

**REM WORKING PAPER SERIES**

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**REM Working Paper 0214-2022**

February 2022

**REM – Research in Economics and Mathematics**

Rua Miguel Lúpi 20,  
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ISSN 2184-108X

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# The Trade Effects of Pandemics<sup>1</sup>

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February 2022

## Abstract

Early evidence suggests that COVID-19 caused a sharp decrease in international trade and a widening of current account imbalances. This paper shows that (qualitatively) similar responses have characterized the effects of previous pandemics. Using data from a sample of 170 countries, we find that a pandemic shock is typically followed by a sizable decrease in output and trade volumes, but an uneven current account response: balances improve in developed (or surplus) economies but deteriorate in developing (or deficit) ones. We also explore potential mechanisms for this asymmetry, and our evidence is pointing to national saving and the business cycle phase as the main reasons behind the divergent current account dynamic responses.

**Keywords:** pandemics; current account; local projection; panel data; recessions; nonlinearities  
**JEL codes:** C33, E32, F14, F40, I15,

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<sup>1</sup> Jalles acknowledges financial Support from FCT – Fundação para a Ciência e Tecnologia (Portugal), national funding through research grant UIDB/05069/2020. The usual disclaimer applies and any remaining errors are the authors' own responsibility. Data availability statement: The data that support the findings of this study are available on request from the corresponding author.

## 1. Introduction

The Covid-19 pandemic has taken lives and disrupted economic activity worldwide. To prevent the spread of the virus, governments have imposed lockdowns with varying degrees of stringency. The general population has also sought to reduce exposure to the virus through voluntary social distancing. The result has been a dramatic contraction in economic activity in 2020 with global GDP estimated to have declined by 3.5 percent (IMF, 2021). The economic rebound in 2021 has not restored GDP to pre-crisis 2019 levels in most countries and is not expected to do so before 2023 for advanced economies and even later for developing ones (World Bank, 2022). The global reduction in work hours in the second quarter of 2020 compared with the fourth quarter of 2019 was equivalent to 400 million full-time jobs; already 155 million full-time jobs were lost in the first quarter (ILO, 2020).

International trade effects were almost as pronounced (IMF, 2021). Trade volumes declined sharply, though, as expected, the effect was milder and more temporary for goods than services. The effects on the current account, however, were less uniform: global current account imbalances widened, indicating the uneven impact of the pandemic on the trade balance of different countries. Measured by the sum of absolute surpluses and deficits, imbalances widened from 2.8 percent of world GDP in 2019 to 3.2 percent of world GDP in 2020, indicating the uneven impact of the pandemic on the current account of different countries.

While many aspects of the macroeconomic effects of pandemics have been extensively studied, a deeper and more detailed assessment of their effects on international trade is lacking. This paper aims to fill this gap. We believe that an understanding of how pandemics affect exports, imports, and the current account balance is crucial for economists and policymakers alike, because it can shed light on the mechanisms governing the determination of trade, and also help optimize policy responses to various economic threats. To that end, this paper studies the short to medium-term trade impact of past pandemics in a sample of 170 countries.

The paper relates to the literature on the economic effects of pandemics and epidemics. Studies of the macroeconomic impact of past pandemics and of other major diseases (such as SARS and HIV/AIDs) have typically quantified the resulting short-term loss in output and

growth.<sup>2 3</sup> However, there is little consensus on economic consequences of pandemics. Results critically depend on the models used and on the availability of data (Bell and Lewis, 2004). A study by Brainerd and Siegler (2003), one of the few on the economic effects of the Spanish flu, suggested that the 1918/19 pandemic in the US actually increased growth in the 1920s. In contrast, Almond and Mazumber (2005) argued that the Spanish flu had long-term negative effects through its impact on fetal health. Using a theoretical model, Young (2004) argued that the AIDS epidemic in South Africa would increase net future per capita consumption, while Bell and Gersbach (2004) found strong negative effects. Jonung and Roeger (2006) estimated the macroeconomic effects of a pandemic using a quarterly macro-model constructed and calibrated for the EU-25 as a single economic entity. The recent literature on this topic, motivated by the Covid-19 pandemic, provides evidence of large and persistent effects on economic activity (see e.g. Atkeson, 2020; Barro et al., 2020; Eichenbaum et al., 2020). In fact, Ma et al. (2020), in an empirical analysis of the economic effects of past pandemics, found that real GDP is 2.6 percent lower on average across 210 countries in the year the outbreak is officially declared and remains 3 percent below pre-shock level five years later. Moreover, according to Jorda et al. (2020), significant macroeconomic after-effects of pandemics persist for decades, with real rates of return substantially depressed. Pandemics induce relative labor scarcity in some areas and/or a shift to greater precautionary savings.

As mentioned above, the present paper focuses on trade effects. Theoretically, the effects of a pandemic on trade volumes in general, and the current account balance in particular, are ambiguous. To illustrate with an example, consider Obstfeld and Rogoff's (1996) "fundamental current account" equation,  $CA_t = (Y_t - \tilde{Y}_t) - (I_t - \tilde{I}_t) - (G_t - \tilde{G}_t)$ , where  $Y$  is GDP,  $I$  investment,  $G$  government purchases, and  $\tilde{X}_t$  denotes the permanent component of variable  $X_t$ . The first origin of the ambiguity will be that a pandemic will be a combination of both an aggregate supply shock (reducing production) and an aggregate demand shock (reducing expenditure), that push the current account balance in opposite directions. Second, the equation predicts that the effect will also depend on whether the shocks are (or, are expected to be) permanent or transitory (transitory effects having a greater impact on the current

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<sup>2</sup> Even then, direct measures based on data from past episodes are not generally available (e.g. in the US, see Meltzer et al., 1999). An alternative would be to look at microeconomic outcomes for a given population in response to episodes for which high-quality administrative data are available (e.g. in Sweden Karlsson et al., 2014). Absent such data, economic historians have to use more aggregated data at the regional or national level to study the relationship between pandemic incidence and economic outcomes (e.g., the 1918 flu epidemic across the US states, see Brainerd and Siegler, 2003).

<sup>3</sup> For a historic view of pandemics, see Kenny (2021).

account), so the response will depend on the persistence, in addition to the magnitude, of the shock. Third, under uncertainty, the decrease of consumption will be exacerbated by the precautionary saving motive, so the response will also depend on the extent of uncertainty. Fourth, the pandemic is by definition international in nature, so it will affect domestic and Rest-of-the-World conditions almost simultaneously. Finally, macroeconomic (fiscal and monetary) policy responses as well as containment measures will differ across countries and over time, complicating each of the factors mentioned above.<sup>4</sup> We believe an empirical investigation is necessary to resolve these theoretical ambiguities.

In a nutshell, using the local projection method, we find that a pandemic shock results in a substantial decrease in output and trade volumes, but in uneven current account responses: balances improve in developed (or surplus) economies but deteriorate in developing (or deficit) ones. When we examine mechanisms that can account for this asymmetry, our estimates suggest that national saving and the phase of the business cycle appear to be responsible for the divergent current account responses.

The remainder of the paper is structured as follows. Section 2 presents the empirical strategy followed to study the dynamic response of trade variables to past pandemic shocks. Section 3 presents the data and key stylized facts. Section 4 discusses our empirical results together with sensitivity and robustness checks. Section 5 concludes and elaborates on the policy implications.

## 2. Econometric Methodology

In order to estimate the response of trade-related variables to major pandemic shocks, we use the local projection method proposed by Jordà (2005) to estimate impulse-response functions. This approach has been advocated by Auerbach and Gorodnichenko (2013) and Romer and Romer (2019) as a flexible alternative, well suited to estimating a dynamic response—such as, in our context, interactions between pandemic shocks and macroeconomic conditions. The baseline specification is:

$$y_{t+k,i} - y_{t-1,i} = \alpha_i + \tau_t + \beta_k \text{pand}_{i,t} + \boldsymbol{\theta}' \mathbf{X}_{i,t} + \varepsilon_{i,t} \quad (1)$$

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<sup>4</sup> Appendix A illustrates some of these theoretical ambiguities in the context of a simple theoretical model.

in which  $y$  is the dependent trade variable of interest;  $\beta_k$  denotes the (cumulative) response of the variable of interest  $k$  years after the pandemic shock;  $\alpha_i$  and  $\tau_t$  are country and time fixed effects respectively, included to take account for cross-country heterogeneity and global shocks;  $pand_{i,t}$  denotes the pandemic shock from Ma et al. (2020);<sup>5</sup> and  $X_{i,t}$  is a vector of control variables including two lags of pandemic shocks, two lags of real GDP growth and two lags of the relevant dependent variable.

Equation (1) is estimated using OLS.<sup>6</sup> Impulse response functions (IRFs) are then obtained by plotting the estimated  $\beta_k$  for  $k = 0, 1, \dots, 6$  with 90 (and 68) percent confidence bands computed using the standard deviations associated with the estimated coefficients  $\beta_k$ —based on robust standard errors clustered at the country level. Pandemic shocks are treated as exogenous events as they cannot be anticipated nor correlated with past changes in economic activity. In large scale epidemics, effects will be felt across whole economies, or across wider regions, for two reasons: either because the infection itself is widespread or because trade and market integration eventually propagate the economic shock across borders.

