

COVID-19, asset markets and capital flows

John Beirne,¹ Nuobu Renzhi,² Eric Sugandi,³ and Ulrich Volz⁴

This draft: 24 March 2021

Abstract

This paper empirically examines the reaction of global financial markets across 38 economies to the COVID-19 outbreak, with special focus on the dynamics of capital flows across 14 emerging market economies. The effectiveness of fiscal and monetary policy responses to COVID-19 is also tested. Using daily data over the period 4 January 2010 to 31 August 2020, and controlling for a host of domestic and global macroeconomic and financial factors, we use a fixed effects panel approach and a structural VAR framework to show that emerging markets have been more heavily affected than advanced economies. In particular, emerging economies in Asia and Europe have experienced the sharpest impacts on stock, bond and exchange rates due to COVID-19, as well as abrupt and substantial capital outflows. Fiscal stimulus packages and interest rate reductions helped to restore overall investor confidence through reducing bond yields at the global level. Quantitative easing mainly helped to boost stock prices, notably for advanced and emerging economies in Asia. Our findings highlight the role that global factors and developments in the world's leading financial centers have on financial conditions in EMEs. Importantly, the impact of COVID-19 related quantitative easing measures by central banks in advanced countries extended to EMEs, with significant positive spillovers to EME stock markets in Asia, Europe and Latin America. Going forward, while the ultimate resolution of COVID-19 may be expected to lead to a market correction as uncertainty declines, our impulse response analysis suggests that there may be small permanent effects on financial markets and capital flows as a result of COVID-19, particularly in EMEs.

Keywords: COVID-19, financial markets, capital flows.

JEL Classification: F32, F41, F62

¹ Asian Development Bank Institute, Japan; e-mail: jbeirne@adbi.org

² Capital University of Economics and Business, China; and Asian Development Bank Institute, Japan; e-mail: nrenzhi@adbi.org

³ Asian Development Bank Institute, Japan; e-mail: esugandi@adbi.org

⁴ SOAS, University of London, UK; and German Development Institute, Germany; e-mail: uv1@soas.ac.uk

1. Introduction

COVID-19 has been a truly global shock. The pandemic and the resulting lockdowns have led to an unprecedented economic contraction and turbulences in financial markets, causing the largest ever outflow of portfolio capital from emerging market economies (EMEs). This paper is aimed at gaining an insight into the impact of COVID-19 on global financial market and capital flow dynamics. This approach also enables an assessment of the impact of COVID-19 in comparative terms across different advanced and emerging economy groups in Asia, Europe and elsewhere. In addition, in a similar way, our analysis assesses the effectiveness of fiscal and monetary policy responses to COVID-19 in advanced and emerging economies. More specifically, our approach is based on a panel regression and panel structural VAR approach with daily data over the period January 2010 to August 2020, whereby we assess the impact of COVID-19 on bond yields, stock prices, and exchange rates for a sample of 38 advanced and emerging markets. We also examine how equity and bond flows from a sample of 14 EMEs have been affected by COVID-19. Moreover, we isolate and test the role played by COVID-19 related fiscal stimulus packages and various monetary policy measures (conventional, quantitative easing and central bank swap arrangements) in supporting asset markets and capital flows across advanced and emerging economy sub-panel groupings.⁵

We conduct a comprehensive empirical analysis to contribute to the growing literature on the financial market impact of COVID-19. First, our analysis incorporates three asset markets, as well as capital flows, in a consistent econometric set-up. Second, our analysis is on a global sample of countries, which is of crucial importance, particularly given that global markets are increasingly interconnected and that COVID-19 constitutes an example of a global exogenous shock to markets. Prevailing empirical studies to date have tended to focus on single country analyses, and on specific asset markets. Importantly, this set-up enables a determination to be made of the relative impact of COVID-19 across different advanced and emerging economy panels. Third, we use two alternative econometric techniques to draw our conclusions. These approaches – which also control for a variety of domestic factors as well as global spillovers – enable comparisons to be made on which financial markets have been most affected by COVID-19 at the global level, and also enable us to determine whether the virus may have lasting effects on markets. Fourth, we estimate the relative effectiveness of policy responses to COVID-19, including quantitative easing measures that were introduced for the first time in many EMEs.

Overall, we find that emerging markets have been more heavily affected than advanced economies. In particular, emerging economies in Asia and Europe have experienced the sharpest impacts on stock, bond and exchange rates due to COVID-19, as well as abrupt and substantial capital outflows. Fiscal stimulus packages and interest rate reductions helped to restore overall investor confidence through reducing bond yields at the global level. Quantitative easing mainly helped to boost stock prices, notably for advanced overall and emerging economies in Asia. Our findings also highlight the role that global factors and developments in the world's leading financial centers have on financial conditions in EMEs. Importantly, the impact of COVID-19 related quantitative easing measures by central banks

⁵ An earlier working paper version of this work is based on a sample period from 4 January 2010 to 30 April 2020 (see Beirne et al., 2020). In the current paper, we draw some comparisons with this earlier analysis as regards the COVID-19 market impact and policy response effectiveness.

in advanced countries extended to EMEs, with significant positive spillovers to EME stock markets in Asia, Europe and Latin America. Going forward, while the ultimate resolution of COVID-19 may be expected to lead to a market correction as uncertainty declines, our impulse response analysis suggests that there may be small permanent effects on financial markets and capital flows as a result of COVID-19, particularly in EMEs.

The remainder of the paper is organized as follows: Section 2 reviews the related literature on the dynamics of asset prices and capital flows during periods of heightened uncertainty, as well as previous studies on the impact on the economic and financial of COVID-19. Section 3 presents the data and empirical methodology. Section 4 presents the empirical results. Section 5 concludes.

2. Related Literature

This paper contributes to the literature on asset price and capital flow dynamics during periods of heightened uncertainty. During such episodes, the typical response of markets is a flight to safety due to risk aversion (e.g. Beirne and Gieck, 2014). Our paper also contributes to the growing literature on the impact of pandemics as the source of uncertainty on markets and capital flows, as well as to the broader literature on the economic effects of COVID-19 and other pandemics. These wider effects undoubtedly are also manifested in financial market and capital flow dynamics, which is the main focus of our paper.

In general, pandemics impact the economy through both the supply and demand sides of the economy and can be transmitted via trade, financial, and travel/tourism channels (e.g. see Correia et. al. (2020) who ascribe the downturn in the US economy during the Great Influenza to demand and supply factors). Verikios et. al. (2011) find that economic activity is more strongly affected by a pandemic that has a high infection rate as opposed to a high virulence rate (i.e. the ability of the virus to harm the host). They suggest that the more integrated a region to the world economy is, the more likely it will be affected by a pandemic. Jordà et. al. (2020) find that the economic impacts of a pandemic are different from those of wars, as a pandemic does not involve the destruction of capital while war does. As such, a pandemic can be followed by a long period of excessive capital per surviving workers and rising real wage if the mortality rate among productive population segments is high, such as in the case of the 14th Century Black Death and the Great Influenza. On the contrary, Garrett (2013) finds that the economic effects of the 1918 Influenza Pandemic were rather short-term although he also observes labor shortage and rising wages.

A range of other papers on pandemics examines the economic costs. For example, Barro et. al. (2020) suggest that the Great Influenza can provide a plausible worst-case scenario for the mortality rates and economic contraction for the ongoing COVID-19 pandemic. The Great Influenza mortality rate was 2.1% of the world's total population and caused an average GDP decline of 6%. In April 2020, the IMF (2020) revised its global GDP growth projection for 2020 to -3.0%, compared to +3.3% before the pandemic. The IMF revised the figure further in January 2021, where the global GDP growth in 2020 is estimated at -3.5%. The Asian Development Bank (ADB) (2020) estimates that the economic losses of COVID-19 could reach 6.4% of global GDP (USD 5.8 trillion) under a 3-month containment scenario and 9.7% of global GDP (USD 8.8 trillion) under a 6-month containment scenario. Other similar effects on GDP were carried out in studies by Maliszewska et. al. (2020), Boissay and Rungcharoenkitkul (2020), and McKibbin and Fernando (2020).

Many studies on the impacts of the COVID-19 pandemic on the financial markets are country-specific, particularly on the US financial markets. Cox et. al. (2020) find that US stock market movements in the early phase of the pandemic have been more reflective of sentiment than fundamentals. Albuлесcu (2021) finds that the persistence of the COVID-19 crisis and its related uncertainty amplifies the US financial markets' volatility and has implications for the global financial cycle. Vasileou (2020) finds that US stock markets were not efficient during the pandemic and that behavior and sentiment indicators may be more useful than economic variables in explaining investor decisions. Ramelli and Wagner (2020) discuss the impact of US firms' trade and financial policies on US stock prices during the COVID-19 pandemic. They make the point that investors retreated from the stocks of US firms that were highly exposed to China, in line with the traditional response of markets to increases in uncertainty. As the virus spread to Europe and the US, investors became more concerned about the financial conditions of firms located in these areas, particularly those with high debt and/or low liquidity, with negative repercussions for stock prices. Baker et.al. (2020) find that the impact of COVID-19 on US stock market volatility is much greater than that of previous pandemics since 1900, particularly due to the economic ramifications of containment policies. Other papers that focus on the implications of COVID-19 for the US stock markets include Alfaro et. al. (2020), Landier et. al. (2020), Mazur et. al. (2020). On the US bond markets, Haddad et. al. (2020) examine disruptions to the US debt market due to COVID-19 and the role played by interventions by the Federal Reserve. They find that while investors initially shifted out of bonds towards more liquid securities to raise cash, Federal Reserve purchases of corporate bonds helped to alleviate the disruption in the bond market.

Cristofaro et. al. (2020) find that the shock from the COVID-19 pandemic has only temporary impacts on China's Shanghai and Shenzhen Composite Indices, unlike the shock from the 2007-2008 Global Financial Crisis that have permanent impacts on the two indices. Espinosa-Méndez and Arias (2021) find that the COVID-19 pandemic increased herding behavior in European capital markets, where uncertainty drives less informed agents. Takyi and Bentum-Ennin (2020) examine the impacts of COVID-19 on the stock markets of 13 African countries and find that the pandemic had a significant negative effect in most cases.

Some studies analyze the global impacts of the pandemic on the volatility of financial markets and cross-border capital flows. Substantial effects on volatility of the global stock markets due to COVID-19 have been stressed by Zhang et. al. (2020). They find that global financial market risks increased substantially in response to the pandemic, where individual stock market reactions are linked to the severity of the outbreak in each country. Lyócsa et.al. (2020) find that fear of the coronavirus – manifested as excess search volume in Google – represents a timely and valuable data source for forecasting stock price variation in the world's 10 largest stock markets. Singh et.al. (2020) find evidence of the Overreaction Hypothesis (ORH) existence in the G20 financial markets during the earlier phase of the pandemic. The G20 financial markets rebound when investors began to make rational decisions along with intervention by policymakers to boost market confidence.

Harjoto et. al. (2020) examine the impact of COVID-19 on the stock markets of 53 emerging market countries and 23 developed countries. They find that COVID-19 cases and deaths adversely affect stock returns and increase volatility and trading volume in all of these countries, but there are different market reactions from the emerging markets and the developed economies. Cases and deaths affected stock returns and volatility in the emerging

markets, while only cases of COVID-19 affected stock returns, volatility, and trading volume in the developed markets.

Hördahl and Shim (2020) examine the impact of COVID-19 on the relationship between bond portfolio outflows and the exchange rate, and between bond outflows and long-term interest rates in 19 EMEs. They find that bond portfolio outflows from EMEs are indeed related to currency depreciation and long-term interest rates, but with some difficulty in ascertaining the direction of causality. The impulse responses generated from our panel structural VAR approach will help to address this issue. More generally on capital flow dynamics, McKibbin and Sidorenko (2006) indicate that a pandemic tends to lead to a major shift in capital from the more to the less affected economies. As regards EMEs, Hofmann et.al. (2020) suggest that borrowing through local currency bonds has not helped to insulate these economies from financial tensions. Indeed, many EME local currency bond spreads spiked amid sharp currency depreciation and capital outflows.

Souza et.al. (2020) find that the COVID-19 pandemic affected the efficiency behavior of the capital market indexes in 44 countries. In the pre-pandemic period, the market efficiency was reduced by individualism and aversion to uncertainty and the increased inflation. In the pandemic period, the market efficiency was increased by individualism and reduced by indulgence. Topcu and Gulal (2020) find that the impact of the COVID-19 outbreak has been the highest in Asian emerging markets whereas emerging markets in Europe have experienced the lowest.

Other studies focus on the impacts of policy responses by the fiscal and financial authorities in many countries to their respective financial markets. Cox et.al (2020) find that the unconventional US monetary policies helped the US financial markets to rebound in late March and April 2020, while they find no evidence that the conventional monetary policy instruments help such rebounds. Caballero and Simsek (2020) discuss the important role of large-scale asset purchases by central banks to cope with downward asset price spirals and severe aggregate demand contractions following a large supply-side shock such as that caused by COVID-19. Adopting an event-study approach, Hartley and Rebucci (2020) find that COVID-19 related quantitative easing measures introduced by advanced and emerging economies had a dampening effect on sovereign bond yields (particularly in emerging economies, many of which had introduced QE measures for the first time). Arslan et. al (2020) also find that QE announcements by central banks in emerging markets were effective in lowering local currency bond yields and restoring investor confidence. On central bank swap lines introduced in response to COVID-19, Bahaj and Reis (2020a) and Bahaj and Reis (2020b) find significant effects in lowering deviations in covered interest parity (CIP). Topcu and Gulal (2020) find that official response time and the size of the stimulus package provided by the governments matter in offsetting the effects of the pandemic. Overall, they found that EMEs with monetary policy frameworks that address the feedback loop between exchange rate depreciation and capital outflows have a greater likelihood of mitigating the detrimental impact of COVID-19. Compared to these studies, our paper examines a wider spectrum of policy responses from the fiscal, monetary, and macroprudential areas.

