

Appendix A: Model Description

The BVAR model contains the following macroeconomic variables for each of the five blocs: GDP, the CPI index, the government budget balance (as a ratio of GDP), the short-term interest rate and the real effective exchange rate.¹ We include the (Brent) oil price and the CBOE VIX equity market volatility index as global variables that are not linked to any individual block. In total, the model has 26 variables. All of them are endogenous, except for the VIX, which is added as an exogenous variable to capture financial shocks (such as the GFC).

We estimate the model on quarterly data for the period 1997Q1 to 2019Q4. Given the large number of variables in the model, we base our analysis on generalized impulse responses, which have the important advantage that they are independent of the ordering of the variables in the model.²

Although some economic dislocation is unavoidable in order to contain the spread of the virus, the overall economic consequences will depend on how quickly economic activity rebounds after confinement measures are repealed.³ Two economic parameters play a central role in the response to the pandemic: the persistence of output fluctuations within each part of the world and the strength of international spillovers.

To illustrate the estimated persistence of output fluctuations in our BVAR model, Table A1 shows the sum of the coefficients on the first two lags of output in each economy. What is clear from the coefficients is that, even at quarterly frequency, it takes time for output shocks to die out. Persistence is largest for China (0.74), followed by the euro area (0.63).⁴ An important caveat to our results is that we assume that these historical relationships are at work in the current episode. To the extent that the virus-induced economic contraction reflects an artificial and intended suppression of economic activity that could be reversed once containment measures are released, this could cause us to overstate the persistence of the economic slowdown. On the other hand, economic outcomes in advanced economies over the past decade indicate that slowdowns that lead to large increases in unemployment rates can take a long time to unwind, in part because firms are reluctant to hire workers if they are uncertain about the speed and sustainability of the economic recovery.⁵ This pattern of behaviour could still be relevant if the virus-induced slowdown leads to large increases in unemployment or there is a significant number of bankruptcies, even if direct containment measures are relatively short-lived. The role of unemployment in the persistence of the output shortfall points to the importance of policies like wage subsidies that help firms maintain their workforce ready to restart production as soon as confinements are relaxed.

¹ For the United States and the euro area we use the Wu-Xia shadow interest rate whenever the policy rate is at the lower bound. Because the exchange rates are measured in US-dollar terms, we do not include the exchange rate in the US block.

² Intuitively, our GIRFs trace out the typical response of the variables in the BVAR to a change in GDP, averaging across all of the structural shocks that can affect GDP. The arguments for using GIRFs are particularly compelling in our case because the economic fallout from a pandemic is likely to involve a combination of supply, demand and financial shocks.

³ To the extent that it limits the spread and severity of the pandemic, the initial contraction in GDP may help to speed up the return to normal economic conditions. Correia et al (2020) report that cities in the US that intervened earlier to limit the spread of the 1918 flu epidemic experienced smaller and less persistent declines in economic activity than cities that put fewer measures in place.

⁴ Because GDP enters the model in logs, these parameters indicate the degree of persistence in the *level* of GDP, relative to its long-run trend. GDP growth will be considerably less persistent.

⁵ This is likely to be particularly evident for workers that had only temporary work contracts. The share of such contracts has risen steadily over the past decade.

Persistence of output shocks

Table A1

	Output - Sum of AR(1) and AR (2) components
United States	0.483
Euro area	0.628
China	0.740
OAE	0.230
OEM	0.226

Euro area = DE, ES, FR, IT and NL; OAE = AU, CA, CH, GB, JP and SE; OEM = BR, ID, IN, KR and MX.

¹ The table reports the sum of the two lag coefficients of the dependent variable in the output equation for each country/block.

Source: Authors' calculations.

The second key set of parameters of the model are those that influence the degree of spillovers across regions of the world. Indeed, domestic policies to counter the economic effects of the virus would be of little avail if the economy depends on the rest of the world. To illustrate the size of these effects, Table A2 shows the effect of a 1% decline in GDP in each of the economic blocks in the BVAR on GDP in the other regions. The results reveal substantial spillovers between regions, with decreases in GDP of between –0.3% in the rest of the world, for shocks emanating from the US (a relatively closed economy), to over –0.4% for the euro area and OAEs (which have a larger ratio of exports and imports to GDP).

GDP spillovers: Impact on the rest of the world (ROW)¹

GDP change in ROW. after four quarters, per (negative) 1% change in originator

Table A2

	ROW GDP effect (%)	Trade flows/GDP (%)
United States	–0.305	27.5
Euro area	–0.432	87.5
China	–0.405	38.2
OAE	–0.456	69.5
OEM	–0.411	55.8

Euro area = DE, ES, FR, IT and NL; OAE = AU, CA, CH, GB, JP and SE; OEM = BR, ID, IN, KR and MX.

¹ This table shows the fall in the GDP of the rest of the world that is associated with a 1% fall in respective originating country or block GDP. Estimates are based on a BVAR model of the global economy. Trade openness figures are based on the ratio of the sum of exports and imports to GDP. For blocks, the figures refer to simple averages of the countries in the block. In the case of the euro area, the figure represents the average of Germany, France, Italy, Spain and the Netherlands.

Source: Authors' calculations.
