf{W}}\mathbf{y}_t$ in (4), and after partitioning $\mathbf{B}_f\mathbf{f}_{t-1} = (\mathbf{B}_g, \mathbf{B}_{\tilde{y}})\begin{pmatrix}\mathbf{g}_{t-1}\\ \tilde{\mathbf{y}}_{t-1}\end{pmatrix}$, we obtain

$$\mathbf{y}_t = \mathbf{c}_y + \left(\mathbf{\Phi} + \mathbf{B}_y\mathbf{W} + \mathbf{B}_{\tilde{y}}\tilde{\mathbf{W}}\right)\mathbf{y}_{t-1} + \mathbf{B}_g\mathbf{g}_{t-1} + \mathbf{\Lambda}_y\mathbf{z}_{t-1}(\boldsymbol{\gamma}) + \mathbf{A}_v\mathbf{v}_t + \mathbf{u}_t, \tag{5}$$

Using identity $\tilde{\mathbf{y}}_{t-1} = \tilde{\mathbf{W}}\mathbf{y}_{t-1}$ in equations for $\mathbf{g}_t$ in (3), we have

$$\mathbf{g}_t = \mathbf{c}_g + \mathbf{\Theta}_g\mathbf{g}_{t-1} + \mathbf{\Theta}_{gy}\tilde{\mathbf{W}}\mathbf{y}_{t-1} + \mathbf{v}_{gt}, \tag{6}$$

Stacking (5) and (6), we obtain a TGVAR representation for the full set of observables. Using the $(k+2) \times 1$ vector $\mathbf{x}_t = (\mathbf{y}_t', \mathbf{g}_t')'$,

$$\mathbf{x}_t = \mathbf{c} + \mathbf{G}\mathbf{x}_{t-1} + \mathbf{\Lambda}\mathbf{z}_{t-1}(\boldsymbol{\gamma}) + \mathbf{e}_t, \tag{7}$$

where

$$\mathbf{c} = \begin{pmatrix}\mathbf{d}\\ \mathbf{c}_g\end{pmatrix}, \mathbf{G} = \begin{pmatrix}\mathbf{\Phi} + \mathbf{B}_y\mathbf{W} + \mathbf{B}_{\tilde{y}}\tilde{\mathbf{W}} & \mathbf{B}_g\\ \mathbf{\Theta}_{gy}\tilde{\mathbf{W}} & \mathbf{\Theta}_g\end{pmatrix}, \mathbf{\Lambda} = \begin{pmatrix}\mathbf{\Lambda}_y\\ \mathbf{0}_{2\times(n+1)}\end{pmatrix}. \tag{8}$$

Also

$$\mathbf{e}_t = \mathbf{\Gamma}\mathbf{v}_t + \boldsymbol{\varepsilon}_t, \tag{9}$$

where $\mathbf{v}_t = \left(\mathbf{v}'_{gt}, \mathbf{v}'_{\tilde{y}t}\right)'$,

$$\mathbf{\Gamma} = \begin{pmatrix} \mathbf{A}_g & \mathbf{A}_{\tilde{y}} \\ \mathbf{I}_4 & \mathbf{0} \end{pmatrix}, \text{ and } \boldsymbol{\varepsilon}_t = \begin{pmatrix} \mathbf{u}_t \\ \mathbf{0}_{4\times 1} \end{pmatrix}. \tag{10}$$

$\mathbf{e}_t$ is a vector of reduced form shocks, composed of global $(\mathbf{v}_t)$ and idiosyncratic shocks $(\boldsymbol{\varepsilon}_t)$.

To keep the analyses empirically manageable, we consider the effects of the threshold variable on the output growth variables only, and accordingly set $\boldsymbol{\lambda}_{y,i} = (\lambda_{\Delta gdp,i}, 0, 0, 0)'$.We identify advanced economies by $i = 0, 1, ..., n_a$ and emerging market countries by $i = n_a + 1, n_a + 2, ..., n$. Moreover, we estimate two separate threshold parameters for advanced and emerging economies:

$$\gamma_i = \begin{cases} \gamma_{adv} & \text{for } i = 0, 1, ..., n_a \\ \gamma_{eme} & \text{for } i = n_a + 1, n_a + 2, ..., n \end{cases}. \tag{11}$$

Thresholds γ_{adv} and γ_{eme} are estimated by a grid-search method outlined in Chudik et al. (2020).[2] We excluded the threshold indicator from a few countries, where $\hat{\lambda}_{\Delta gdp,i} > 0$.