We also explore whether initial economic conditions at the time of the pandemic shock influence its effect on trade outcomes. We implement this by allowing the response to vary as follows:

$$y_{i,t+k} - y_{i,t-1} = \alpha_i + \tau_i + \beta_k^L F(z_{i,t})pand_{i,t} + \beta_k^H (1 - F(z_{i,t}))pand_{i,t} + \boldsymbol{\theta}' X_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$\text{with } F(z_{it}) = \frac{\exp(-\gamma z_{it})}{1 + \exp(-\gamma z_{it})}, \quad \gamma > 0$$

in which  $z_{it}$  is an indicator of economic activity (proxied by real GDP growth or the output gap) normalized to have zero mean and unit variance.<sup>7</sup> The coefficients  $\beta_L^k$  and  $\beta_H^k$  capture the trade impact of pandemics at each horizon  $k$  in cases of recessions ( $F(z_{it}) \approx 1$  when  $z$  goes to minus infinity) and expansions ( $1 - F(z_{it}) \approx 1$  when  $z$  goes to plus infinity), respectively. We choose  $\gamma = 1.5$ .<sup>8</sup>

<sup>5</sup> All pandemic shocks featured in our analysis are country-wide shocks.

<sup>6</sup> Another advantage of the local projection method compared to vector autoregression (or autoregressive distributed lag) specifications is that the computation of confidence bands does not require Monte Carlo simulations or asymptotic approximations. One limitation, however, is that confidence bands at longer horizons tend to be wider than those estimated by VARs.

<sup>7</sup> The weights assigned to each regime vary between 0 and 1 according to the weighting function  $F(\cdot)$ , so that  $F(z_{it})$  can be interpreted as the probability of being in a given economic space state, recession or boom.

<sup>8</sup> Our results hardly change when using alternative values of the parameter  $\gamma$ , between 1 and 4.

As discussed in Auerbach and Gorodnichenko (2012, 2013), the local projection approach to estimating non-linear effects is equivalent to the smooth transition autoregressive (STAR) model developed by Granger and Teräsvirta (1993). The advantage of this approach is twofold. First, compared with a model in which each dependent variable would be interacted with a measure of the business cycle position, it permits a direct test of whether the effect of pandemics varies across different regimes such as recessions and expansions. Second, compared with estimating structural vector autoregressions for each regime, it allows the effect of pandemic shocks to change smoothly between recessions and expansions by considering a continuum of states to compute the impulse response functions, thus making the response more stable and precise.

### **3. Data**

The key regressor in the study is taken from the dataset on pandemics/epidemics put together by Ma et al. (2020). This dataset consists of a heterogeneous unbalanced sample of 166 countries from 2000-2019 and covers SARS in 2003; H1N1 in 2009; MERS in 2012; Ebola in 2014; and Zika in 2016. Among the five events, the most widespread one is H1N1 (Swine Flu Influenza). We constructed a dummy variable, the pandemic event or shock, which takes the value 1 when the World Health Organization declares a pandemic for the country and zero otherwise. The list of countries that are affected by each event is given in Table 1 below.

**Table 1. List of Pandemic and Epidemic Episodes**

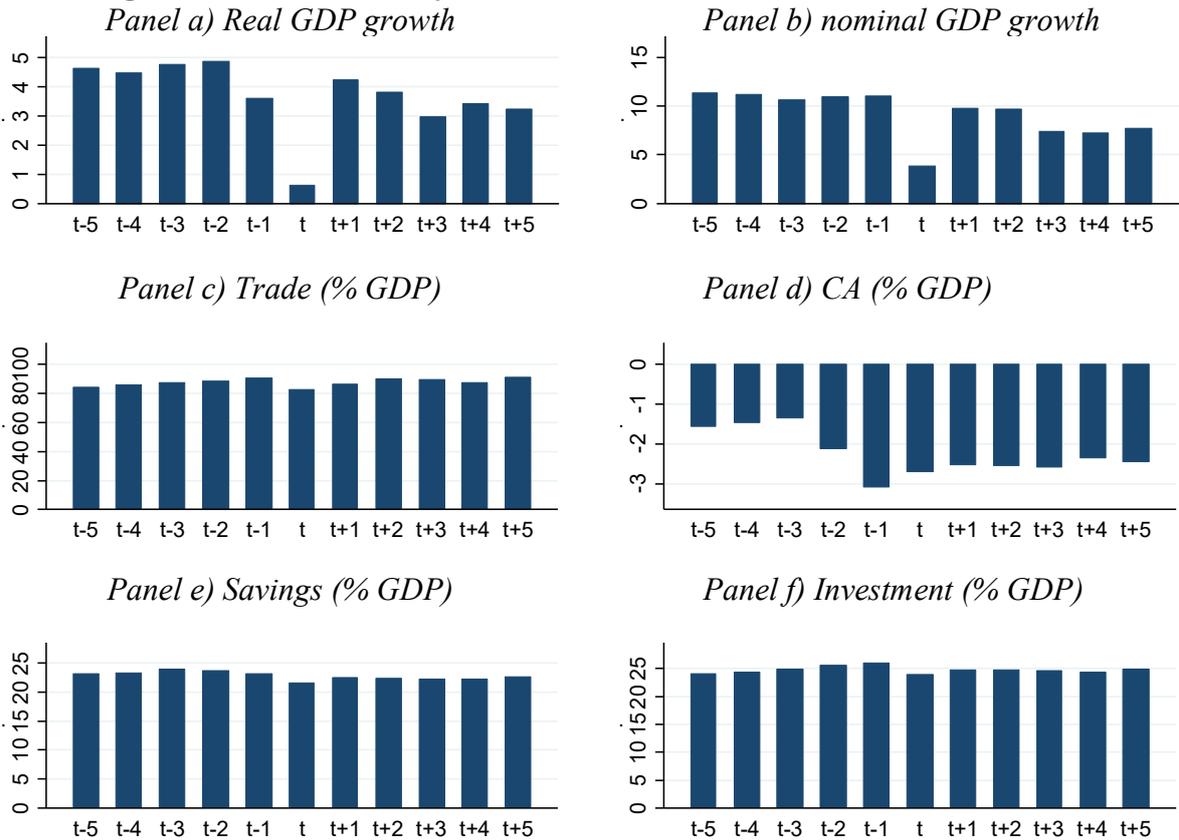
| Starting year | Event Name | Affected Countries  | Number of countries |
|---------------|------------|---|---------------------|
| 2003          | SARS       | AUS, CAN, CHE, CHN, DEU, ESP, FRA, GBR, HKG, IDN, IND, IRL, ITA, KOR, MNG, MYS, NZL, PHL, ROU, RUS, SGP, SWE, THA, TWN, USA, VNM, ZAF   | 27                  |
| 2009          | N1H1       | AFG, AGO, ALB, ARG, ARM, AUS, AUT, BDI, BEL, BGD, BGR, BHS, BIH, BLR, BLZ, BOL, BRA, BRB, BTN, BWA, CAN, CHE, CHL, CHN,CIV, CMR, COD, COG, COL, CPV, CRI, CYP, CZE, DEU, DJI, DMA, DNK, DOM, DZA, ECU, EGY, ESP, EST, ETH, FIN, FJI, FRA, FSM, GAB, GBR, GEO, GHA, GRC, GTM, HND, HRV, HTI, HUN, IDN, IND, IRL, IRN, IRQ, ISL, ISR, ITA, JAM, JOR, JPN, KAZ, KEN, KHM, KNA, KOR, LAO, LBN, LCA, LKA, LSO, LTU, LUX, LVA, MAR, MDA,MDG, MDV, MEX, MKD, MLI, MLT, MNE, MNG, MOZ, MUS, MWI, MYS, NAM, NGA, NIC, NLD, NOR, NPL, NZL, PAK,PAN, PER, PHL, PLW, PNG, POL, PRI, PRT, PRY, QAT, ROU, RUS, RWA, SAU, SDN, SGP, SLB, SLV, STP, SVK, SVN, SWE, SWZ, SYC, TCD, THA, TJK, TON, TUN, TUR, TUV, TZA, UGA, UKR, URY, USA, VEN, VNM, VUT, WSM, YEM, ZAF, ZMB, ZWE | 148                 |
| 2012          | MERS       | AUT, CHN, DEU, EGY, FRA, GBR, GRC, IRN, ITA, JOR, KOR, LBN, MYS, NLD, PHL, QAT, SAU, THA, TUN, TUR, USA, YEM  | 22                  |
| 2014          | Ebola      | ESP, GBR, ITA, LBR, USA   | 5                   |
| 2016          | Zika       | ARG, BOL, BRA, CAN, CHL, COL, CRI, DOM, ECU, HND, LCA, PAN, PER, PRI, PRY, SLV, URY, USA  | 18                  |
|               |            | <b>Total Pandemic and Epidemic Events</b>   | 220                 |

Source: based on Ma et al. (2020)

Other macroeconomic variables come from the IMF’s World Economic Outlook (WEO) database. Specifically, in addition to real and nominal GDP, the following variables are analyzed as main dependent variables: exports, imports, trade (defined as exports plus imports over GDP), and the current account balance (all expressed in percent of GDP or in log nominal terms).