3. Data and Empirical Methodology

A twofold approach is implemented to estimate the impact of COVID-19. First, using a daily data frequency, we use a fixed-effects panel model over the period from 4 January 2010 to 31 August 2020 across 38 advanced and emerging economies to examine the effects of COVID-19 on bond yields, stock prices and exchange rates. For the assessment of the impact on equity and bond flows, data availability over the same time period limits our country sample to 14 EMEs.⁶ We consider the following regression in our first stage:

$$y_{i,t}^j = \beta COVID19_{i,t} + \gamma x_{i,t-1} + EPU_{t-1} + VIX_{t-1} + \delta_i + \varepsilon_{i,t}, \quad (1)$$

$j \in \{Bonds, Stocks, ExchangeRates, EquityFlows, DebtFlows\}$

where the dependent variable $y_{i,t}$ is either the 10-year government bond yield, the stock prices, the effective exchange rate, equity flows, or debt flows of country i at time t . Our key explanatory variable $COVID19_{i,t}$ is defined as daily new cases per one million population. The domestic controls $x_{i,t}$ include the central bank policy rate, a dummy variable for COVID-19 related quantitative easing announcements by central banks, a dummy variable for fiscal stimulus packages announced by national governments in response to COVID-19, a dummy variable for international central bank swap announcements by central banks due to COVID-19,⁷ the consumer price index (CPI), the industrial production index, the Citigroup Economic Surprise Index which measures contemporaneous economic surprises in macroeconomic data, and financial market indicators referring to bond yields, stock prices, and effective exchange rates.⁸ EPU stands for the US Daily News Index, a measure of global economic policy uncertainty (Baker et al. 2020). VIX stands for the Chicago Board Options Exchange (CBOE) Volatility Index, a measure of global risk aversion. Controlling for the policy responses to the pandemic also importantly enables us to assess the pure market reaction of COVID-19 on asset prices and capital flows. We also test for spillover effects of quantitative easing measures by advanced economy central banks on emerging markets. δ_i represents country fixed effects; and $\varepsilon_{i,t}$ is the error term. All of the control variables are lagged by one period to mitigate endogeneity concerns. Table A2 in Appendix I provides details of all variables used, as well as the sources.

Second, a structural panel VAR is used to examine the response of financial markets and capital flows to shocks from COVID-19. Crucially, shocks control for a range of domestic and global factors. The panel SVAR is implemented in the same sample used in the first stage. The panel SVAR can be denoted as follows in its general specification, with structural shocks identified by a recursive restriction:

$$A(L)Y_{i,t} = \mu_{i,t} \quad (2)$$

⁶ See Table A1 in Appendix I for the full list of countries by regional sub-group.

⁷ We considered including dummies for the announcement of a program with the International Monetary Fund (IMF). However, only two countries in our sample received IMF support during the COVID-19 crisis: Pakistan (Rapid Financing Instrument, April 16) and Chile (Flexible Credit Line, May 29, 2020). At the time of writing, South Africa is in negotiations with the IMF. Please refer to Appendix II for details of the announcement dates of various key policy responses to COVID-19.

⁸ We drop the asset market indicator from $x_{i,t}$ if it is used as the dependent variable in the left-hand side of the regression.

where $A(L)$ is the matrix of the lag polynomial; $Y_{i,t}$ refers to the demeaned value of endogenous variables of country i to accommodate country-specific fixed effects; and $\mu_{i,t}$ is a vector of structural disturbances. The ordering of the variables is imposed in a recursive form (Christiano, Eichenbaum, and Evans 1999), which results in the following matrix A to fit a just-identified model:

$$A = \begin{bmatrix} a_{1,1} & 0 & \dots & 0 \\ a_{2,1} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{11,1} & \dots & a_{11,10} & a_{11,11} \end{bmatrix} \quad (3)$$

We place our COVID-19 variable at the top in the ordering, which implies that it will only be affected by contemporaneous shock to itself. Following the COVID-19 variable, we place the global economic policy uncertainty variable second in the ordering, which implies that global factors will be affected by contemporaneous shocks to COVID-19 and itself, but not by contemporaneous shocks to domestic factors or financial market indicators. Importantly, we put the financial market indicators in the last place in the ordering, which is not only based on the assumption that COVID-19 will affect the markets, but also on the consideration of our first-stage empirical results that imply the global and domestic factors that are driving the financial markets. Last, we place our domestic factors in the middle of the ordering. The panel VAR includes three lags selected by the Akaike information criterion (AIC).

4. Empirical Results

Prior to examining the results from our panel regressions and panel structural VAR, it is useful to consider the trajectory of global financial markets and capital flows in the aftermath of the COVID-19 outbreak (see Figures A1 to A4 in Appendix I). It can be seen that government bond yields initially declined globally given rising uncertainty amidst a bleak economic outlook, suggesting that investors considered sovereign bonds as safe havens assets at the time. On “Black Monday” (9 March 2020), financial markets panicked over the worsening of the COVID-19 pandemic and the concomitant oil price war between Saudi Arabia and Russia. Stock markets tanked, while bond yields spiked. Even US Treasuries, usually considered the ultimate safe haven asset, were dropped as investors were desperate for cash (Schrimpf et al. 2020; Tooze 2020a). Central banks, particularly those in advanced economies, responded quickly with interventions “on an unprecedented scale” and helped to avert “a full-scale meltdown” (Tooze 2020b). Large scale asset purchases of sovereign bonds by the US Federal Reserve, the European Central Bank, the Bank of Japan and other central banks helped to stabilize the situation and lead to a significant decline in sovereign bond yields in advanced economies. Following this spike, yields generally trended downwards globally until around June 2020, when yields upticked somewhat given concerns about a second wave of the virus and the related effects of uncertainty. As well as central bank support packages, substantial COVID-19 related fiscal measures were introduced by national governments, which further reinforced the actions of central banks. Figure A6 demonstrates some cross-country heterogeneity in the magnitudes of the fiscal response to the crisis, with some countries such as Japan and New Zealand bringing in new fiscal measures equating to over 20% of GDP. Our empirical approach controls for the effects of COVID-19 related monetary and fiscal policy measures introduced using announcement date dummy variables.

As regard stocks prices, these had started to slump already in February 2020, but then dropped sharply at the global level on Black Monday. Stocks have recovered somewhat during April, as containment measures imposed by infected countries began to be relaxed, as well as positive spillovers of liquidity measures by central banks to stock markets. On exchange rate and capital flow developments, EMEs as a whole experienced sharp currency depreciations and substantial capital outflows as COVID-19 took hold. This reflected the typical pattern observed in global financial markets during periods of heightened uncertainty. The scale of capital flight, however, was unprecedented: during February and March 2020, EMEs experienced portfolio capital outflows totaling around \$100 billion, triple the amount of outflows during the 2008 Global Financial Crisis (Georgieva 2020). Indeed, both equity and bond outflows from EMEs were much faster and more pronounced than during previous episodes of EME turmoil, including the 2013 “taper tantrum”, the 2015 “China scare”, and the 2008 Global Financial Crisis (GFC) (Figure A5). The spike in bond yields after Black Monday was extraordinarily large and steep, but unlike in previous episodes of EME turmoil, bond yields returned to original levels after around a month. Exchange rate devaluation of EMEs was broadly similar to those seen during the GFC, which is also true for stock price changes.

Our panel regression results help to shed more light on developments in global markets and EMEs in particular due to COVID-19. Tables 1 to 4 display the impact of COVID-19 on sovereign bond yields, stock prices, effective exchange rates, and EME capital flows, respectively. Controlling for domestic and global factors, our analysis also sheds light on the impact of monetary and fiscal policy responses to COVID-19 in supporting domestic asset markets and capital flows.

{Insert Tables 1 to 4 about here }

In terms of the magnitudes of the effect of COVID-19 on financial markets, these are notably higher for emerging rather than advanced economies across bond, stocks and exchange rates, particularly for European and Asian EMEs. Importantly, these results controls for a vast number of domestic and global factors, the coefficient signs of which (where significant) largely are in alignment with priors.⁹

On sovereign bond yields, Table 1 shows that over the sample period, COVID-19 has had a significant dampening effect in all advanced economies and emerging economies in Asia.¹⁰ The largest relative effect on yields is apparent for Asian EMEs. It is worth noting that the magnitude of the effect on of COVID-19 on yields seems to be much lower across country groups compared to the early stage of the crisis. Beirne et al. (2020) show that, over the period 4 January 2010 to 30 April 2020, the virus has led to a reduction in bond yields in European and Asian EMEs by around 0.24 and 0.14 percentage points respectively.¹¹ In this updated analysis to the end of August, the sharp impact of COVID-19 has waned somewhat, and this is undoubtedly related to the adjustment of markets to the shock, as well as the

⁹ As can be seen from Figures A7 to A10 in Appendix I, the panel models estimated appear to reflect well the trajectory of actual global asset market prices and EME capital flows.

¹⁰ Given that our COVID-19 variable is defined as one new confirmed case per one million of the population, our results therefore imply a substantial accumulated effect of COVID-19 on financial markets and capital flows.

¹¹ See Table A3 in Appendix I for an alternative specification in relation to the effect of COVID-19 on EME sovereign bond yields, the results of which are fully in line with our baseline.

longer impact for monetary and fiscal rescue packages to pass through to asset prices. The finding of negative overall effect of COVID-19 on yields may seem counter-intuitive, as one might expect an increase in COVID-19 cases to worsen financial market turmoil and also increase sovereign bond yields. There are two explanations why the overall effect on bond yields was negative. First, government bonds were perceived as safer assets than corporate bonds, given the corporate sector, with few exceptions, was very heavily affected by the COVID-19 lockdowns. With many businesses fighting for survival, sovereign bonds were seen as the better alternative, even if the crisis also cast questions on the sustainability of public debt. Secondly, the crisis gave way to extremely accommodative central bank policy in most places, with slashes in interest rate and new rounds of QE policies in all major advanced economies.

As can be seen from the regression results, central bank swap line announcements were highly effective in bringing down sovereign bond yields in advanced economies overall, including in Europe and Asia, while interest rate reductions due to COVID-19 also passed through to bond yields across all advanced and emerging economies. There is also some evidence to indicate that fiscal policy has been effective at the global level over the period up to 31 August 2020. In addition, fiscal stimulus packages announced by national governments also seemed to have much stronger effects in this earlier period, both in advanced economies and EMEs in Europe and Asia. Consistent with the earlier analysis in Beirne et al (2020), we find that the effects of QE announcements by EME central banks had no significant effect on domestic government bond yields. This is in contrast to the findings of Hartley and Rebucci (2020) and Arslan et al (2020), who use an event study analysis to show that QE announcements by central banks in EMEs have had significant dampening effects on bond yields. Unlike that analysis, however, our paper controls for a large number of domestic and global macroeconomic and financial bond yield determinants. It should be also noted that international central bank swaps played no meaningful role for EMEs, which is not surprising: among the beneficiaries of the bilateral currency swaps extended by the Federal Reserve of the United States were only two EMEs, Brazil and Mexico (Gallagher et al. 2021). On the controls, the expected negative relationship between bond yields and both inflation and industrial production holds across the vast majority of regional groups, while global financial market uncertainty as proxied by the VIX is also positively related to bond yields, as expected. It is also notable that, in contrast to Beirne et al. (2020), QE measures by advanced economy central banks do not spill over to EMEs for the period up to the end of August 2020, with all of these spillover effects taking place during the first phase of the QE response to COVID-19.¹²

¹² It is also notable that the results of the effects on bond yields are positive and significant for the overall sample and the sample of all EMEs, while mostly negative and significant elsewhere. There are a number of possible valid explanations for this. First, the full panel is a much more heterogeneous set of countries with a different level of daily cases of COVID-19. The use of fixed effects in such a set-up may not always be sufficient to fully capture that heterogeneity. Second, the subsample of all EMEs contains 15 economies, and do not reflect the sum of Emerging Europe, Latin America and Emerging Asia (we have not shown the results for 'Other EMEs', containing Tunisia and South Africa, given the difficulty in ascribing an interpretation to this sub-panel). Finally, the subsample analysis of Emerging Asia has less policy controls (e.g., CB swaps) compared to other advanced economy panels. For all of these reasons, there can be some differences in the signs of the effects found across the panels of different country groupings. It follows that making comparisons of the results across different country groups are subject to caveats.

Turning to the impact on stock markets, Table 2 indicates that while the effect has been marginal relative to new COVID-19 cases confirmed in advanced economies, stock prices have declined most substantially in European EMEs by around 3%, compared to around 1% in EMEs in Asia and Latin America. These are similar to the magnitudes found in Beirne et al. (2020). In the case of stock markets, we see a strong impact of expansionary monetary policy in advanced economies (through QE and interest rate reductions), which clearly helped to prop up stock markets in advanced economies as well as emerging markets in Asia and Latin America. We also find significant positive spillover effects of advanced economy QE to all EME stock markets. As regards QE announcements by EME central banks, it is notable that these have been effective in Asian EMEs in supporting stock prices. On fiscal stimulus packages, these have been more important for stock markets in emerging rather than advanced economies overall, although stock markets in advanced economies in Asia rallied strongly due to COVID-19 related fiscal measures introduced. The domestic and global controls for the stock market equation are also in accordance with priors, e.g. positive relationship with inflation and industrial production, and negative relationship with the VIX.