2.4 Pandemic-Related Fiscal Responses

We assume that up to 2019Q4 $(t = 1, 2, ..., T)$, $\mathbf{e}_t$ is governed by equation (9), but for Q1 to Q4 of 2020, it is given by

$$\mathbf{e}_{T+q} = \boldsymbol{\omega}_{T+q} + \mathbf{\Gamma}\mathbf{v}_{T+q} + \boldsymbol{\varepsilon}_{T+q}, \text{ for } q = 1, 2, 3, 4, \tag{12}$$

where $\boldsymbol{\omega}_{T+q}$ corresponds to the Covid-19 shock and policy responses to mitigate its economic effects in period $T+q$. We assume $\boldsymbol{\omega}_t = 0$ for $t \leq T$, but it is nonzero for $t = T+1, T+2, T+3, T+4$. The IMF's Fiscal Monitor database of pandemic-related discretionary spending and revenues measures informs the size of fiscal efforts by the 33 countries in our TGVAR, which we denote by $\boldsymbol{\kappa}_q = \left(\kappa_{1,q}, \kappa_{2,q}, ..., \kappa_{n,q}\right)'$, for $q = 1, 2, 3, 4$.

More specifically, we define $\mathbf{S}$ as the matrix that selects all cyclically-adjusted primary balance variables from the vector $\mathbf{x}_t$, namely

$$\mathbf{S}\mathbf{x}_t = \Delta\mathbf{capb}_t = (\Delta capb_{0t}, \Delta capb_{1t}, ..., \Delta capb_{nt})'.$$

[2] See also Chudik et al. (2017) who develop tests for threshold effects in the context of dynamic heterogeneous panel data models with cross-sectionally dependent errors.

We set individual elements of $\boldsymbol{\omega}_{T+1}$ that correspond to the cyclically-adjusted primary balance to be given by the corresponding $\kappa_{i,1}$, and use the historical correlations of the reduced form errors to estimate the remaining elements. This yields

$$\hat{\boldsymbol{\omega}}_{T+1} = \hat{\mathbf{D}}_e \boldsymbol{\kappa}_1, \tag{13}$$

where $\hat{\mathbf{D}}_e = \hat{\boldsymbol{\Sigma}}_e \mathbf{S}' \left(\mathbf{S} \hat{\boldsymbol{\Sigma}}_{\mathbf{e}} \mathbf{S}' \right)^{-1}$, in which $\hat{\boldsymbol{\Sigma}}_e$ is the estimate of $\boldsymbol{\Sigma}_e = \boldsymbol{\Gamma}\boldsymbol{\Sigma}_v\boldsymbol{\Gamma}' + \boldsymbol{\Sigma}_\varepsilon$, $\boldsymbol{\Sigma}_v = E\left(\mathbf{v}_t\mathbf{v}_t'\right)$ and $\boldsymbol{\Sigma}_\varepsilon = E\left(\boldsymbol{\varepsilon}_t\boldsymbol{\varepsilon}_t'\right)$. The innovations, $\hat{\boldsymbol{\omega}}_{T+q}$ for $q = 2, 3, 4$ are computed recursively as

$$\begin{aligned}
\hat{\boldsymbol{\omega}}_{T+2} &= \hat{\mathbf{D}}_e \left(\boldsymbol{\kappa}_2 - \mathbf{S}\hat{\mathbf{G}}\hat{\boldsymbol{\omega}}_{T+1} \right) \\
\hat{\boldsymbol{\omega}}_{T+3} &= \hat{\mathbf{D}}_e \left(\boldsymbol{\kappa}_3 - \mathbf{S}\hat{\mathbf{G}}\hat{\boldsymbol{\omega}}_{T+2} - \mathbf{S}\hat{\mathbf{G}}^2\hat{\boldsymbol{\omega}}_{T+1} \right) \\
\hat{\boldsymbol{\omega}}_{T+4} &= \hat{\mathbf{D}}_e \left(\boldsymbol{\kappa}_4 - \mathbf{S}\hat{\mathbf{G}}\hat{\boldsymbol{\omega}}_{T+3} - \mathbf{S}\hat{\mathbf{G}}^2\hat{\boldsymbol{\omega}}_{T+2} - \mathbf{S}\hat{\mathbf{G}}^3\hat{\boldsymbol{\omega}}_{T+1} \right).
\end{aligned} \tag{14}$$