Figure 2 plots the evolution of key macro and trade aggregates before, during and after the pandemic shock (from up to 5 years before to 5 years after). These unconditional associations shows both real and nominal GDP growth go down in the year of the pandemic, partly recovering the following year and then receding again to levels lower than pre-pandemic ones. Trade also suffers and it takes a few years to attain pre-pandemic levels in percent of GDP. As a result of lower economic activity, that is, uncertainty leads to an increase in precautionary saving and delay in investments, hence an improvement in the current account balance after the pandemic shock.

**Figure 2. Evolution of key macroeconomic variables around Pandemics**



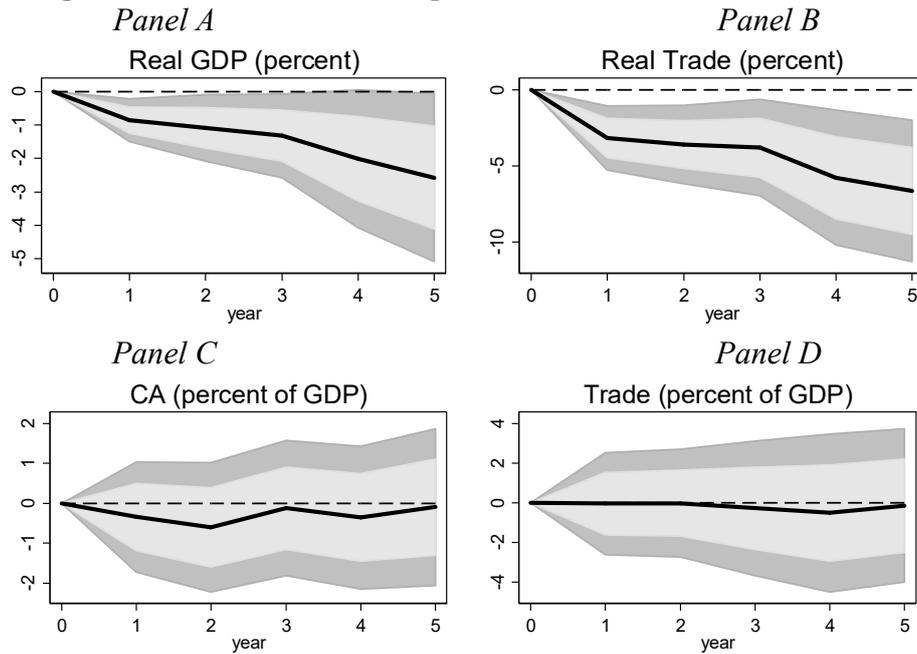
Note: x-axis in years;  $t=0$  is the year of the pandemic shock.

## 4. Main Empirical Results

### 4.1. Trade Consequences of Pandemics

We begin by estimating equation (1) for the full sample. Figure 3 shows the results when the dependent variable is real GDP (Panel A), the trade volume (Panel B), trade as a percent of GDP (panel C), or the current account balance (Panel D). The 90 and 68 percent confidence bands are also shown around the estimated impulse responses. As expected, both real GDP and the volume of trade decrease, and both responses are statistically significant. Interestingly, the two variables appear to decline by similar proportions, so that the response of trade as a percent of GDP is virtually flat. The current account balance also shows a very modest deterioration which is both temporary (the estimated response returns to zero by the third year) and statistically insignificant.

**Figure 3. Baseline Result: Impact of Pandemics on Trade, all countries**

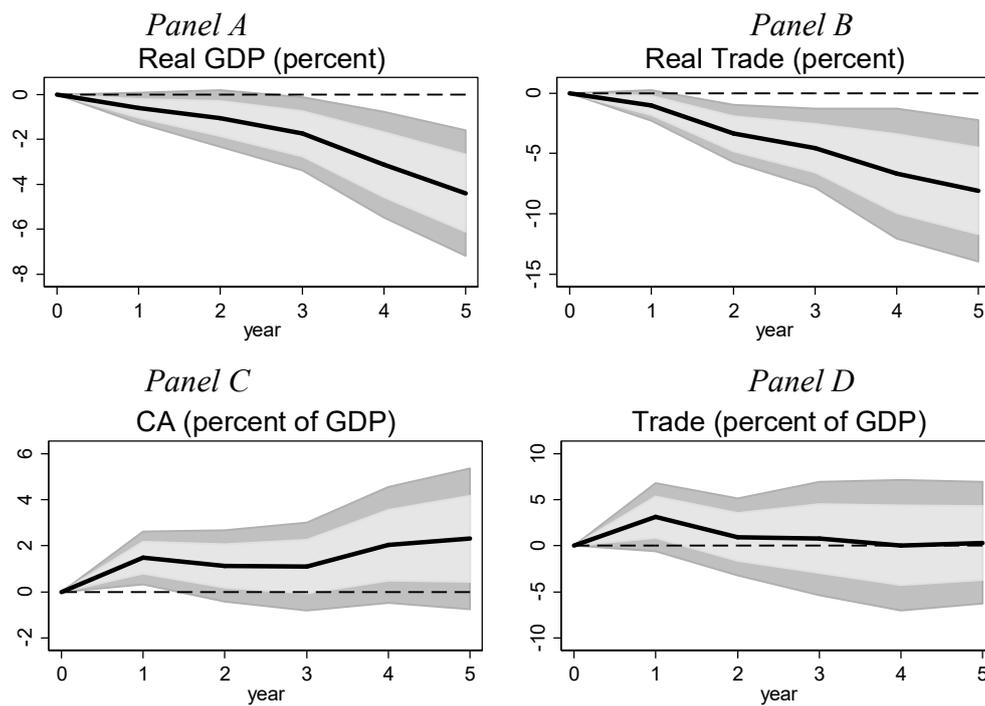


Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

The models of Figure 3 have effectively imposed the constraint that the parameters in equation (1) are the same in all countries. As our sample is quite diverse, we now relax this assumption by allowing these parameters to differ between two subsets of countries, Advanced and Developing, and estimate the model separately for the two subsets.<sup>9</sup> The results are shown in Figures 4a and 4b.

<sup>9</sup> In doing so we follow a well-established practice in the literature of broadly differentiating between advanced and developing economies for issues including (but not limited to) the properties of the trade balance (see Fernández and Gulán, 2015; García-Cicco et al., 2010; and Aguiar and Gopinath, 2007).

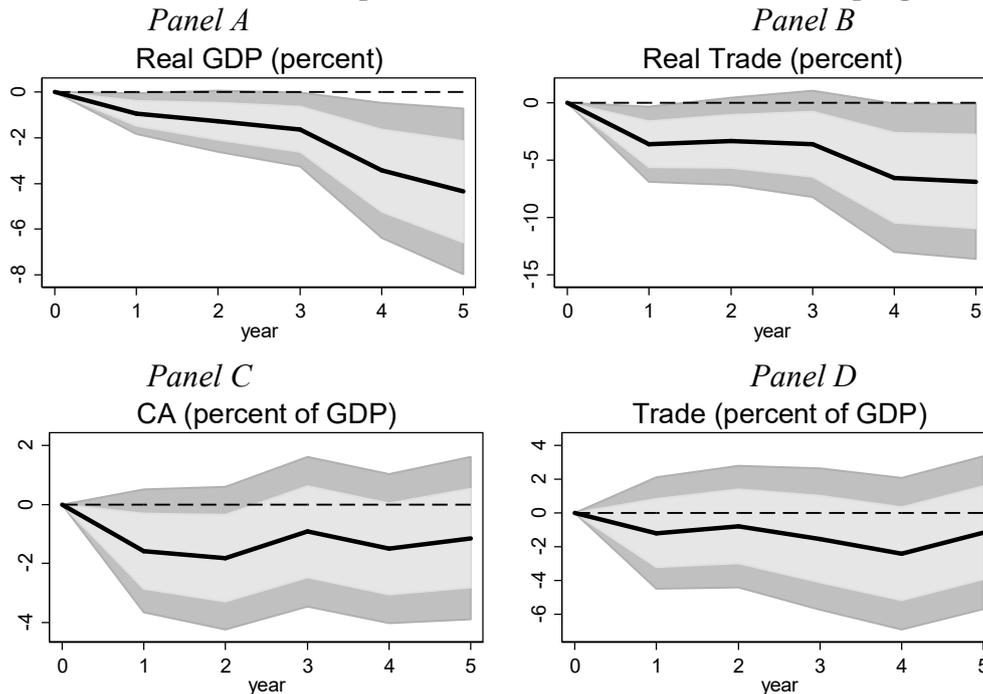
**Figure 4a. Baseline Result: Impact of Pandemics on Trade, Advanced economies**



Note: x-axis in years;  $t=0$  is the year of the pandemic shock;  $t=1$  is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

As Figures 4a and 4b show, allowing for this degree of heterogeneity does not alter the responses of real GDP (panels A) and the trade volume (panels B): as in the full sample, both economic activity and total trade decline in both subsets of economies, and by amounts that are remarkably similar and largely statistically significant.