On exchange rates, Table 3 shows that European and Asian EMEs have been most affected, experiencing currency depreciations due to COVID-19, although the magnitude of these effects are not as large overall compared to the effects on stock and bond markets. QE and swap announcements by central banks in advanced economies overall appear to have been effective on exchange rates, while QE in emerging Asian economies has been effective in stabilizing exchange rates. The effect of fiscal stimulus packages on exchange rates is more limited however, with some evidence of a significant impact at the global level. On asset markets overall, it appears that the initial sharper impact of COVID-19 up to the end of April (as in Beirne et al., 2020) applies only to the sovereign bond market. Extending the analysis to the end of August yields similar magnitudes of effects of COVID-19 on stock and currency markets.

In regard to EME capital flows, Table 4 indicates that COVID-19 has led to statistically significant outflows of both equities and bonds, reflecting investors' flights to safety. The magnitudes of these effects are much lower in the current estimation period compared to that estimated in Beirne et al. (2020) up to the end of April. This is fully in line with what was observed in international capital markets, where EMEs experienced sharp and substantial outflows at the onset of the crisis. QE measures announced by EMEs central banks at that time also had a significant effects on averting capital outflows, while positive QE spillovers were also evident from advanced economy central banks, i.e., advanced countries' asset purchase programs not only helped to lower bond yields and prop up stock markets at home, they also helped to put a stop to capital flight from EMEs. Table 4 shows that over the period up to the end of August 2020, the effect of QE is not statistically significant, in contrast to Beirne et al. (2020), suggesting that the impact of QE on capital flows has waned over time. Fiscal stimulus packages, however, are supporting EMEs equity flows. These results have particular significance for Asia, where half of the EME sample used for the capital flow equation is comprised of Asian economies.

Across all of the models estimated, we have also examined the role of public health and containment policy introduced in response to the pandemic based on specifications that include the COVID-19 Containment and Health Index by the World Health Organization. We find that these policies are associated with lower sovereign borrowing costs, higher capital inflows to EMEs, and appreciating exchange rates, but negatively related to stock

market indices. Moreover, while this alternative specification does not affect the results of our baseline regression, we have opted to maintain as our baseline the model that excludes this variable due to some multicollinearity concerns, particularly in relation to the wider government policy responses to the pandemic. As a robustness to our baseline empirical analysis, we have also estimated the panel model using two-stage least squares with 2-period lags of COVID-19 daily cases as an instrumental variable. These results are fully consistent with our baseline models, and allay concerns about causality and endogeneity, in particular as regards the large number of control variables. Moreover, while COVID-19 should be a good example of a global exogenous shock, we have taken a 2-day lag as the instrumental variable in order to make it more exogenous. Finally, given the importance of our dummy variables for policy responses to COVID-19, we have examined alternative definitions of these dummies as a form of sensitivity analysis. While our benchmark model uses 1-period lags for the policy dummy variables, we also estimated regressions with the policy dummy defined as 1 *and* after the announcement date, and the estimations are consistent with the benchmark models.¹³

Turning to the impulse responses from our panel structural VAR models (Figures 1 to 4), the results indicate that COVID-19 may have some small permanent effects on financial markets and capital flows, so that a full market correction to the pre COVID-19 financial market environment when the virus dissipates will not occur.

{Insert Figures 1 to 4 about here }

The results on bond yields indicate that there is a statistically significant response of bond yields to COVID-19 shocks at periods over a longer time horizon (40-50 days) for Emerging Europe and Latin America. For Emerging Asia and Advanced Europe, we find that bond yields respond to COVID-19 shocks significantly at periods earlier in the time horizon (1-10 days). For other regions, we do not find a significant result. For stock markets, we find that the responses to COVID-19 shocks are statistically significant and negative across the sample of all countries, but that this is largely driven by advanced economies. Moreover, the statistical significance of the effect wanes after around 10 days. As regards exchange rates, we find that the impulse responses are mostly not significant, except however in the case of Emerging Asia where COVID-19 shocks lead to initial depreciating effects on exchange rates up to a horizon of just after 10 days, after which point the responses to shock become insignificant. This effect of shocks at the early horizon stage is in line with expectations and also in line with what was observed at the outbreak of COVID-19, i.e. depreciating exchange rates in EMEs linked to large capital outflows. Indeed, we also find that the IRFs are highly significant in the case of capital flow reactions to COVID-19. For equity flows, the response is negative and highly significant across the entire time horizon. For bond flows, we also find a negative and highly significant effect up to around 10 days, after which point the effect becomes statistically insignificant. Importantly, the direction of the impulse responses across all asset markets and capital flows are fully consistent with the signs of the COVID-19 coefficients estimated in the earlier panel regression.¹⁴ Moreover, these impulse responses also control for the same full set of domestic and global factors.

¹³ Given the extremely large volume of these additional results, they are not provided in the paper, but are available from the authors upon request.

¹⁴ We have also computed the full set of IRFs across all variables used in the analysis. The huge volume of results prevents us from including them in the paper, but they are all available from the authors upon request.

Finally, and also in line with the panel analysis, permanent effects of the shocks are most pronounced in magnitude for emerging economies in Europe and Asia.

5. Conclusions

This paper provides an empirical analysis of the impact of the COVID-19 pandemic on global financial markets and EME capital flow dynamics, as well as the effectiveness of policy responses. Against the backdrop of globally interconnected financial markets, we examine the impact across sovereign bond and equity markets, as well as exchange rates and capital flows. Our analysis enables a comparative assessment to be made across advanced and emerging economies. Controlling for a large number of domestic and global financial and macroeconomic factors, our results suggest that COVID-19 has had the most substantial effects on financial markets in European and Asian EMEs. Moreover, EME equity and bond outflows appear to be directly linked to COVID-19 given investor risk aversion and flight to safety. Sovereign bond markets in EMEs appear to have been most affected by COVID-19, compared to the magnitude of the effects on stock prices and exchange rates. In addition, while COVID-19 will ultimately subside, our results suggest that markets globally may experience some marginal permanent effects. In terms of the magnitude of the effect on markets, comparing the current results to Beirne et al. (2020) indicates that COVID-19 had a much more substantial impact on sovereign bond yields and capital flows in the first phase of the crisis, up to the end of April 2020.

On policy responses, our findings show that the impact of conventional monetary policy reactions to COVID-19 dominate the effect on sovereign bond markets compared to other policy responses. The magnitude of the effect is about twice as large for advanced compared to emerging economies. Unlike the earlier analysis in Beirne et al. (2020), the impact of QE on bond yields is not statistically significant over the sample period up to the end of August. As regards stock markets, interest rate reductions were more effective in advanced compared to emerging economies overall by a factor of around two. In addition, QE measures in advanced economies, as well as spillovers to EMEs, helped to boost domestic stock prices by around 2% and 13% respectively. QE spillovers from advanced economies to emerging Asia boosted stock prices by around 8%, while QE by central banks in emerging Asia helped to increase stock prices by around 14%. The impact of fiscal policy on stock markets was confined to Asian advanced economies and EMEs overall. At the global level, while the magnitude of the effect of policy responses on exchange rates was much lower than in other markets, COVID-19 fiscal stimulus packages helped to boost equity flows by around 6%.

Heightened uncertainty due to the COVID-19 pandemic has clearly affected the financial markets of EMEs more detrimentally than advanced economies. However, it appears that EMEs have performed strongly in their policy responses to the pandemic. While fiscal stimulus packages have contributed to restoring confidence in local markets, many EME central banks have embarked successfully on quantitative easing for the first time. Our results would suggest that these monetary policy measures have been particularly effective in the case of Asian EMEs, supporting stock prices. While Beirne et al. (2020) show that these QE measures also helped to stabilize capital flows up to end April 2020, our results indicate an important capital flow stabilizing role for fiscal policy and interest rate policy responses over the period up to end August 2020. Moreover, given the scale of bond and equity capital outflows from EMEs, particularly at the onset of the crisis, our results highlight the importance of strengthening the domestic investor base to be less reliant on international portfolio investment, corroborating findings by Hofmann et al. (2020). Going

forward, the COVID-19 crisis illustrates the need for concerted efforts at bolstering domestic financial resource mobilization in EMEs, and for reducing exposure to international portfolio capital and financial contagion. The extent of capital outflows also strengthens the case for reviving discussions around the management of capital flows and on the development of the global financial safety net. Finally, our results highlight the importance for EMEs to develop further their overall policy toolkits to respond to spikes in financial market volatility and crisis episodes, notably with the use of QE measures. With conventional monetary policy having easing limits and fiscal policy space constrained by excessive public debt, using QE policies can be a potent stimulator in domestic markets, particularly where inflation expectations are contained and exchange rates are flexible.

References

Albulescu, Claudiu Tiberiu. 2021. COVID-19 and the United States Financial Markets' Volatility. *Finance Research Letters* 38(1). <https://doi.org/10.1016/j.frl.2020.101699>

Alfaro, Laura, Anusha Chari, Andrew N. Greenland, and Peter K. Schott. 2020. Aggregate and Firm-Level Stock Returns During Pandemics, in Real Time. NBER Working Paper No. 26950. Cambridge, MA: National Bureau of Economic Research.

Arslan, Yavuz, Mathias Drehmann and Boris Hofmann. 2020. Central Bank Bond Purchases in Emerging Market Economies. *BIS Bulletin* No. 20. Basel: Bank for International Settlements.

Asian Development Bank. 2020. An Updated Assessment of the Economic Impact of COVID-19. *ADB Briefs* No. 133. Manila: Asian Development Bank.

Bahaj, Saleem, and Ricardo Reis. 2020a. Central Bank Swap Lines During the COVID-19 Pandemic. *COVID Economics* 2, pp. 1-12.

Bahaj, Saleem and Ricardo Reis. 2020b. Central Bank Swap Lines: Evidence on the Effects of the Lender of Last Resort", *IMES Discussion Paper* No. 2019-E-9, Bank of Japan.

Baker, Scott R., Nicholas Bloom, Steven J. Davis, Kyle J. Kost, Marco C. Sammon, and Tasaneeya Viratyosin. 2020. The Unprecedented Stock Market Impact of COVID-19. NBER Working Paper No. 26945. Cambridge, MA: National Bureau of Economic Research.

Barro, Robert J., José F. Ursúa, and Joanna Weng. 2020. The Coronavirus and the Great Influenza Pandemic: Lessons from the "Spanish Flu" for the Coronavirus's Potential Effects on Mortality and Economic Activity. NBER Working Paper No. 26866. Cambridge, MA: National Bureau of Economic Research.

Beirne, J., N. Renzhi, E. Sugandi, and U. Volz. 2020. Financial Market and Capital Flow Dynamics During the COVID-19 Pandemic. *ADB Working Paper* 1158. Tokyo: Asian Development Bank Institute.

Beirne, John and Jana Gieck. 2014. Interdependence and Contagion in Global Asset Markets. *Review of International Economics* 22(4), 639-659.

Belke, Ansgar and Ulrich Volz. 2019. Capital Flows to Developing and Emerging Market Economies: Global Liquidity and Uncertainty Versus Push Factors. *Review of Development Finance* 9(1), 32-50.

Boissay, Frédéric, Daniel Rees and Phurichai Rungcharoenkitkul. 2020. Dealing with COVID-19: Understanding the Policy Choices. BIS Bulletin No. 19. Basel: Bank for International Settlements.

Boissay, Frederic and Phurichai Rungcharoenkitkul. 2020. Macroeconomic Effects of COVID-19: An Early Review. BIS Bulletin No. 7. Basel: Bank for International Settlements.

Caballero, Ricardo J. and Alp Simsek. 2020. A Model of Asset Price Spirals and Aggregate Demand Amplification of a COVID-19 Shock. NBER Working Paper No. 27044. Cambridge, MA: National Bureau of Economic Research.

Correia, Sergio, Stephan Luck, and Emil Verner. 2020. Pandemics Depress the Economy, Public Health Interventions Do Not: Evidence from the 1918 Flu. SSRN: <https://ssrn.com/abstract=3561560> or <http://dx.doi.org/10.2139/ssrn.3561560>.

Cox, Josue, Sydney C. Ludvigson, and Daniel L. Greenwald. 2020. What Explains the COVID-19 Stock Market? NBER Working Paper No. 27784. Cambridge, MA: National Bureau of Economic Research.

Cristofaro, Lorenzo, Luis A. Gil-Alana, Zhongfei Chen, and Peter Wanke. 2020. Modelling Stock Market Data in China: Crisis and Coronavirus. *Finance Research Letters* 37. <https://doi.org/10.1016/j.frl.2020.101865>

De Souza, Paulo Vitor Souza and César Augusto Tibúrcio Silva. 2020. Effects of COVID-19 Pandemic on International Capital Markets. *International Journal of Economics and Financial Issues* 10(6), 163-171.

Espinosa-Méndez, Christian and Jose Arias. 2021. COVID-19 Effect on Herding Behaviour in European Capital Markets. *Finance Research Letters* 38. <https://doi.org/10.1016/j.frl.2020.101787>

Gallagher, Kevin P., Haihong Gao, William N. Kring, José Antonio Ocampo, and Ulrich Volz. 2021. Safety First: Expanding the Global Financial Safety Net in Response to COVID-19. *Global Policy* 12(1), 140-148. <https://doi.org/10.1111/1758-5899.12871>

Garrett, Thomas A. 2013. *Economic Effects of the 1918 Influenza Pandemic: Implications for a Modern-day Pandemic*. Darby, PA: Diane Publishing Company.

Georgieva, Kristalina. 2020. Confronting the Crisis: Priorities for the Global Economy, 9 April, <https://www.imf.org/en/News/Articles/2020/04/07/sp040920-SMs2020-Curtain-Raiser>

Haddad, Valentin, Alan Moreira, and Tyler Muir. 2020. When Selling Becomes Viral: Disruptions in Debt Markets in the COVID-19 Crisis and the Fed's Response. NBER Working Paper No. 27168. Cambridge, MA: National Bureau of Economic Research.