We define the macroeconomic effects of pandemic-related fiscal effects by

$$\boldsymbol{\eta}^c\left(T, h\right) = \mathbf{x}^c_{T+h} - \mathbf{x}^0_{T+h}, \tag{15}$$

where $\mathbf{x}^c_{T+h}$ is a counterfactual realization of the global economy after the fiscal support, namely $\{\boldsymbol{\omega}_{T+j} = \hat{\boldsymbol{\omega}}_{T+j}\}_{j=1}^4$, and $\mathbf{x}^0_{T+h} = E\left(\mathbf{x}_{T+h} | \mathcal{I}_T\right)$ is the conditional expectation of global economy without fiscal support, given the information set $\mathcal{I}_T = \{\mathbf{x}_T, \mathbf{x}_{T-1}, ...\}$. The distribution of $\boldsymbol{\eta}^c\left(T, h\right)$ can be computed by stochastically simulating $\mathbf{x}^c_{T+h}$ and $\mathbf{x}^0_{T+h}$ as described in Appendix A of Chudik et al. (2020).

3 Empirical Findings

Figure 2 reports the results of our counterfactual estimates for the path of quarter on quarter (QoQ) real GDP growth between 2020Q1 and 2021Q4. Solid lines are the generalized impulse responses, while the bounds represent the range of likely growth outcomes given the constellation of shocks that the global economy had experienced over the past four decades. We show that the mitigating effects of fiscal actions on growth vary across regions and countries, depending on country-specific characteristics and institutions, interconnections and cross-border spillovers, and the size and composition of policy support. In general, countries with spending and revenue actions have experienced less output contractions.

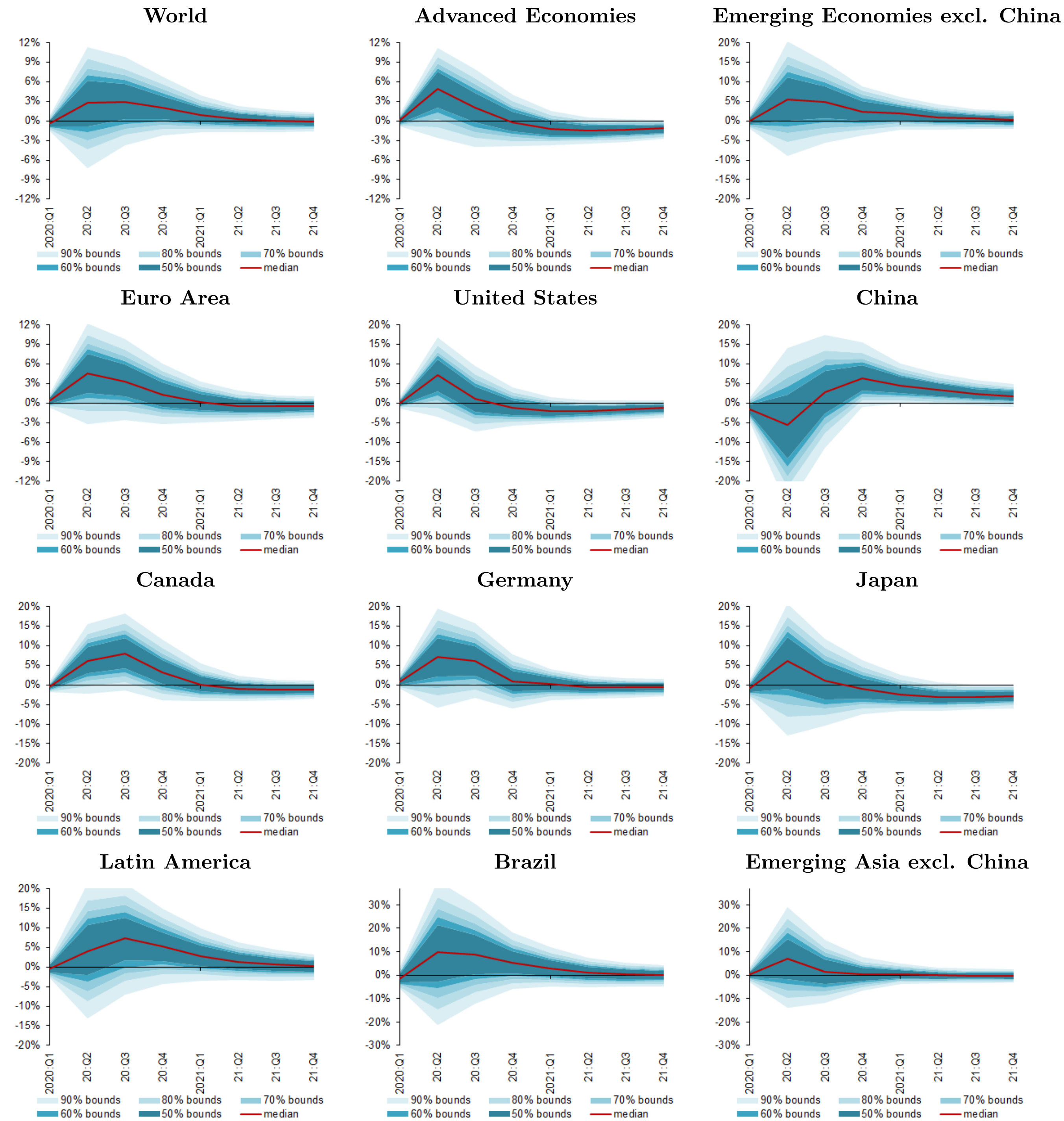
Advanced economies have provided large fiscal support packages to households and firms, and central banks and regulators have reinforced these measures with monetary accommodation and financial sector policies (thereby, reducing global volatility). These policies have mitigated the pandemic's impact on consumption and output. For example, employment protection or household income support through wage subsidies, transfers, and unemployment benefits lifted consumer spending, and liquidity support to firms prevented corporate bankruptcies. As a result, QoQ GDP growth in advanced economies was 4.9 and 2 percentage points higher in 2020Q2 and Q3 than would have happened without fiscal support. These effects are estimated to taper off over time and turn into a fiscal drag in 2021 (assuming no additional fiscal support). They also vary across advanced economies—from 7.9, 7.1, and 7 percentage points at peak in Canada, the United States, and Germany to 6 and 4.5 percentage points at peak in Japan and the euro area—reflecting pre-existing conditions, institutional settings, structural rigidities, and importantly the size and composition of fiscal measures. The additional spending and foregone revenue in Canada, the United States, and Germany were 14.6, 16.7, and 11 percent of their 2020 GDP, respectively. In the United States, further sizable fiscal support is likely in 2021 and will help lift growth everywhere