**Figure 4b. Baseline Result: Impact of Pandemics on Trade, Developing economies**



Note: x-axis in years;  $t=0$  is the year of the pandemic shock;  $t=1$  is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

This similarity does not extend to the current account, however, where allowing for the heterogeneity unveils a stark difference between the responses in the two subsets of countries. Indeed, following a pandemic shock, the current account is shown to improve in advanced countries (Figure 4a), whereas it deteriorates in developing economies (Figure 4b). Both effects are sizeable, reaching maximum (absolute) values near 2 percent of GDP (though more precisely estimated for the advanced group, where it is statistically significant for the year after the pandemic shock).

So far, the evidence paints a rather nuanced picture of the pandemic effects: while real GDP and trade volumes decline everywhere, the current account tends to improve in advanced economies but deteriorate in developing ones. The remainder of this section will examine possible mechanisms that can account for the observed patterns.

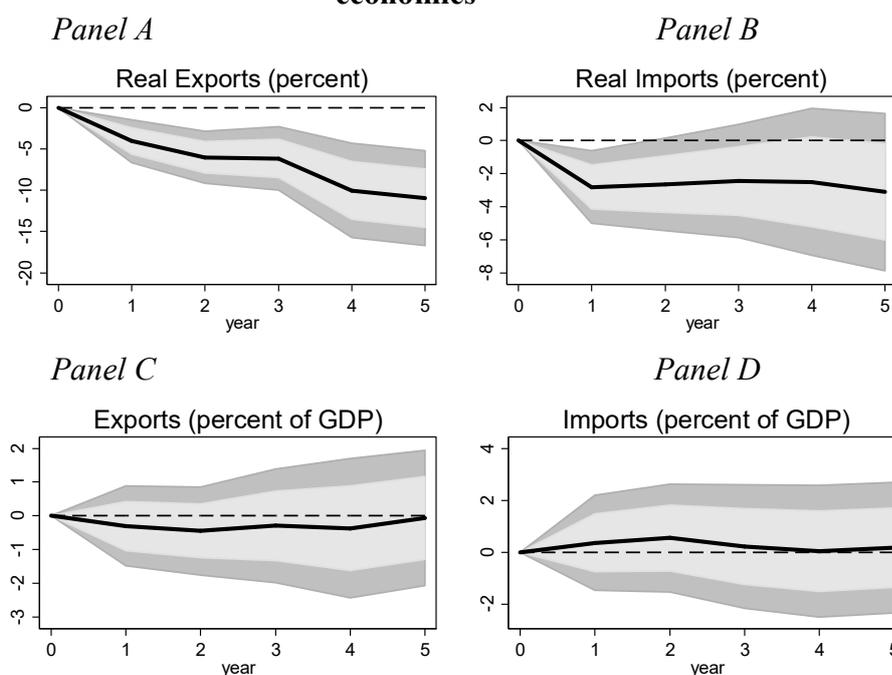
#### **4.2. Channel #1: Exports vs Imports**

The biggest component of the current account is almost always the trade balance, so a natural place to start looking deeper is the differential impacts on exports and imports.

Figure 5 starts this exercise by estimating versions of the model for the full sample, using separately exports and imports (in volume and percent of GDP) as the dependent

variables. The results suggest that, as expected, the volumes of both exports and imports decline following a pandemic shock, while both variables as percent of GDP display small and insignificant changes – results consistent with the negligible CA effects obtained earlier in the full sample.

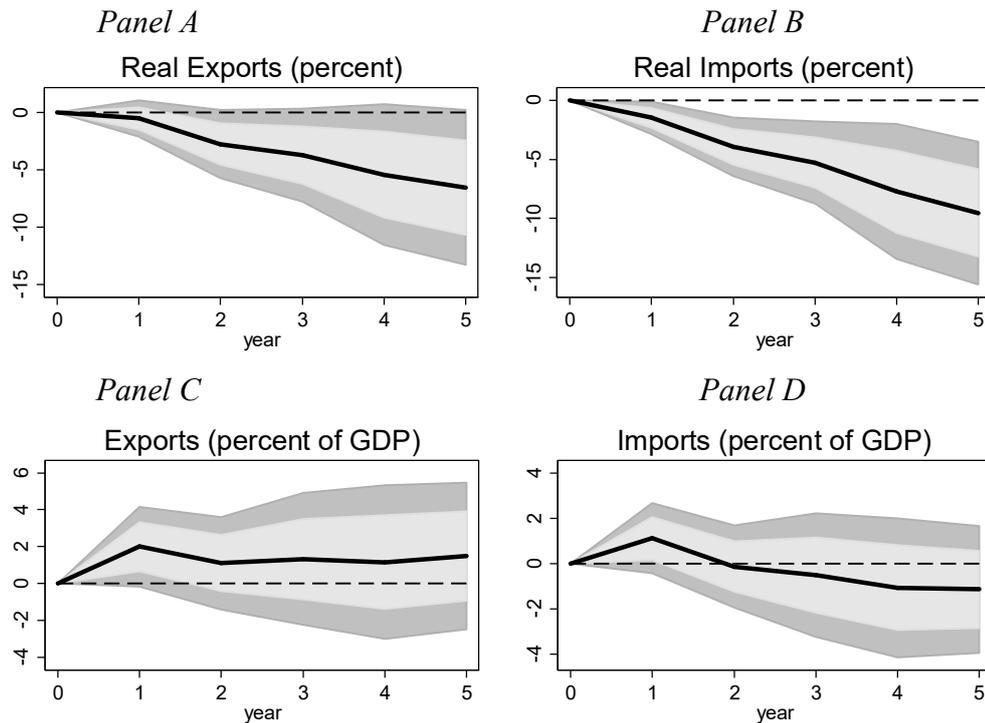
**Figure 5. Channel 1 Results: Impact of Pandemics on Exports and Imports, All economies**



Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

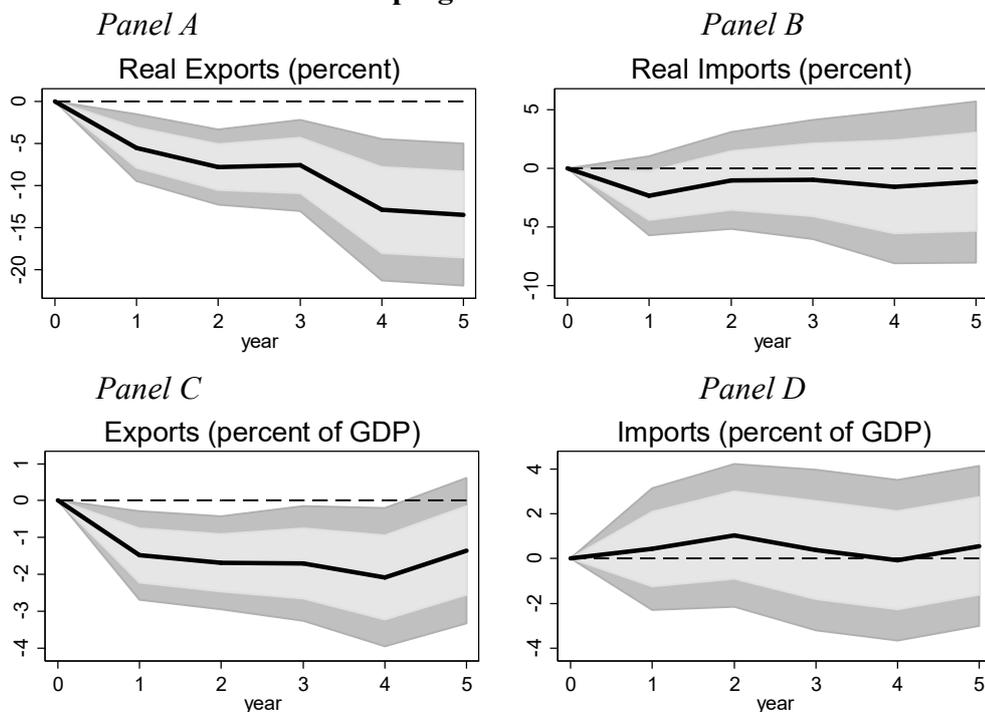
Next, we estimate the export and import effects separately for Advanced and Developing economies, showing the results in Figures 6a and 6b, respectively. Qualitatively the estimated responses appear to be similar in the two subsets of countries: both exports and imports decline, as in the full sample. Closer inspection, however, reveals crucial quantitative differences between Advanced and Developing responses. Specifically, imports fall by more than exports in advanced economies (Figure 6a), while exports decline by more than imports (which are actually statistically unaffected) in developing economies (Figure 6b). This is consistent with the current account improvement (deterioration) of the current account that we estimated earlier for the advanced (developing) countries.