- Harjoto, Maretno Agus, Fabrizio Rossi, Robert Lee, and Bruno S. Sergi. 2020. How Do Equity Markets React to COVID-19? Evidence from Emerging and Developed Countries. *Journal of Economics and Business*, 105966. <https://doi.org/10.1016/j.jeconbus.2020.105966>
- Hartley, Jonathan and Alessandro Rebucci. 2020. An Event Study of COVID-19 Central Bank Quantitative Easing in Advanced and Emerging Economies. NBER Working Paper No. 27339. Cambridge, MA: National Bureau of Economic Research.
- Hofmann, Boris, Ilhyock Shim and Hyun Song Shin. 2020. Emerging Market Economy Exchange Rates and Local Currency Bond Markets Amid the COVID-19 Pandemic. BIS Bulletin No. 5. Basel: Bank for International Settlements.
- Hördahl, Peter and Ilhyock Shim. 2020. EME Bond Portfolio Flows and Long-term Interest Rates During the COVID-19 Pandemic. BIS Bulletin No. 18. Basel: Bank for International Settlements.
- International Monetary Fund. The Great Lockdown. World Economic Outlook April 2020. Washington, DC: International Monetary Fund.
- International Monetary Fund. Policy Support and Vaccines Expected to Lift Activity. World Economic Outlook Update January 2021. Washington, DC: International Monetary Fund.
- Jackson, James K., Martin A. Weiss, Andres B. Schwarzenberg, and Rebecca M. Nelson. 2020. Global Economic Effects of COVID-19. Congressional Research Service R46270. Washington, DC: Congressional Research Service.
- Jordà, Òscar, Sanjay R. Singh, and Alan M. Taylor. 2020. Longer-Run Economic Consequences of Pandemics. Federal Reserve Bank of San Francisco Working Paper No. 2020-09. San Francisco, CA: Federal Reserve Bank of San Francisco.
- Landier, Augustin and David Thesmar. 2020. Earnings Expectations in the COVID Crisis. NBER Working Paper No. 27160. Cambridge, MA: National Bureau of Economic Research.
- Lyócsaa, Štefan, Eduard Baumöhl, Tomáš VÝrost, and Peter Molnár. 2020. Fear of the Coronavirus and the Stock Markets. *Finance Research Letters* 36. <https://doi.org/10.1016/j.frl.2020.101735>
- Maliszewska, Maryla, Aaditya Mattoo, and Dominique van der Mensbrugghe. 2020. The Potential Impact of COVID-19 on GDP and Trade: A Preliminary Assessment. World Bank Policy Research Working Paper No. 9211. Washington, DC: World Bank.
- Mazur, Mieszko, Man Dang, and Miguel Vega. 2021. COVID-19 and the March 2020 Stock Market Crash: Evidence from S&P1500. *Finance Research Letters* 38. <https://doi.org/10.1016/j.frl.2020.101690>
- McKibbin, Warwick and Alexandra A. Sidorenko. 2006. Global Macroeconomic Consequences of Pandemic Influenza. CAMA Miscellaneous Publications. Canberra: Centre for Applied Macroeconomic Analysis, Crawford School of Public Policy, Australian National University.

McKibbin, Warwick and Roshen Fernando. 2020. The Global Macroeconomic Impacts of COVID-19: Seven Scenarios. CAMA Working Paper No. 19/2020. Canberra: Centre for Applied Macroeconomic Analysis, Crawford School of Public Policy, Australian National University.

Schrimpf, Andreas, Hyun Song Shin, and Vladyslav Sushko. 2020. Leverage and Margin Spirals in Fixed Income Markets during the COVID-19 Crisis. BIS Bulletin No. 2. Basel: Bank for International Settlements.

Singh, Bhanwar, Rosy Dhall, Sahil Narang, and Savita Rawat. 2020. The Outbreak of COVID-19 and Stock Market Responses: An Event Study and Panel Data Analysis for G-20 Countries. *Global Business Review*. <https://doi.org/10.1177%2F0972150920957274>

Takyi, Paul Owusu and Isaac Bentum-Ennin. 2020. The Impact of COVID-19 on Stock Market Performance in Africa: A Bayesian Structural Time Series Approach. *Journal of Economics and Business*, 105968. <https://doi.org/10.1016/j.jeconbus.2020.105968>

Tooze, Adam. 2020a. Is the Coronavirus Crash Worse Than the 2008 Financial Crisis? *Foreign Policy*, 18 March.

Tooze, Adam. 2020b. How coronavirus almost brought down the global financial system, *The Guardian*, 14 April, <https://www.theguardian.com/business/2020/apr/14/how-coronavirus-almost-brought-down-the-global-financial-system>

Topcu, Mert and Omer Serkan Gulal. 2020. The impact of COVID-19 on Emerging Stock Markets. *Finance Research Letters* 36. <https://doi.org/10.1016/j.frl.2020.101691>

Vasileou, Evangelos. 2020. Behavioral finance and market efficiency in the time of the COVID-19 pandemic: does fear drive the market? *International Review of Applied Economics*. <https://10.1080/02692171.2020.1864301>

Verikios, George, Maura Sullivan, Pane Stojanovski, James Giesecke, and Gordon Woo. 2011. The Global Economic Effects of Pandemic Influenza. General Paper G-224, Centre of Policy Studies. Melbourne: Monash University.

Ramelli, Stefano and Alexander F. Wagner. 2020. Feverish Stock Price Reactions to COVID-19. Swiss Finance Institute Research Paper Series No. 20-12. Zurich: Swiss Finance Institute.

Zhang, Dayong, Min Hu, M. and Qiang Ji. 2020. Financial Markets Under the Global Pandemic of COVID-19. *Finance Research Letters* 38. <https://doi.org/10.1016/j.frl.2020.101528>

Table 1: COVID-19 impact on sovereign bond yields

	Full sample (1)	Advanced			Emerging			
		(2) All	(3) Europe	(4) Asia	(5) All	(6) Europe	(7) Asia	(8) Latin
COVID-19	0.002*** (0.000)	-0.007*** (0.001)	-0.007*** (0.001)	-0.003*** (0.001)	0.001*** (0.000)	-0.002 (0.005)	-0.021*** (0.003)	-0.000 (0.000)
Domestic COVID-19 policy responses								
Interest rate	0.193*** (0.009)	0.338*** (0.031)	0.250*** (0.026)	0.180*** (0.013)	0.084*** (0.008)	0.072 (0.102)	0.154*** (0.012)	-0.031 (0.026)
QE	-0.150 (0.216)	0.044 (0.325)	0.063 (0.528)	-0.016 (0.188)	-0.003 (0.201)	-0.459 (0.352)	0.213 (0.320)	0.005 (0.307)
Fiscal	-0.349** (0.150)	-0.225 (0.191)	-0.086 (0.255)	0.033 (0.114)	-0.106 (0.196)	-0.326 (0.389)	-0.006 (0.235)	0.213 (0.443)
CB swap	-0.954*** (0.174)	-0.677*** (0.200)	-0.552** (0.249)	0.371* (0.210)	-1.020 (0.625)	-0.837 (0.694)	n/a	-0.033 (0.733)
Domestic controls								
Stock prices	-1.045*** (0.024)	-0.557*** (0.034)	0.129** (0.053)	-0.214*** (0.019)	-0.777*** (0.026)	-0.932*** (0.040)	-2.143*** (0.054)	-1.430*** (0.048)
Exchange rate	-1.935*** (0.071)	-0.890*** (0.137)	-5.040*** (0.323)	1.260*** (0.066)	-3.479*** (0.067)	-9.255*** (0.235)	-4.433*** (0.139)	-1.808*** (0.093)
Policy rate	0.600*** (0.005)	1.306*** (0.013)	1.882*** (0.021)	0.733*** (0.008)	0.481*** (0.003)	0.608*** (0.010)	0.264*** (0.007)	0.335*** (0.005)
Inflation	-1.280*** (0.088)	-3.272*** (0.198)	-2.937*** (0.333)	-6.958*** (0.095)	-3.218*** (0.083)	-15.466*** (0.334)	-1.980*** (0.161)	-3.973*** (0.111)
Ind. prod.	-1.609*** (0.050)	-3.844*** (0.085)	-7.304*** (0.129)	0.384*** (0.066)	-0.073* (0.042)	-0.853*** (0.145)	1.172*** (0.054)	-0.846*** (0.095)
Citi surprise	0.465*** (0.024)	0.381*** (0.029)	0.219*** (0.037)	0.714*** (0.038)	0.952*** (0.039)	1.501*** (0.082)	-0.022 (0.062)	1.145*** (0.057)
Global controls								
EPU	0.191*** (0.009)	0.202*** (0.013)	0.259*** (0.019)	-0.125*** (0.007)	0.005 (0.009)	0.287*** (0.016)	-0.125*** (0.013)	-0.219*** (0.014)
VIX	0.585*** (0.017)	0.375*** (0.026)	0.550*** (0.038)	-0.023* (0.014)	0.430*** (0.017)	0.118*** (0.031)	0.056** (0.026)	0.703*** (0.028)
Advanced QE	n/a	n/a	n/a	n/a	-0.015 (0.076)	-0.020 (0.134)	0.110 (0.114)	-0.027 (0.127)
Constant	28.74*** (0.696)	39.04*** (1.080)	67.79*** (2.194)	23.08*** (0.510)	37.28*** (0.700)	144.87*** (2.414)	48.13*** (1.238)	45.09*** (1.159)
Observations	105,509	63,867	41,628	13,900	41,642	8,282	16,680	11,120
R-squared	0.331	0.333	0.390	0.553	0.571	0.851	0.556	0.684
#countries	38	23	15	5	15	3	6	4
Country Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES

Note: Standard errors in parentheses; ***, **, * denotes p<0.01, p<0.05, and p<0.1 respectively.

Table 2: COVID-19 impact on stock prices

	Full sample	Advanced			Emerging			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		All	Europe	Asia	All	Europe	Asia	Latin
COVID-19	-0.001*** (0.000)	0.001*** (0.000)	0.000 (0.000)	-0.001** (0.000)	-0.001*** (0.000)	-0.020*** (0.001)	-0.007*** (0.000)	-0.001*** (0.000)
Domestic COVID-19 policy responses								
Interest rate	-0.011*** (0.001)	-0.074*** (0.003)	-0.202*** (0.012)	-0.038*** (0.004)	-0.007*** (0.001)	0.086*** (0.022)	-0.012*** (0.001)	-0.052*** (0.004)
QE	-0.043 (0.028)	0.018** (0.008)	0.200*** (0.049)	0.245*** (0.082)	0.105*** (0.038)	0.027 (0.095)	0.139*** (0.045)	0.175*** (0.061)
Fiscal	-0.019 (0.019)	-0.004 (0.022)	-0.034 (0.024)	0.173*** (0.050)	0.104*** (0.037)	0.218** (0.105)	0.060* (0.033)	-0.004 (0.088)
CB swap	0.025 (0.022)	0.007 (0.023)	-0.000 (0.023)	0.105 (0.092)	-0.122 (0.118)	-0.262 (0.188)	n/a	0.165 (0.145)
Domestic controls								
Sov. yield	-0.017*** (0.000)	-0.009*** (0.000)	-0.000 (0.000)	-0.041*** (0.004)	-0.023*** (0.001)	-0.065*** (0.003)	-0.043*** (0.001)	-0.050*** (0.002)
Exchange rate	0.328*** (0.009)	-0.136*** (0.016)	0.479*** (0.030)	-1.306*** (0.027)	0.487*** (0.013)	1.098*** (0.067)	0.560*** (0.020)	0.342*** (0.018)
Policy rate	-0.036*** (0.001)	-0.056*** (0.002)	-0.088*** (0.002)	0.048*** (0.004)	-0.027*** (0.001)	-0.015*** (0.003)	-0.036*** (0.001)	-0.025*** (0.001)
Inflation	1.355*** (0.010)	1.892*** (0.021)	1.900*** (0.028)	0.880*** (0.045)	1.441*** (0.014)	0.658*** (0.097)	1.779*** (0.018)	0.351*** (0.022)
Ind. prod.	0.358*** (0.006)	0.533*** (0.010)	0.854*** (0.012)	1.016*** (0.027)	0.246*** (0.008)	0.049 (0.038)	0.104*** (0.008)	-0.126*** (0.019)
Citi surprise	0.056*** (0.003)	0.060*** (0.003)	0.046*** (0.003)	0.278*** (0.017)	0.038*** (0.007)	0.404*** (0.022)	-0.070*** (0.009)	0.025** (0.011)
Global controls								
EPU	-0.013*** (0.001)	-0.019*** (0.001)	-0.014*** (0.002)	-0.026*** (0.003)	-0.001 (0.002)	0.038*** (0.004)	-0.037*** (0.002)	0.037*** (0.003)
VIX	-0.090*** (0.002)	-0.090*** (0.003)	-0.058*** (0.003)	-0.132*** (0.006)	-0.065*** (0.003)	-0.089*** (0.008)	-0.086*** (0.004)	-0.033*** (0.006)
Advanced QE	n/a	n/a	n/a	n/a	0.125*** (0.014)	0.171*** (0.036)	0.075*** (0.016)	0.148*** (0.025)
Constant	-1.502*** (0.088)	-2.910*** (0.123)	-7.480*** (0.198)	4.638*** (0.226)	-1.902*** (0.135)	-3.371*** (0.755)	-1.520*** (0.182)	6.492*** (0.236)
Observations	105,509	63,867	41,628	13,900	41,642	8,282	16,680	11,120
R-squared	0.411	0.348	0.409	0.348	0.551	0.400	0.839	0.396
#countries	38	23	15	5	15	3	6	4
Country Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES

Note: Standard errors in parentheses; ***, **, * denotes p<0.01, p<0.05, and p<0.1 respectively.