The QoQ growth effects of fiscal measures are also estimated to be large in emerging market economies excluding China, in part reflecting policy spillovers from actions in advanced economies. The impact on Latin America is particularly large—7 percentage points at peak—as some countries in the region (e.g. Brazil) implemented large fiscal packages, and benefitted from the partial recovery in oil prices and positive policy spillovers, including through easier financing conditions. For example, the QoQ growth effects of the approved fiscal measures in Brazil (about 8.3 percent of the 2020 GDP) is estimated to be 9.7, 8.6, and 5.4 percentage points in 2020Q2, Q3, and Q4, respectively. A different impact profile is estimated for China as the country has been able to largely bring the infections under control early, and thereby was able to gradually unwind emergency lifelines and rotate to a forceful public investment response which is paying off with a lag. Growth in Emerging Asia is also being pulled up by China's recovery and the adopted country-specific fiscal measures. Overall, the country-specific fiscal actions and their spillovers are estimated to have mitigated the collapse in QoQ global growth in 2020Q2–Q3 by 2.7–2.8 percentage points.

4 Concluding Remarks

Using a threshold-augmented Global VAR model and a unique database of fiscal measures, we quantified the macroeconomic effects of countries' discretionary spending and revenue actions in response to Covid-19 and its economic fallout. We showed that fiscal policy has been effective in preventing a more severe economic downturn across the world. We attributed the differential growth effects of fiscal packages across regions and countries to their size and composition as well as countries' economic structures, and highlighted the role

Figure 2: The Impact of Fiscal Support on QoQ Real GDP Growth (percentage point deviation from the baseline)



Notes: The impact is in percentage points and the horizon is quarterly. This figure plots quantiles of $\boldsymbol{\eta}^c(T, h)$ defined by (15).

of policy spillovers in reinforcing domestic fiscal actions through financial and trade-related linkages. Studying the effectiveness of various types of fiscal measures is left for future research. From a policy perspective, continued fiscal support to households and firms is necessary until vaccine rollout is advanced and the recovery is underway. A risk management approach to policymaking would also call for activism to insure against tail events that are likely in the absence of policy support (as depicted by the distribution of likely outcomes).

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