**Figure 6a. Channel 1 Results: Impact of Pandemics on Exports and Imports, Advanced economies**



Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

**Figure 6b. Channel 1 Results: Impact of Pandemics on Exports and Imports, Developing economies**



Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

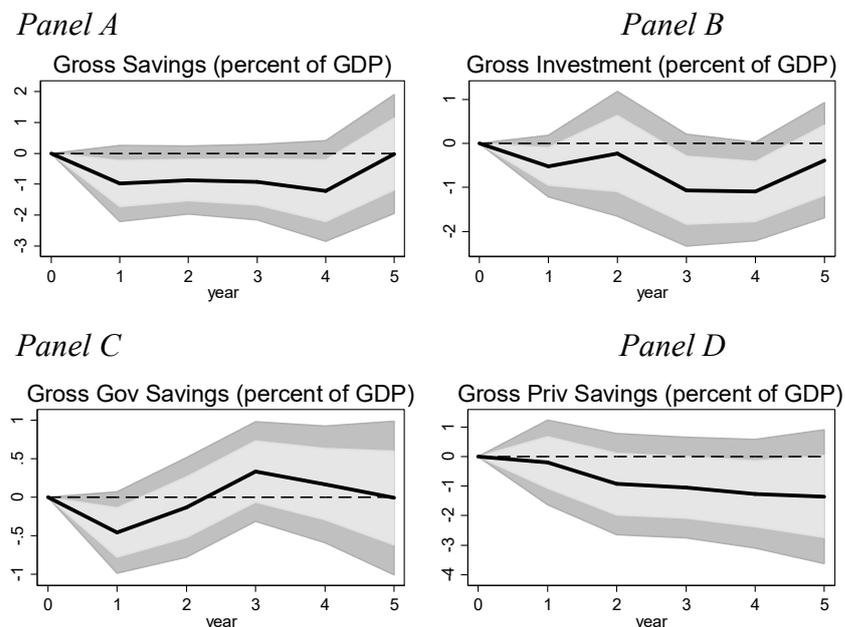
Overall, our estimates suggest that a pandemic shock causes imports to fall by more than exports in advanced economies, improving the current account, whereas it causes mainly exports to fall in developing economies, worsening the current account.

### **4.3. Channel #2: Saving vs Investment**

An alternative way to think of the current account balance is in terms of saving and investment. As is well known, the open-economy national accounting identities can be combined to express the current account balance as equal to the difference between national saving and gross domestic investment. We now make use of this and employ model (1) to estimate the effects on saving and investment. We also decompose national saving into its private and government components and estimate separate effects on those two components as well.

Figure 7 shows the estimated responses for the full sample. Point estimates suggest that both saving and investment decline, but effects are similar in magnitude (and statistically insignificant), a pattern that is consistent with our earlier finding that the current account balance is not substantially changing in the full sample.

**Figure 7. Channel 2 Results: Impact of Pandemics on Savings and Investment, All economies**



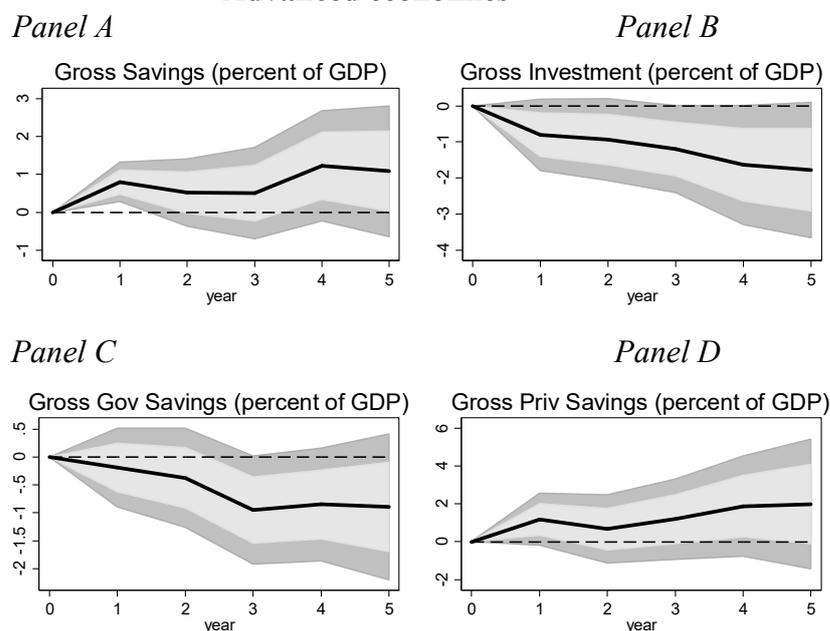
Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

It is worth mentioning that the decrease in national saving originates in a reduction in government saving in the short run (the result of a stabilizing fiscal response) but is sustained by a decrease in private saving in the longer run.

We next allow again for heterogeneity between Advanced and Developing economies, estimating saving and investment responses separately for each subset and reporting the results in Figures 8a and 8b. Unlike the export/import application of the previous section, the saving/investment differences between the two types of countries are not just quantitative but qualitative as well.

Specifically, in advanced economies, saving increases (and statistically significantly) in the short run) while investment decreases (though insignificantly). Both effects contribute to the improvement in the current account we noted above for advanced countries. On the contrary, saving declines in developing economies while investment is virtually unaffected (as a percent of GDP), a combination that is consistent with the deterioration in the current account we obtained for developing countries.

**Figure 8a. Channel 2 Results: Impact of Pandemics on Savings and Investment, Advanced economies**

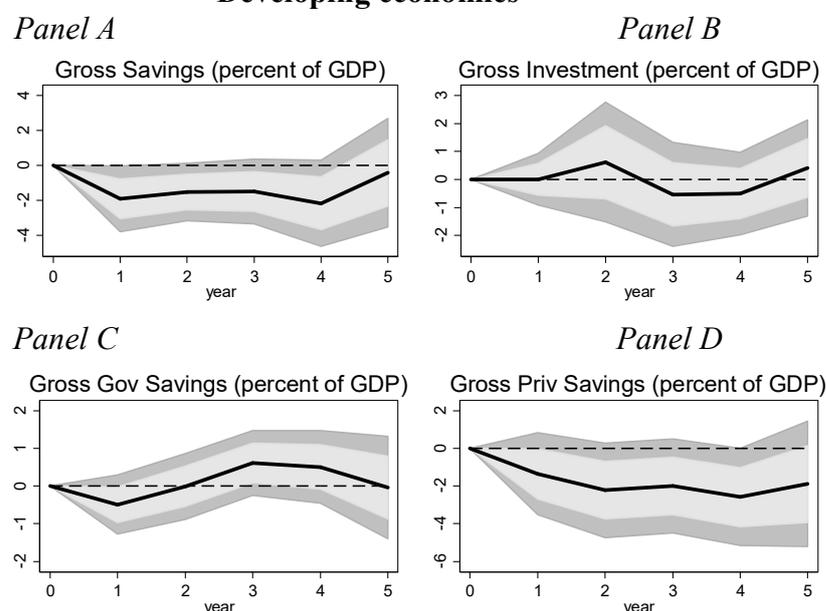


Note: x-axis in years;  $t=0$  is the year of the pandemic shock;  $t=1$  is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

It is worth noting that the stark difference in saving behavior between advanced and developing economies appears to be generated mostly by the response of private saving. While both effects are imprecisely estimated to be statistically significant, the point estimates of the

responses suggest that a pandemic is causing private saving to increase in advanced economies but decline in developing ones.

**Figure 8b. Channel 2 Results: Impact of Pandemics on Savings and Investment, Developing economies**



Note: x-axis in years;  $t=0$  is the year of the pandemic shock;  $t=1$  is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

Overall, our estimates suggest that the current account improvement in the advanced economies comes from higher saving and (possibly) lower investment, whereas the current account deterioration in developing economies is almost entirely attributed to a drop in saving.

## 5. Robustness and Extensions

### 5.1. Sensitivity and Robustness checks

Several sensitivity exercises and robustness checks were conducted—see the Online Annex for detailed description and discussion. First, we re-estimated equation (1) including country-specific time trends as additional control variables (Figure A1 in the Annex). Results are similar to, and not statistically different from, the baseline results.

Given the possible concern that results may suffer from omitted variable bias we expanded the set of controls to include other macroeconomic variables that have been typically found to affect the current account (see e.g. IMF, 2018, 2019). Results suggest that this source of omitted variable bias is likely to be negligible (Figure A2 in the Annex).

Finally, to mitigate cross-sectional dependency concerns, we re-estimated equation (1) with a Driscoll-Kraay (1998) robust standard errors. Results are similar to, and not statistically different from, those obtained using OLS, suggesting that this is not a serious concern in our case (Figure A3 in the Annex).

## 5.2. Extensions

### 5.2.1. Relative pandemic shock

Unlike trade and output volumes which can decrease (or increase) for all countries following a shock, current account balances cannot, by definition, decrease (or increase) everywhere following a shock. To ensure that our results are not affected by the constraint that all current account balances must add up to zero, we also measured the pandemic shock in *relative* terms. Following the example of Fogli and Perri (2015) for relative volatility, we define the relative pandemic shock to equal the absolute shock (i.e., the value of the pandemic dummy) minus the average (across the rest of countries) value of the shock.<sup>10</sup>

We re-estimated all previous specifications using the relative shock, but as the obtained results were virtually unaffected, we only report the baseline results for the full sample to preserve space (all results are available on request). As shown by Figure 9, using the relative shock does not appreciably change any of our estimates (for example, compared to Figure 3).