Table 3: COVID-19 impact on effective exchange rates

	Full sample (1)	Advanced			Emerging			
		(2) All	(3) Europe	(4) Asia	(5) All	(6) Europe	(7) Asia	(8) Latin
COVID-19	0.000*** (0.000)	0.000*** (0.000)	-0.000** (0.000)	-0.000* (0.000)	-0.000*** (0.000)	0.003*** (0.000)	0.001*** (0.000)	0.000 (0.000)
Domestic COVID-19 policy responses								
Interest rate	-0.005*** (0.000)	0.006*** (0.001)	-0.021*** (0.002)	-0.007*** (0.001)	-0.002*** (0.000)	-0.050*** (0.003)	-0.004*** (0.000)	-0.043*** (0.002)
QE	0.038*** (0.009)	0.033*** (0.009)	0.008 (0.008)	0.028 (0.024)	0.010 (0.014)	-0.001 (0.015)	0.058*** (0.017)	0.016 (0.031)
Fiscal	0.033*** (0.007)	-0.001 (0.006)	-0.003 (0.004)	0.004 (0.015)	-0.002 (0.014)	0.023 (0.017)	0.011 (0.013)	-0.037 (0.045)
CB swap	0.054*** (0.008)	0.017*** (0.006)	0.017*** (0.004)	-0.031 (0.027)	-0.024 (0.045)	0.057* (0.030)	n/a	-0.041 (0.075)
Domestic controls								
Sov. yield	-0.005*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	0.020*** (0.001)	-0.018*** (0.000)	-0.019*** (0.000)	-0.013*** (0.000)	-0.021*** (0.001)
Stock prices	0.039*** (0.001)	-0.008*** (0.001)	0.013*** (0.001)	-0.112*** (0.002)	0.070*** (0.002)	0.029*** (0.002)	0.083*** (0.003)	0.092*** (0.005)
Policy rate	-0.002*** (0.000)	0.022*** (0.000)	0.008*** (0.000)	-0.027*** (0.001)	0.002*** (0.000)	0.030*** (0.000)	-0.013*** (0.000)	0.005*** (0.001)
Inflation	-0.759*** (0.003)	0.250*** (0.005)	0.026*** (0.005)	0.723*** (0.012)	-0.964*** (0.004)	-0.499*** (0.015)	-0.886*** (0.005)	-0.964*** (0.007)
Ind. prod.	0.084*** (0.002)	0.029*** (0.002)	-0.050*** (0.002)	0.305*** (0.008)	0.104*** (0.003)	0.066*** (0.006)	0.070*** (0.003)	0.031*** (0.010)
Citi surprise	-0.035*** (0.001)	-0.011*** (0.001)	-0.011*** (0.001)	0.013** (0.005)	-0.022*** (0.003)	0.016*** (0.004)	-0.047*** (0.003)	-0.013** (0.006)
Global controls								
EPU	0.008*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.012*** (0.001)	0.008*** (0.001)	0.004*** (0.001)	-0.004*** (0.001)	0.013*** (0.001)
VIX	-0.013*** (0.001)	-0.010*** (0.001)	0.001 (0.001)	-0.002 (0.002)	-0.006*** (0.001)	-0.007*** (0.001)	0.010*** (0.001)	-0.029*** (0.003)
Advanced QE	n/a	n/a	n/a	n/a	0.020*** (0.005)	0.035*** (0.006)	0.019*** (0.006)	0.090*** (0.013)
Constant	7.889*** (0.018)	3.404*** (0.027)	4.665*** (0.024)	0.754*** (0.067)	8.708*** (0.028)	7.142*** (0.094)	8.115*** (0.031)	9.100*** (0.092)
Observations	105,509	63,867	41,628	13,900	41,642	8,282	16,680	11,120
R-squared	0.450	0.095	0.048	0.421	0.733	0.567	0.793	0.728
#countries	38	23	15	5	15	3	6	4
Country Fixed Effects	YES	YES	YES	YES	YES	YES	YES	YES

Note: Standard errors in parentheses; ***, **, * denotes p<0.01, p<0.05, and p<0.1 respectively.

Table 4: COVID-19 impact on EME capital flows

	(1) Equity flows	(2) Bond flows
COVID-19	-0.001*** (0.000)	-0.004*** (0.000)
Domestic COVID-19 policy responses		
Policy rate * COVID period	0.006*** (0.001)	0.066*** (0.008)
QE	-0.048 (0.038)	0.118 (0.107)
Fiscal	0.066** (0.031)	0.092 (0.126)
CB swap	0.007 (0.088)	n/a
Domestic Controls		
Exchange rate	0.624*** (0.012)	-0.693*** (0.048)
Stock prices	-0.386*** (0.006)	-0.687*** (0.020)
Government bond yield	-0.015*** (0.001)	-0.075*** (0.005)
Policy rate	-0.001 (0.001)	-0.011** (0.004)
Inflation	1.170*** (0.016)	2.954*** (0.058)
Industrial production	0.313*** (0.009)	0.796*** (0.039)
Citi macro surprise	-0.062*** (0.008)	-0.678*** (0.033)
Global controls		
EPU	-0.027*** (0.002)	-0.019*** (0.006)
VIX	-0.089*** (0.003)	-0.197*** (0.012)
Advanced QE	-0.020 (0.014)	-0.012 (0.051)
Constant	5.707*** (0.123)	6.471*** (0.457)
Observations	23,751	13,900
R-squared	0.364	0.655
#countries	23,751	13,900
	9	5
Country Fixed Effects	YES	YES

Note: Standard errors in parentheses; ***, **, * denotes $p < 0.01$, $p < 0.05$, and $p < 0.1$ respectively.