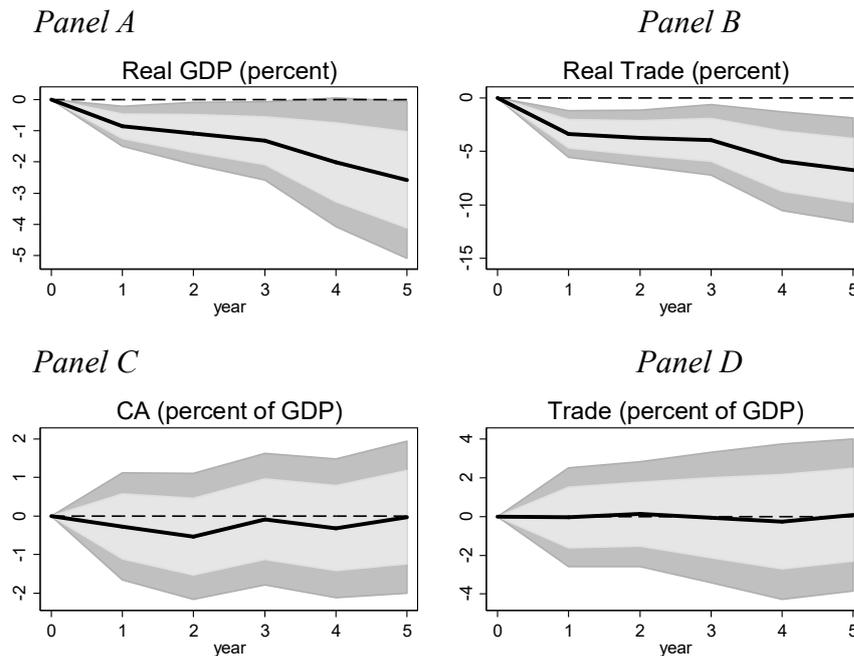
### 5.2.2. Chronic Surplus vs Chronic Deficit countries

In addition to distinguishing between Advanced and Developing economies, we also tried another way to introduce heterogeneity, splitting the sample between countries that have run chronic surpluses versus chronic deficits on their current accounts. The results are shown in Figure 10 and illustrate a sharp asymmetry between the responses of the two groups of countries. A pandemic shock is raising the current account balance in surplus economies (and statistically significantly one year after the shock), whereas it reduces it in deficit countries (though not statistically significantly). Note that this particular asymmetric response implies that a pandemic exacerbates any existing current account imbalances, a pattern similar to the one observed for Covid-19 (IMF, 2021).

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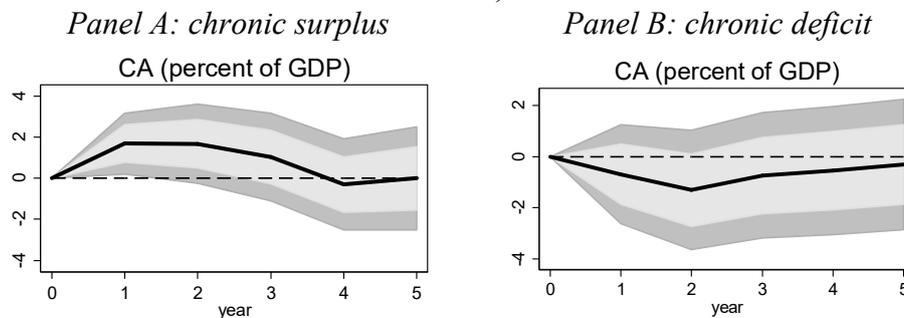
<sup>10</sup> Specifically, the relative pandemic shock,  $Rpand$ , is constructed as  $Rpand_{i,t} = pand_{i,t} - \frac{1}{N-1} \sum_{j \neq i} pand_{j,t}$ .

**Figure 9. Extension 1 Results: Impact of a relative Pandemic shock on Trade, all countries**



Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

**Figure 10. Extension 2 Results: Impact of Pandemic on Trade – chronic surplus vs chronic deficit, all countries**



Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

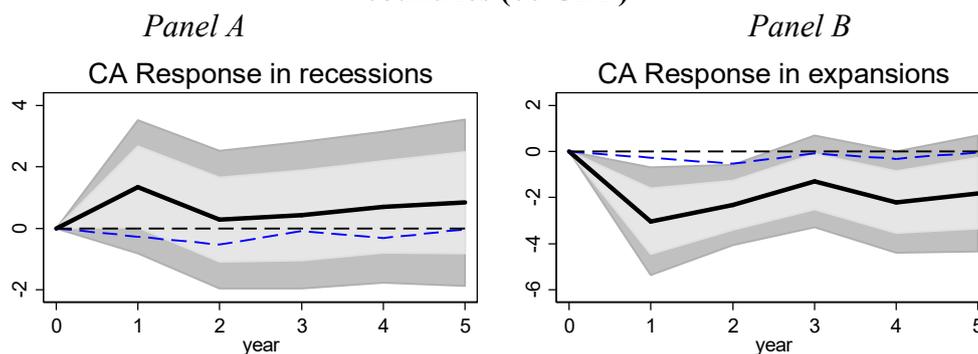
### 5.2.3. Business cycle

Lastly, we examine whether the impact of the pandemic shock differs depending on whether the affected economy is expanding or in recession when the shock hits. The results of estimating equation (2) suggest that the role of the business cycle is decisive.

Beginning with the full sample on Figure 11, our estimates suggest that the phase of the business cycle the economy finds itself in when the pandemic hits makes a big difference. If in

recession, the current account tends to improve following the shock (though not statistically significantly), whereas the current account balance deteriorates (substantially and statistically significantly) if the economy was expanding. The latter effect is both substantial, reaching a peak at -3% of GDP the year after the shock, and statistically significant for at least two years after.

**Figure 11. Impact of Pandemic on Trade in recessions and expansions, all countries (% GDP)**



Note: x-axis in years;  $t=0$  is the year of the fiscal consolidation shock;  $t=1$  is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level. The blue line denotes the unconditional baseline result.

We have also divided the sample further to allow for wider heterogeneities, for example by looking separately at recessions and expansions for each of the Advanced and Developing subsamples. None of these extensions change our main findings, and so we confine the results to the Appendix to preserve space.

## 6. Conclusions

Our understanding of the economic effects of pandemics has been greatly advanced by the outpouring of research in this area following the Covid-19 global shock. One area that remains relatively unexplored, however, is how such shocks affect international trade and current account balances. The present paper attempted to provide additional insights on this question.

Using data from 170 countries, we estimated, by means of the local projection method, the short- and medium-term trade effects of five (pre-Covid-19) 21<sup>st</sup>-century major global pandemic/epidemic shocks. Our findings can be summarized as follows.

As expected, a pandemic shock is typically followed by a sizable decrease in output and trade volumes. This result is uniform, in the sense that it does not substantially change when

we split the sample by income groups, say between Advanced and Developing economies. On the contrary, the effects on the current account are found to be quite uneven: a pandemic shock improves the current account balance in Advanced economies, but the same shock deteriorates it in Developing ones. We obtain a similar asymmetry when we divide the full sample between countries that (during our time period) have had chronic current account surpluses (which are shown to increase following the shock) and countries that had chronic current account deficits (which get deeper after the shock). We note that this pattern is consistent with the widening of global imbalances observed after Covid-19, *even though our data do not include that recent episode*. In that sense, the trade effects of Covid-19 appear to be *qualitatively* similar with those of the previous shocks we study, and this paper could be seen as providing lower-bound results of what Covid-19 is expected to inflict.

We also examined potential mechanisms for the observed asymmetric current account responses, and our evidence pointed to national saving as one of the main reasons behind the divergent current account responses. Specifically, we found that the current account improvement in the Advanced economies was due to a combination of increased saving and decreased investment, whereas in the Developing economies saving declined while investment (as a percent of GDP) was virtually unaffected, resulting in the opposite current account adjustment. Our results also showed that another factor that generated an asymmetric response was the prevailing phase of the business cycle the economy was in when the shock hit. We believe these findings provide fertile ground for future research.

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## APPENDIX A

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### A Simple Theoretical Model

Consider a two-period open economy with a government sector.<sup>11</sup> Levels of output (GDP) and government consumption are denoted by  $y$  and  $g$ , respectively. Period-1 values  $y_t$  and  $g_t$  are known with certainty, but period-2 values  $y_{t+1}$  and  $g_{t+1}$  are stochastic. Specifically, we assume  $y_{t+1} = \bar{y} + \omega$  and  $g_{t+1} = \bar{g} + \varepsilon$ , where the mean values  $\bar{y}$  and  $\bar{g}$  are known,  $\omega \sim N(0, \sigma_\omega^2)$ , and  $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ .

Period utility is given by the constant absolute risk aversion (CARA) function

$$u(c) = -\frac{1}{\alpha} e^{-\alpha c}, \quad (\text{A1})$$

where  $c$  denotes private consumption, and  $\alpha > 0$ .<sup>12</sup>

Following Eichenbaum et al.(2020) and Bloom et al.(2020) we model containment measures as a tax on consumption, so the present-value budget constraint is simply

$$(1 + q)c_t + \frac{c_{t+1}}{(1+r)} = y_t + \frac{y_{t+1}}{(1+r)} - \left( g_t + \frac{g_{t+1}}{(1+r)} \right),$$

where  $q$  represents the ‘‘containment rate’’, and  $r$  is the real interest rate.<sup>13</sup>

Under the assumption that the rate of time preference equals the real interest rate, and using  $\mathbf{E}(\cdot)$  to denote the mathematical expectation, the first-order conditions imply  $u'(c_t)/(1 + q) = \mathbf{E}[u'(c_{t+1})]$ , or, using (A1),

$$\frac{e^{-\alpha c_t}}{1+q} = \mathbf{E}(e^{-\alpha c_{t+1}}). \quad (\text{A2})$$

From the constraint,  $c_{t+1} = (1 + r)(y_t - g_t) + (y_{t+1} - g_{t+1}) - (1 + r)(1 + q)c_t$ .

Using  $x_t = (y_t - g_t)$  to denote net output, and substituting from the equations above, we get

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<sup>11</sup> Similar results would obtain in the context of more ambitious theoretical models. See, for example, Ghosh and Ostry (1997), whose model, while more complex, delivers essentially the same theoretical predictions.

<sup>12</sup> Note that  $\alpha$  equals both the Arrow-Pratt coefficient of absolute risk aversion ( $\alpha = -u''/u'$ ) and the measure of absolute prudence ( $\alpha = -u'''/u''$ ).

<sup>13</sup> For the purposes of realism, we have assumed that containment cannot be permanent:  $q_t = q$  and  $q_{t+1} = 0$ .

$$\begin{aligned}
c_{t+1} &= (1+r)x_t + x_{t+1} - (1+r)(1+q)c_t, \text{ or} \\
c_{t+1} &= (1+r)x_t + \bar{x} + \omega - \varepsilon - (1+r)(1+q)c_t,
\end{aligned} \tag{A3}$$

where  $\bar{x} = \bar{y} - \bar{g}$  is mean net output.

Equation (A3) implies that  $c_{t+1} \sim N(\mathbf{E}(c_{t+1}), \mathbf{Var}(c_{t+1}))$ , with

$\mathbf{E}(c_{t+1}) = (1+r)x_t + \bar{x} - (1+r)(1+q)c_t$ , and  $\mathbf{Var}(c_{t+1}) = \sigma_x^2$ , the variance of net output.<sup>14</sup> Therefore,  $-\alpha c_{t+1} \sim N(-\alpha \mathbf{E}(c_{t+1}), \alpha^2 \mathbf{Var}(c_{t+1}))$ , and thus  $\mathbf{E}(e^{-\alpha c_{t+1}}) = e^{-\alpha \mathbf{E}(c_{t+1}) + \frac{\alpha^2}{2} \mathbf{Var}(c_{t+1})}$ .<sup>15</sup> Making use of (A2), this gives  $\frac{e^{-\alpha c_t}}{1+q} = e^{-\alpha \mathbf{E}(c_{t+1}) + \frac{\alpha^2}{2} \mathbf{Var}(c_{t+1})}$ .

Substituting for the mean and variance, the last equation can be solved for the optimal current (i.e., first-period) consumption,

$$c_t = \frac{1}{1+(1+q)(1+r)} \left[ (1+r)x_t + \bar{x} - \frac{\alpha}{2} \sigma_x^2 - \frac{1}{\alpha} q \right]. \tag{A4}$$

As expected, heightened uncertainty, represented by an increase in  $\sigma_x^2$ , will reduce current consumption (this is the ‘‘precautionary saving’’ motive).

What will be the effect on the current account? The first-period current account balance is simply  $ca_t = y_t - g_t - c_t = x_t - c_t$ , and thus its optimal value is<sup>16</sup>

$$ca_t = \frac{1}{1+(1+q)(1+r)} \left[ (x_t - \bar{x}) + q(1+r)x_t + \frac{\alpha}{2} \sigma_x^2 + \frac{1}{\alpha} q \right]. \tag{A5}$$

SPECIAL CASE: NO CONTAINMENT ( $q = 0$ )

Equations (A4) and (A5) become

$$c_t = \frac{1+r}{2+r} \left[ x_t + \frac{\bar{x}}{1+r} \right] - \frac{\alpha}{2(2+r)} \sigma_x^2, \tag{A4'}$$

And

$$ca_t = \frac{1}{2+r} \left[ (x_t - \bar{x}) + \frac{\alpha}{2} \sigma_x^2 \right]. \tag{A5'}$$

<sup>14</sup> Of course,  $\sigma_x^2$  is a function of  $\sigma_\omega^2$  and  $\sigma_\varepsilon^2$ .

<sup>15</sup> Recall the lognormal distribution property, that if  $z \sim N(\mu_z, \sigma_z^2)$ , then  $\mathbf{E}(e^z) = e^{\mu_z + \frac{\sigma_z^2}{2}}$ .

<sup>16</sup> The approximation  $\ln(1+q) \approx q$  was used.

Note first the standard implication of the intertemporal approach: the first term in the right-hand side of (A5') suggests that changes in net output have an effect on the current account only to the extent they are perceived as temporary, because only then do they generate a smoothing motive.<sup>17</sup> Thus, an increase in output that is expected to be largely transitory would be largely saved, thereby raising the current account surplus (or reducing the current account deficit). On the contrary, a temporary reduction in income will induce dissaving that will result in a smaller current account balance. In addition, equation (A5') predicts that increased uncertainty will increase the current account balance. The reason is precautionary saving: intensified uncertainty will reduce optimal consumption, resulting in higher desired ("precautionary") saving, and thus a greater current account balance. A pandemic causes both a decrease in temporary income and an increase in uncertainty, and so has ambiguous effects on the current account balance.

#### GENERAL CASE: CONTAINMENT ( $q > 0$ )

The current account is now given by (A5, which we rewrite here for convenience:

$$ca_t = \frac{1}{1+(1+q)(1+r)} \left[ (x_t - \bar{x}) + q(1+r)x_t + \frac{\alpha}{2}\sigma_x^2 + \frac{1}{\alpha}q \right] \quad (\text{A5})$$

As in the special case, uncertainty still improves the current account. Unlike the special case, purely temporary changes in net output do have an effect on the current account if  $q > 0$ . The ambiguity, however, remains: a pandemic that causes both a temporary drop in income and an increase in uncertainty has ambiguous effect on the current account.

An increase in containment that successfully reduces consumption, also improves the current account,  $\frac{dca_t}{dq} > 0$ . Containment also enhances the current account effects of changes in

temporary income:  $\frac{\partial \left( \frac{dca_t}{dx} \right)}{\partial q} > 0$ ; but mitigates the current account effects of changes in

uncertainty:  $\frac{\partial \left| \frac{dc}{d\sigma_x^2} \right|}{\partial q} < 0$ .

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<sup>17</sup> Again, this can be shown in much more elaborate theoretical models. See, for example, Obstfeld and Rogoff's (1996, chapter 2) derivation of the "fundamental current account equation" in the context of an infinite-horizon model.

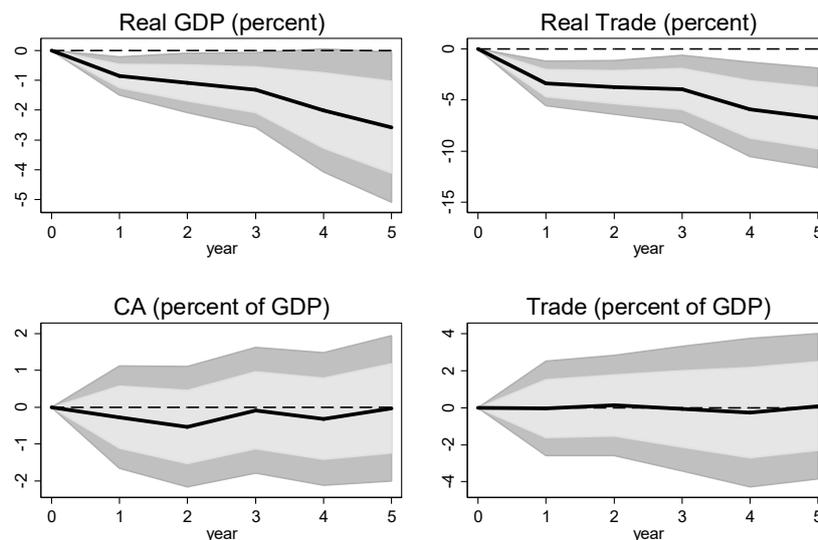
## APPENDIX B

### Sensitivity and Robustness checks

#### *Controlling for country-specific time trends*

To estimate the causal impact of reforms on the current account balance, it is important to control for previous trends in the current account that could lead to reforms. The baseline specification attempts to do this by controlling for up to three lags in the current account balance.<sup>18</sup> To further mitigate this concern, we re-estimate equation (1) by including country-specific time trends as additional control variables. Also in this case, the results are similar to, and not statistically different from, the baseline results (Figure A1).