Figure 1: Response of sovereign bond yields to COVID shock

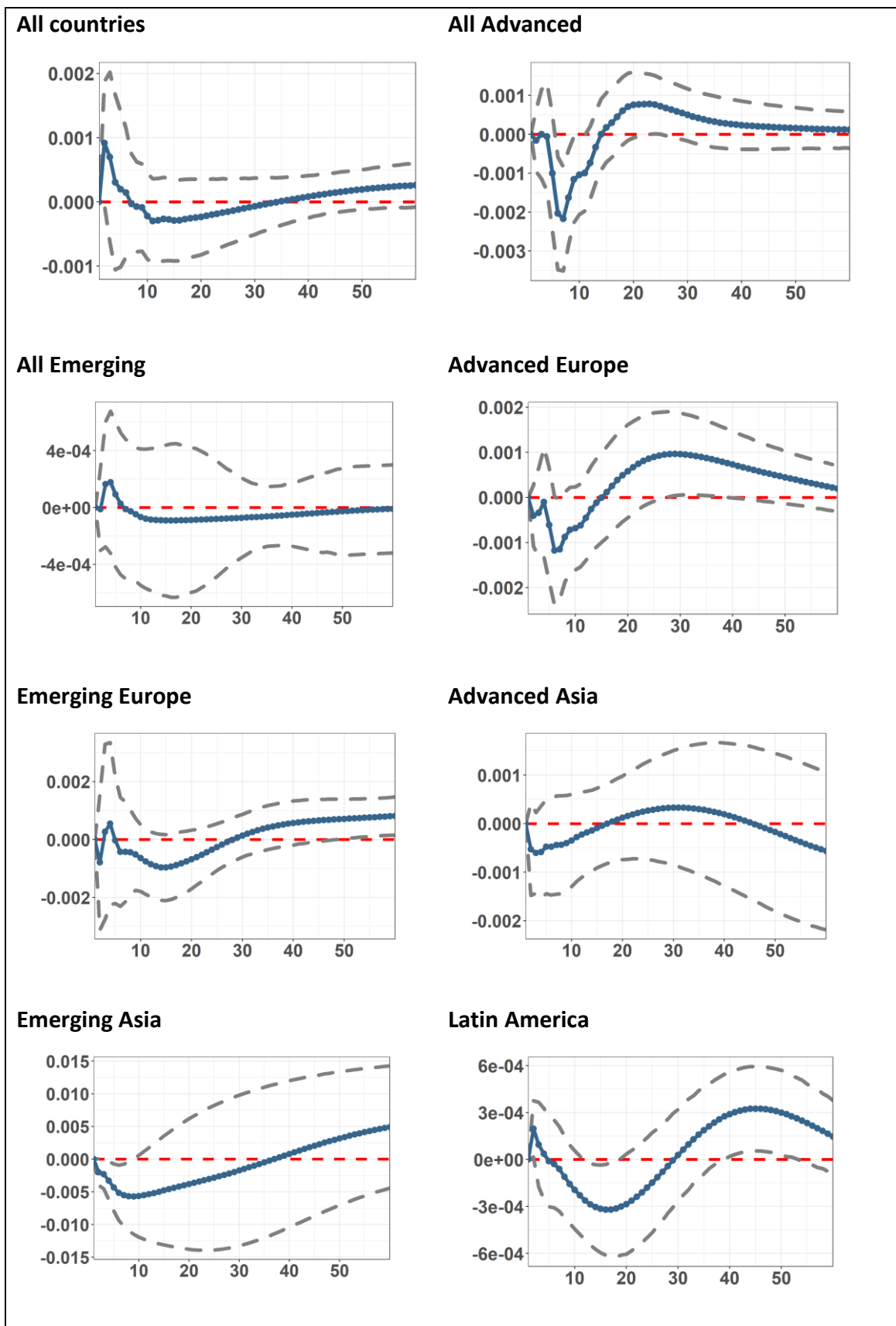


Figure 2: Response of stock prices to COVID shock

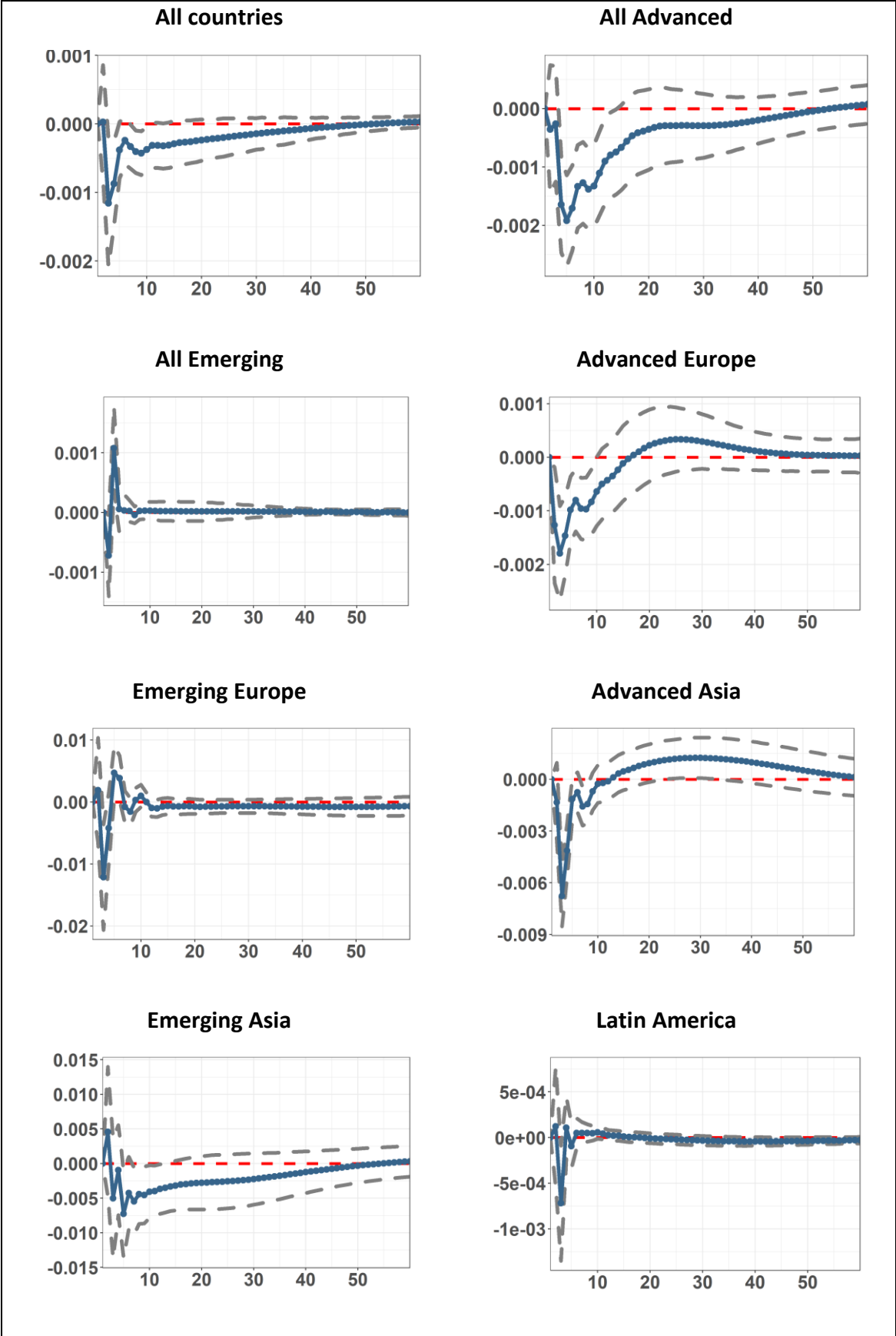


Figure 3: Response of exchange rates to COVID shock

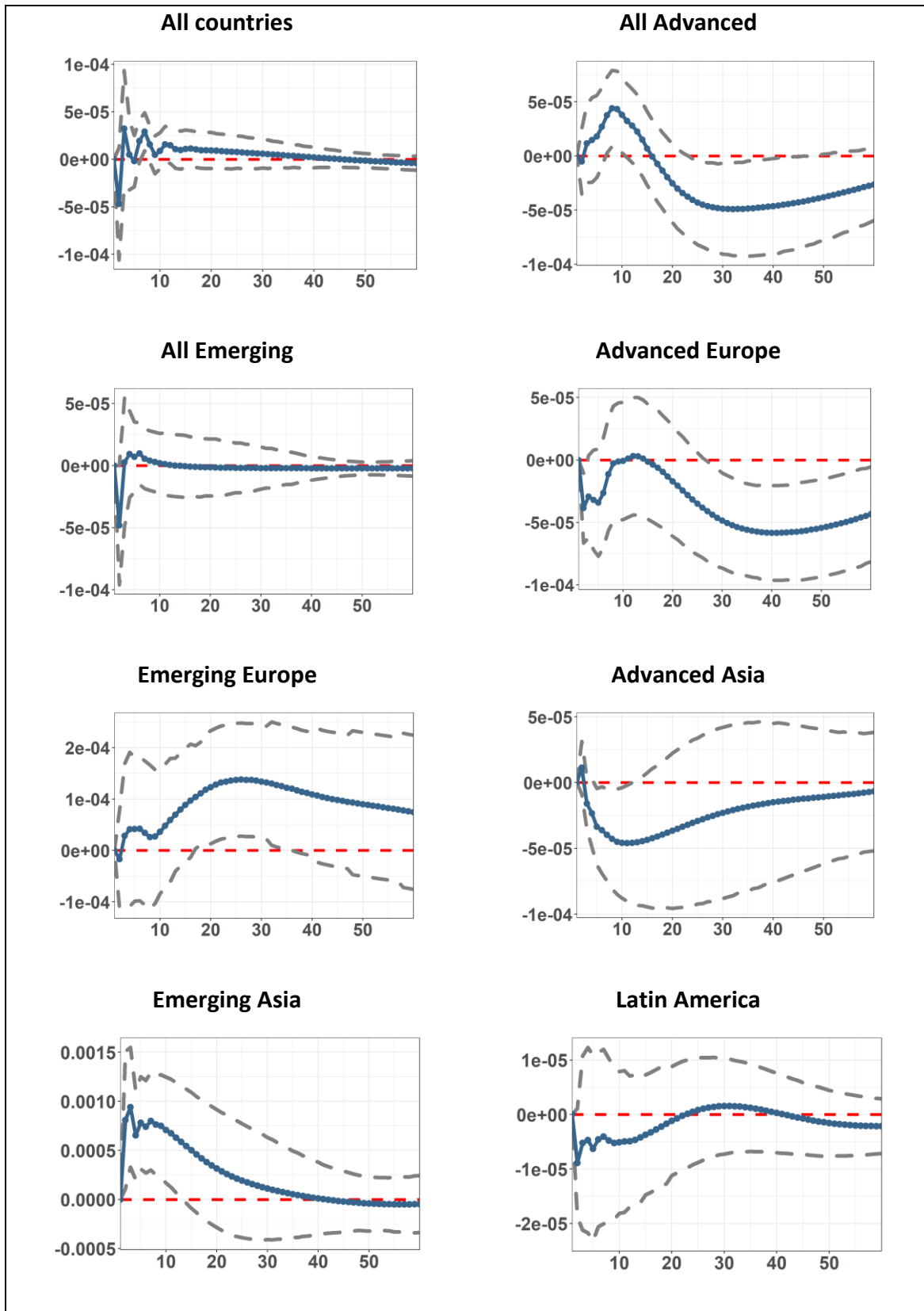
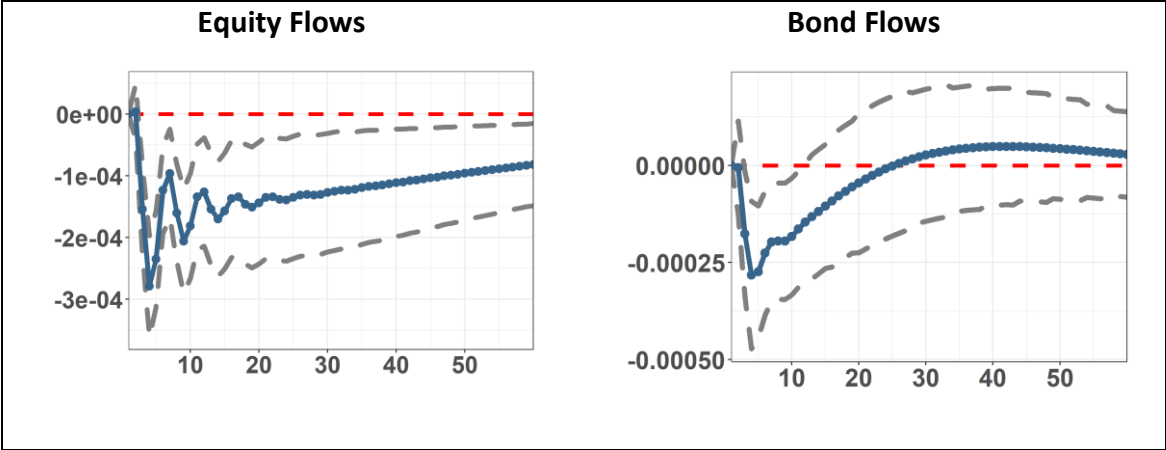


Figure 4: Response of capital flows to COVID shock



Appendix I

Table A1: Country sample

Advanced			Emerging			
<i>Europe</i>	<i>Asia</i>	<i>Other</i>	<i>Europe</i>	<i>Asia</i>	<i>Latin America</i>	<i>Other</i>
Belgium	Japan	Australia	Bulgaria	China	Brazil	South Africa
Denmark	Hong Kong	New Zealand	Hungary	India	Chile	Tunisia
Finland	South Korea	United States	Poland	Indonesia	Colombia	
France	Singapore			Malaysia	Peru	
Germany	Taiwan			Pakistan		
Greece				Philippines		
Ireland						
Italy						
Netherlands						
Portugal						
Spain						
Sweden						
United Kingdom						
Slovakia						
Czech Republic						

Note: The EME country sample for capital flows comprises the following for equity flows - Brazil, China, India, Indonesia, Pakistan, Philippines, South Africa, South Korea, and Taiwan; and the following for bond flows - India, Hungary, Mexico, Poland, and South Africa.

Table A2: Overview of variables used in the empirical analysis

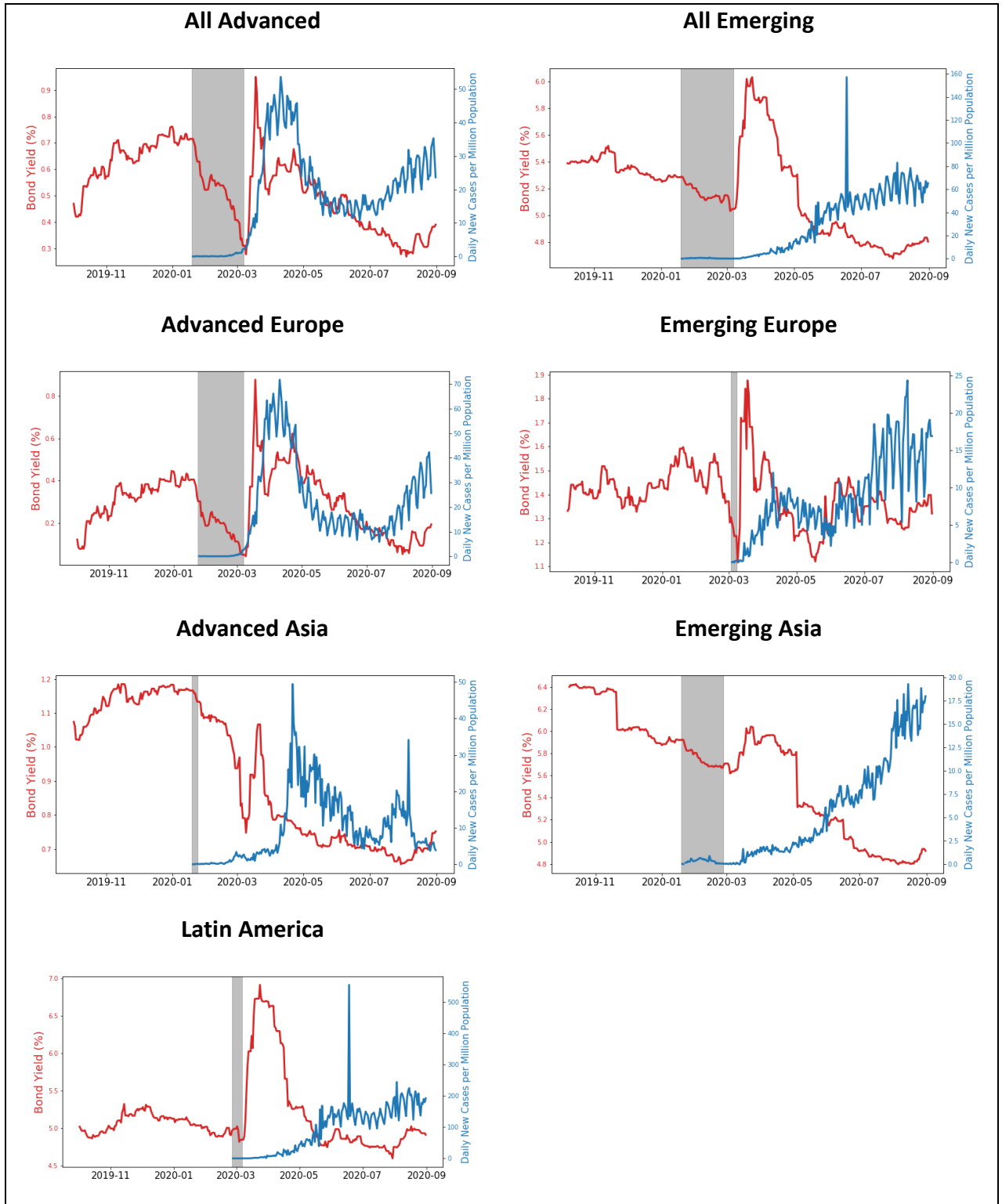
Variable	Data Source		Definition
COVID-19	WHO		The number of daily new confirmed COVID-19 cases per one million population.
10-year government bond yield	Bloomberg		10-year government bond yield.
Stock price	Bloomberg		Stock price index.
Exchange rate	BIS and Bloomberg		Effective exchange rate index.
Policy rate	IMF and CEIC		Central bank policy rate.
QE	National banks	central	Dummy variable defined as 1 for announcement date of quantitative easing measures by central banks in response to COVID-19, and zero otherwise.
Fiscal	IMF		Dummy variable defined as 1 for announcement date of fiscal stimulus measures introduced by national governments in response to COVID-19, and zero otherwise.
CB swap	National banks	central	Dummy variable defined as 1 for announcement date of swap arrangements by central banks in response to COVID-19, and zero otherwise.
CPI	CEIC		Consumer price index (not available for April for some countries).
Industrial production	CEIC and OECD		Industrial production index (not available for latest dates, some only cover until 2019).
EPU index	Economic Uncertainty	Policy	The US daily news-based Economic Policy Uncertainty Index is based on newspaper archives from Access World New's NewsBank service.
Surprise Index	Bloomberg		Citigroup Economic Surprise Indices which are calculated as the normalized deviation of the actual data release from the market consensus prior to the release. For countries for which Surprise Indices are not provided we use the respective regional indices.
VIX	Bloomberg		VIX stands for the Chicago Board Options Exchange (CBOE) Volatility Index, a measure of global risk aversion.
EME equity and bond flow	IIF		Accumulated portfolio equity and bond flows from EMEs.