**Figure A1. Effect of Pandemics on the Current Account (% of GDP) – controlling for country-specific time trends**



Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

#### *Controlling for additional short-term drivers of the current account*

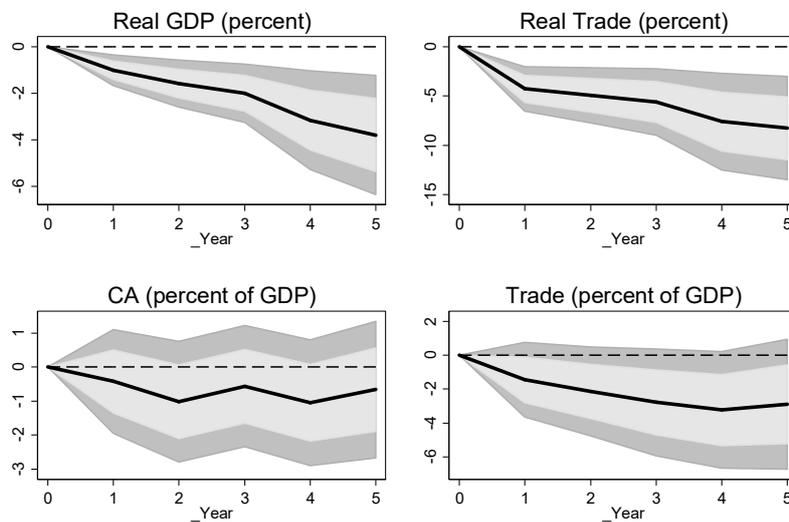
As discussed in the main text, a possible concern regarding the analysis is that the results may suffer from omitted variable bias, as reforms may be carried out because of past economic conditions or at the same time of other macroeconomic policy actions affecting the current account. To address this issue, we expand the set of controls to include other macroeconomic variables that

<sup>18</sup> Similar results are obtained when using alternative lag parametrizations.

have been typically found to affect the current account (see e.g. IMF, 2018, 2019). In particular, we include lagged changes of (i) aggregate demand; (ii) real GDP growth rate of main trading partners; (iii) real exchange rates; (iv) term of trade; (iv) inflation rate—to capture monetary conditions; (v) general government primary budget balance—to capture fiscal policy actions; (iv) the Chinn-Ito index of capital controls; (vii).<sup>19</sup>

The results obtained with this analysis are very similar to, and not statistically different from, those obtained in the baseline specification, suggesting that this source of omitted variable bias is likely to be negligible in our setting (Figure A2).

**Figure A2. Effect of Pandemics on the Current Account (% of GDP) – controlling for other current account determinants**



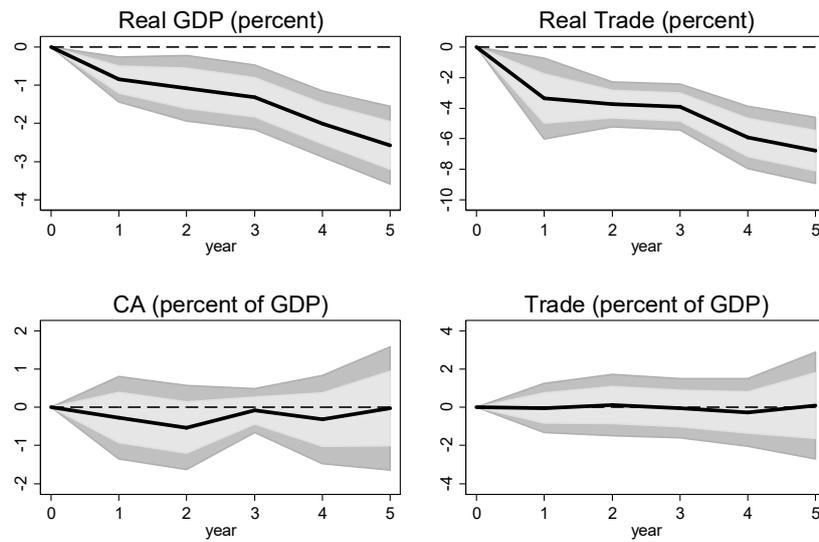
Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

### *Cross-sectional dependencies*

To mitigate cross-sectional dependency concerns, we re-estimated equation (1) with a Driscoll-Kraay (1998) robust standard errors. This non-parametric technique assumes the error structure to be heteroskedastic, autocorrelated up to some lag and possibly correlated between the groups. Results displayed in Figure A3 are qualitatively similar suggesting cross-sectional dependence is not a major issue in our setting.

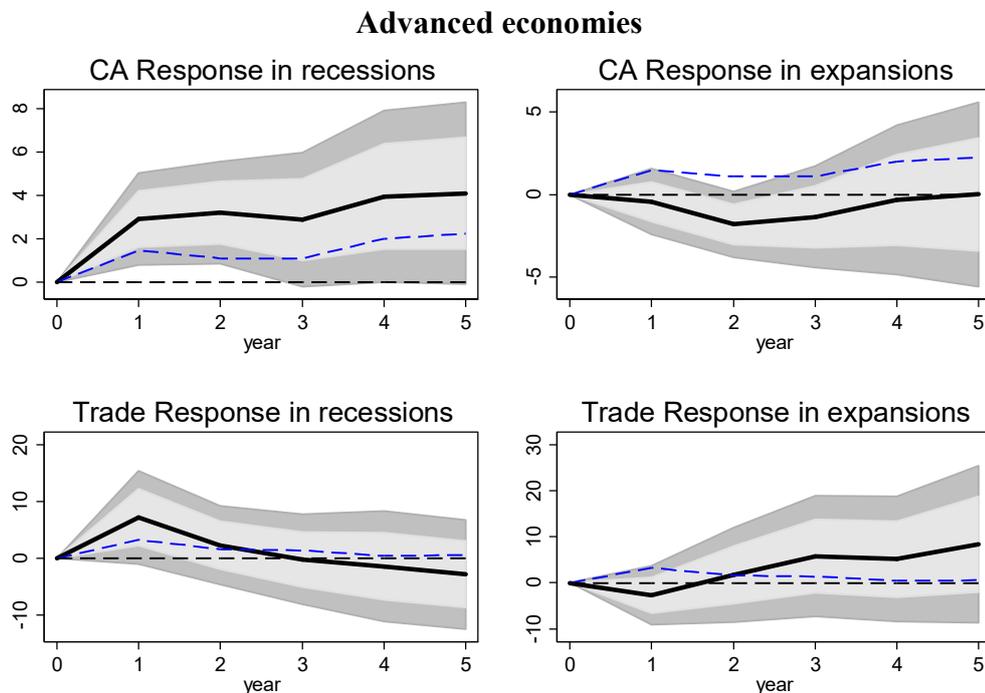
<sup>19</sup> The series (i)-(v) are taken from the IMF World Economic Outlook database. The Chinn-Ito index is taken from [http://web.pdx.edu/~ito/Chinn-Ito\\_website.htm](http://web.pdx.edu/~ito/Chinn-Ito_website.htm)

**Figure A3. Effect of Reforms on the Current Account (% of GDP) – Driscoll-Kraay Robust SE**

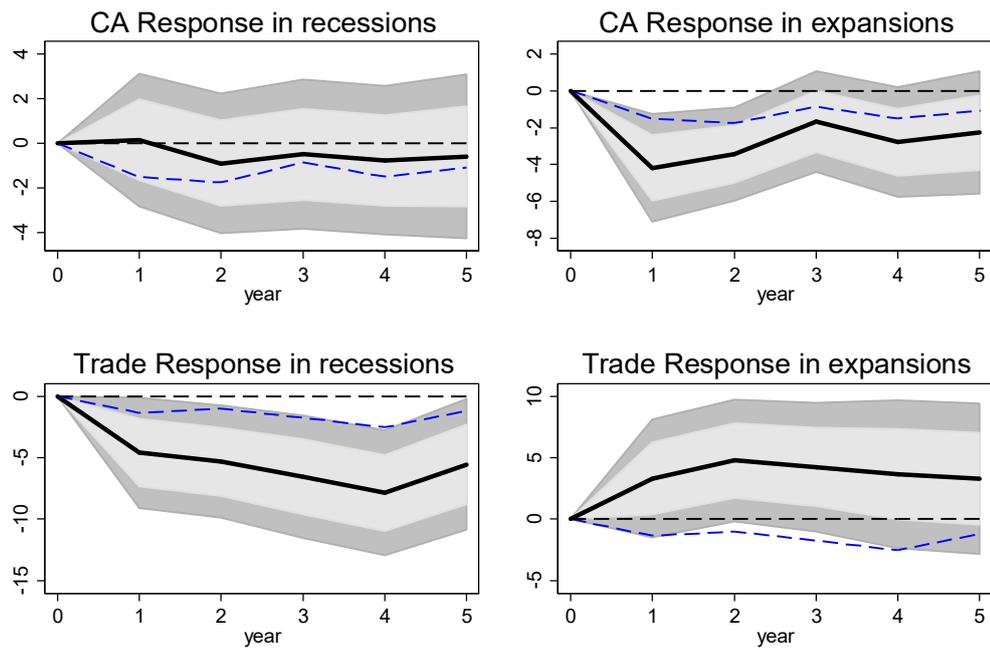


Note: x-axis in years; t=0 is the year of the pandemic shock; t=1 is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level.

**Figure A4. Impact of Pandemic on Trade in recessions and expansions by income group (% GDP)**



## Developing economies



Note: x-axis in years;  $t=0$  is the year of the fiscal consolidation shock;  $t=1$  is the first year of impact. Solid black lines denote the response to a pandemic shock, dark grey area denotes 90 percent confidence bands while light gray area denotes 68 percent confidence bands, based on standard errors clustered at country level. The blue line denotes the unconditional baseline result.