Table A3: Alternative specification for COVID-19 impact on government bond yields in EMEs

COVID-19	0.011*** (0.001)
Domestic COVID-19 policy responses	
Interest rate	0.444*** (0.013)
QE	-0.399** (0.191)
Fiscal	-0.058 (0.224)
CB swap	n/a
Domestic controls	
Stock prices	-0.635*** (0.037)
Exchange rate	-1.962*** (0.084)
Bond flows	-0.313*** (0.021)
Policy rate	0.711*** (0.005)
Inflation	0.956*** (0.117)
Industrial production	-0.441*** (0.071)
Citi macro surprise	2.285*** (0.057)
Global controls	
EPU	0.049*** (0.011)
VIX	0.283*** (0.021)
Advanced economy QE	0.017 (0.092)
Constant	4.112*** (0.818)
Observations	13,900
#countries	5
R-squared	0.776
Country Fixed Effects	YES

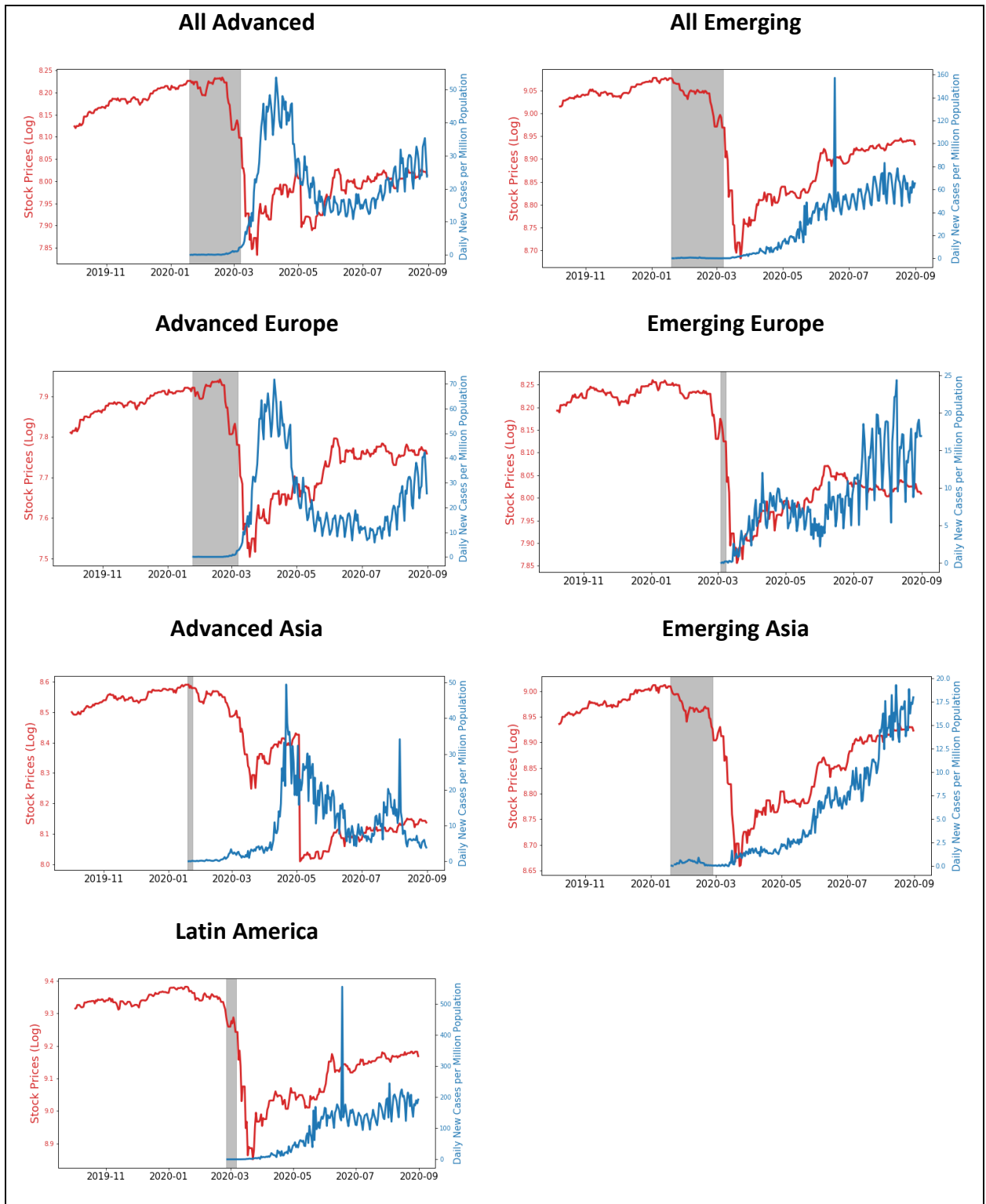
Note: This specification refers to EMEs for which portfolio bond flow data was available. Standard errors in parentheses; ***, **, * denotes $p < 0.01$, $p < 0.05$, and $p < 0.1$ respectively.

Figure A1: Government bond yields (1 October 2019 to 31 August 2020)



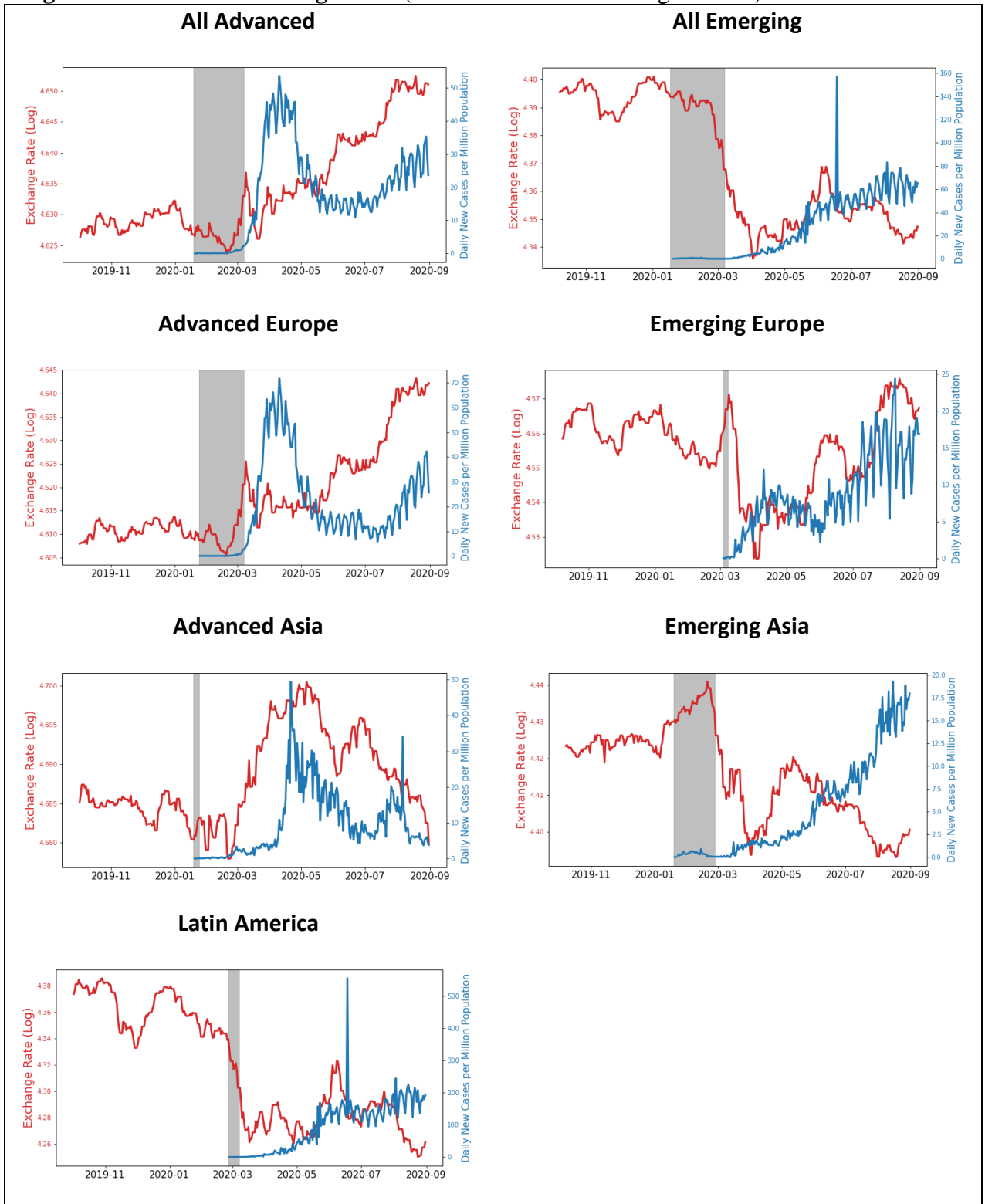
Note: the shaded area denotes the period of the first confirmed COVID-19 case for countries in their respective regions.

Figure A2: Stock price indices (1 October 2019 to 31 August 2020)



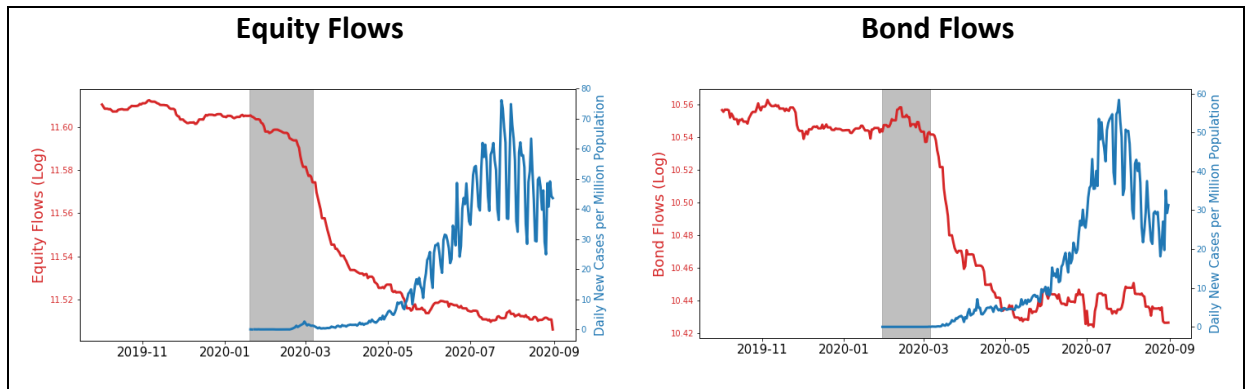
Note: the shaded area denotes the period of the first confirmed COVID-19 case for countries in their respective regions.

Figure A3: Effective exchange rates (1 October 2019 to 31 August 2020)



Note: the shaded area denotes the period of the first confirmed COVID-19 case for countries in their respective regions.

Figure A4: EME capital flows (1 October 2019 to 31 August 2020)



Note: the shaded area denotes the period of the first confirmed COVID-19 case for countries in their respective regions.

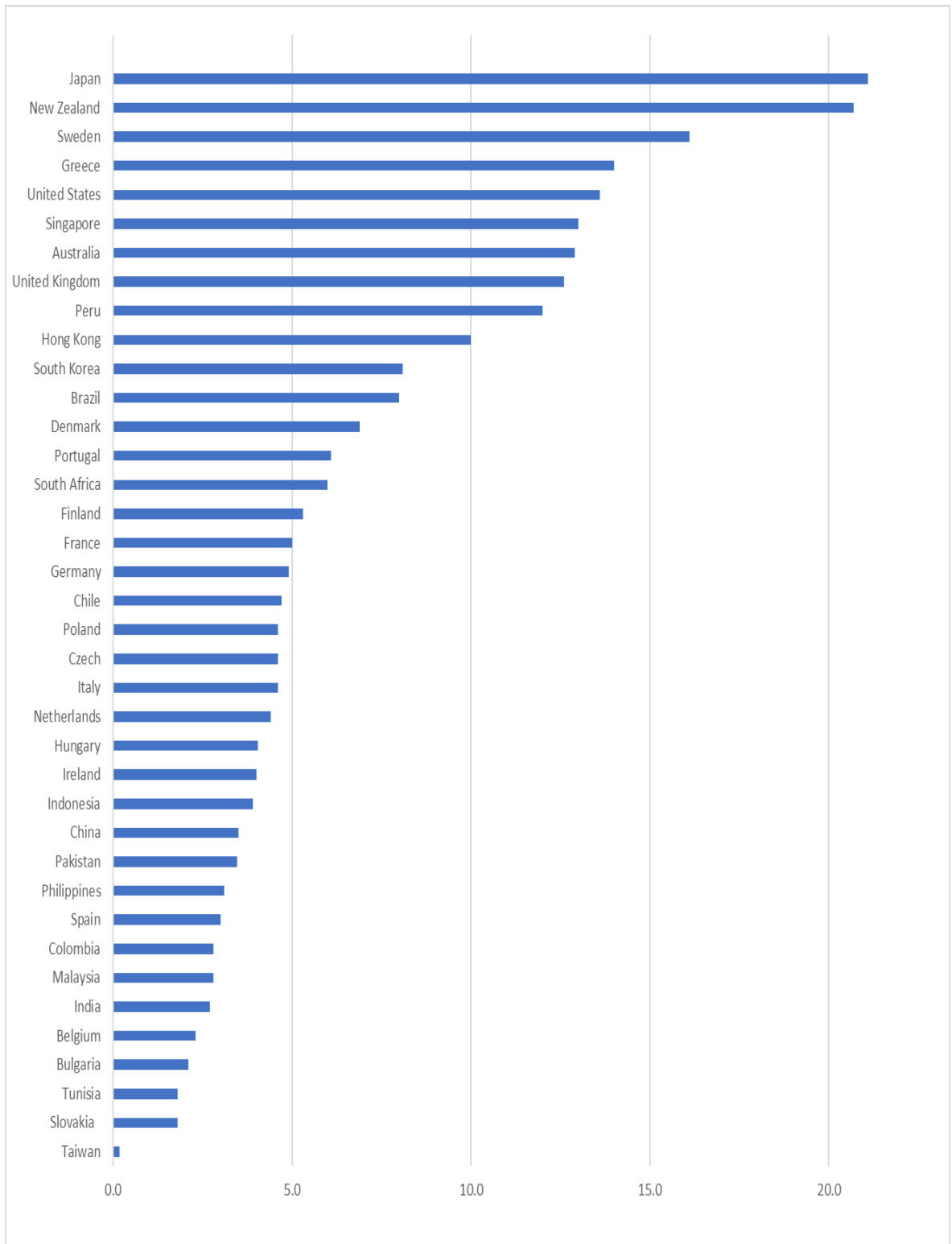
Figure A5: Financial indicators during market turmoil in EMEs



Note: The initial values are set to 100 as baseline index for government bond yields, stock prices, and effective exchange rates; the unit of cumulative capital flows data is one billion US dollars; the horizontal axis refers to the days after the starting date of the market turmoil.

Sources: Authors' calculations with data from Bloomberg, BIS and IIF.

Figure A6: COVID-19 fiscal stimulus measures (total as % of GDP as at end April 2020)



Source: IMF and CSIS

Figure A7: Bond yields vs fitted

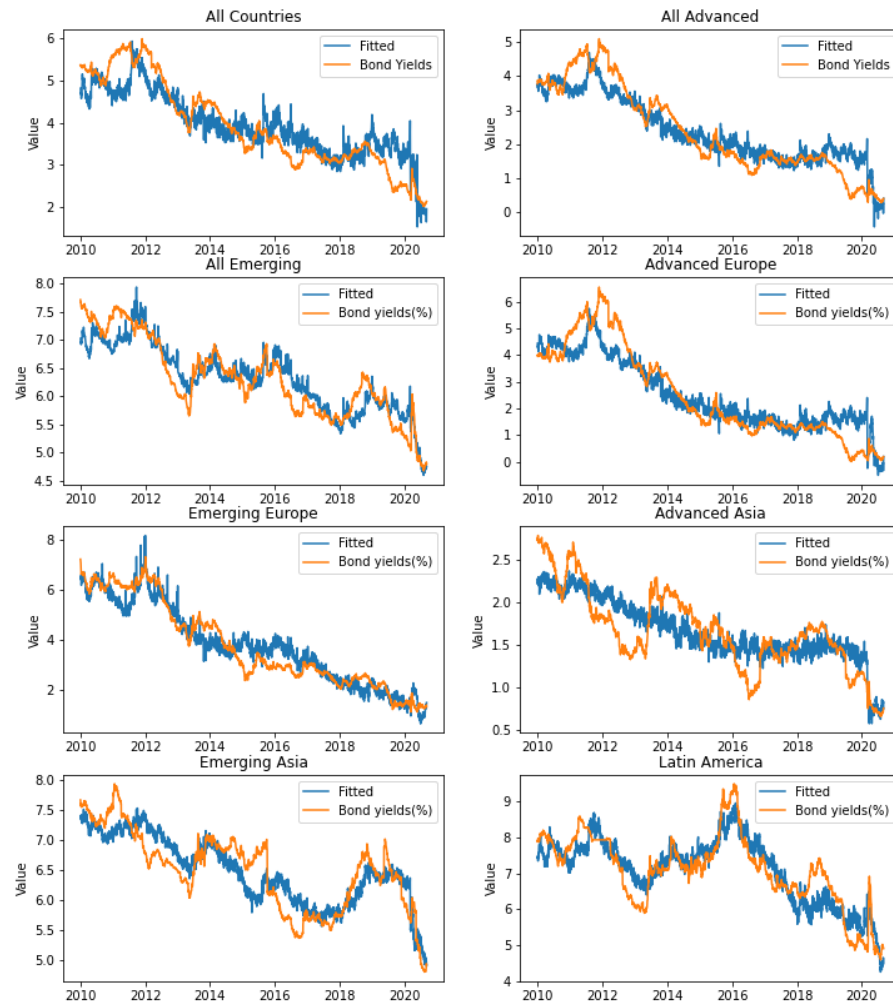


Figure A8: Stock prices vs fitted

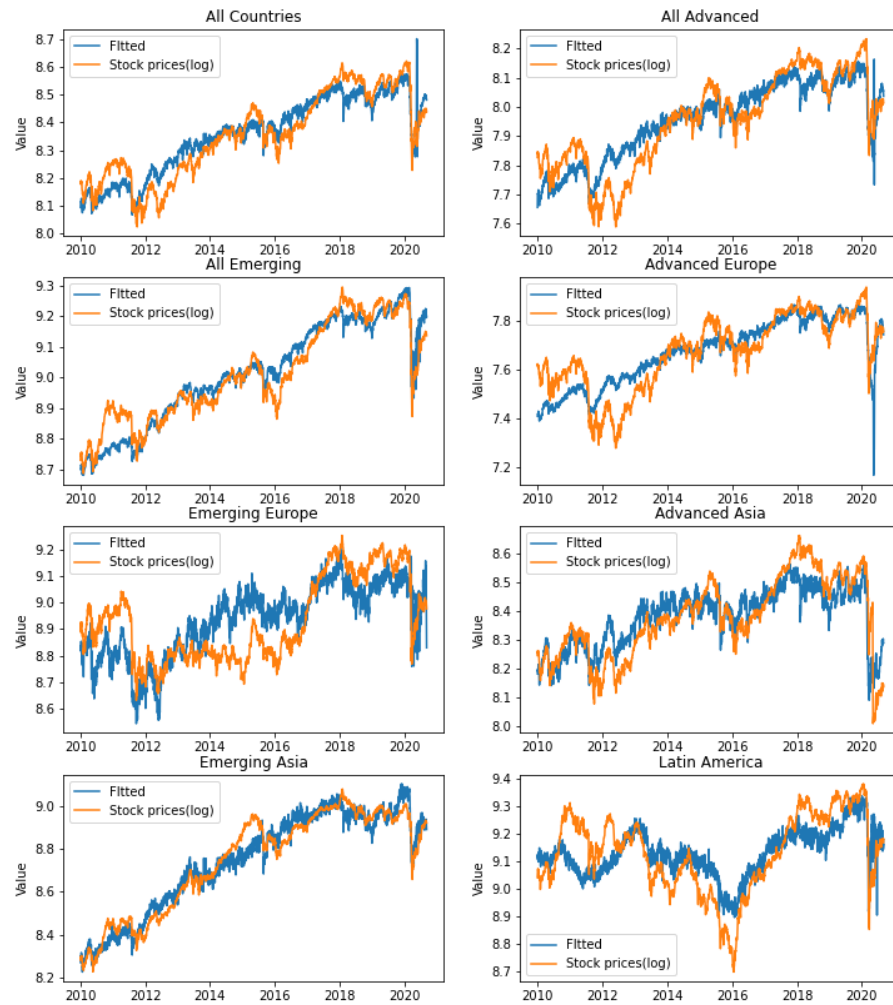


Figure A9: Effective exchange rates vs fitted

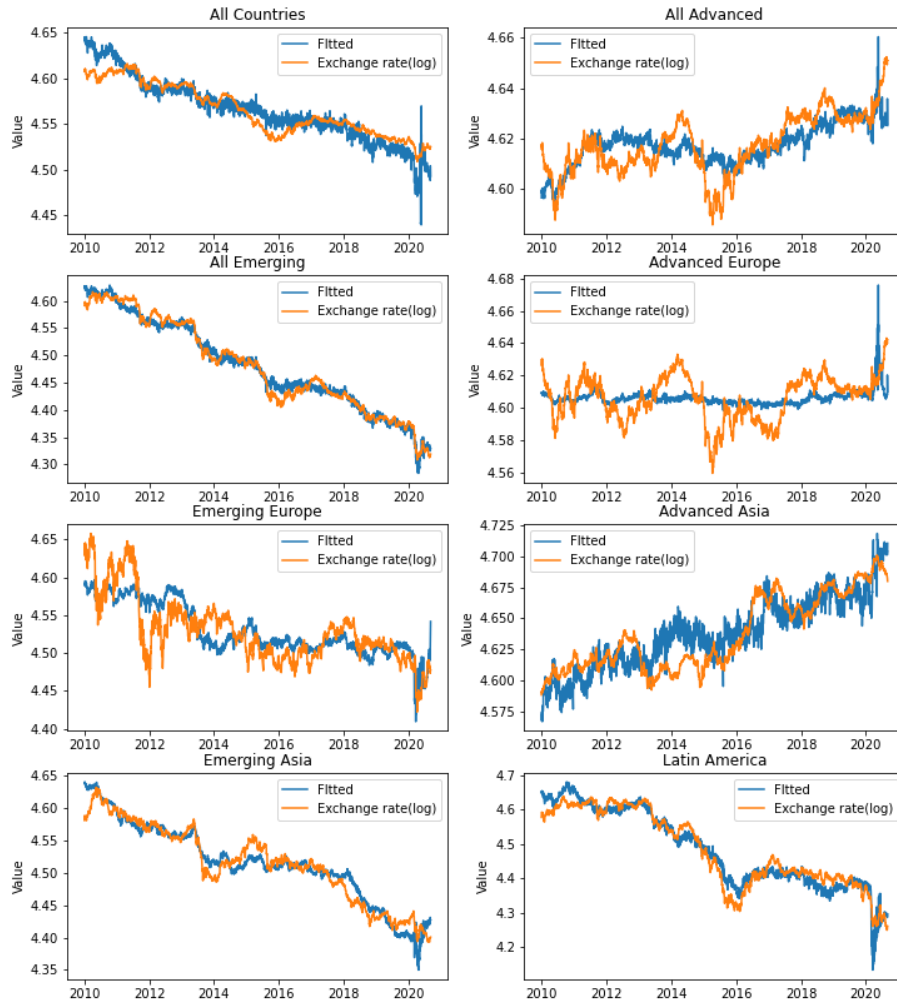


Figure A10: Capital flows vs fitted

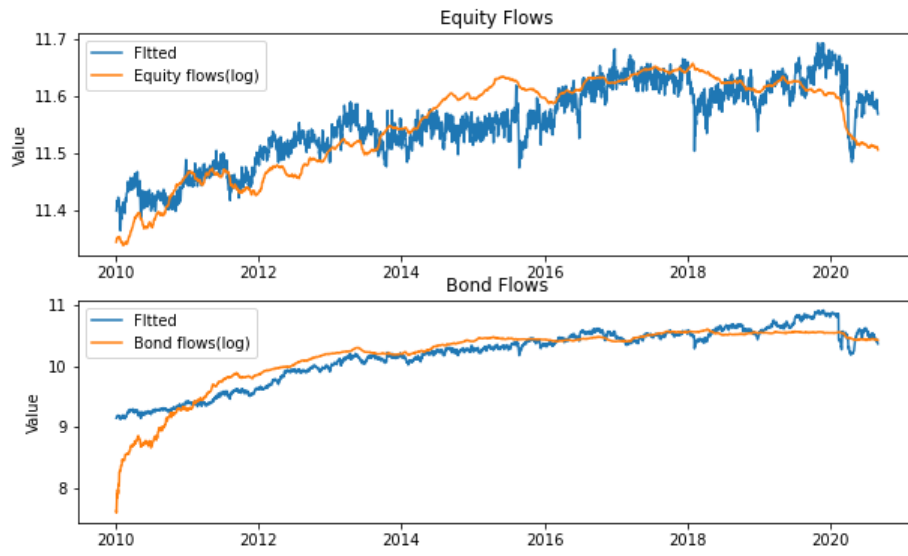


Figure A11: Response of sovereign bond yields to COVID shock

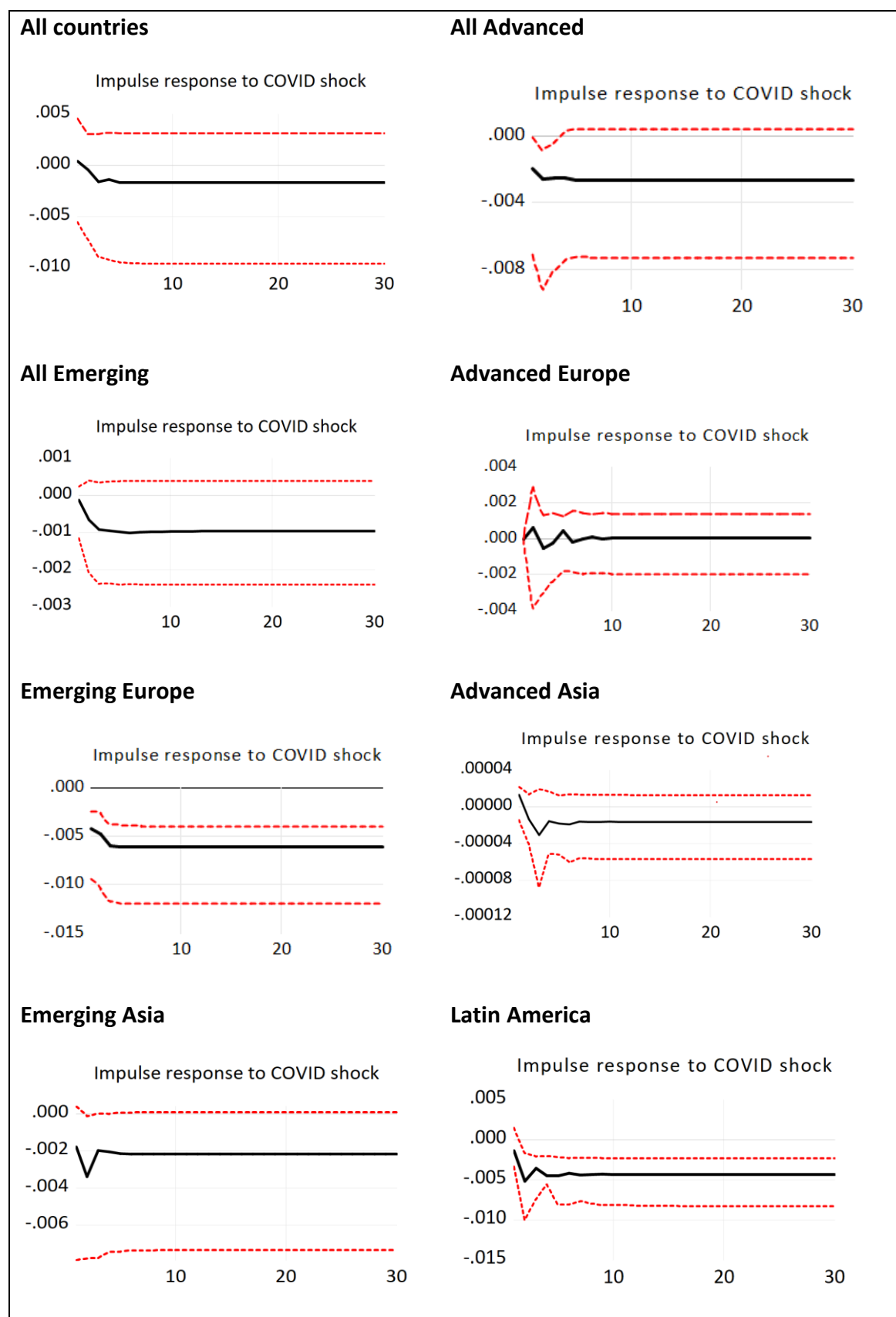


Figure A12: Response of stock prices to COVID shock

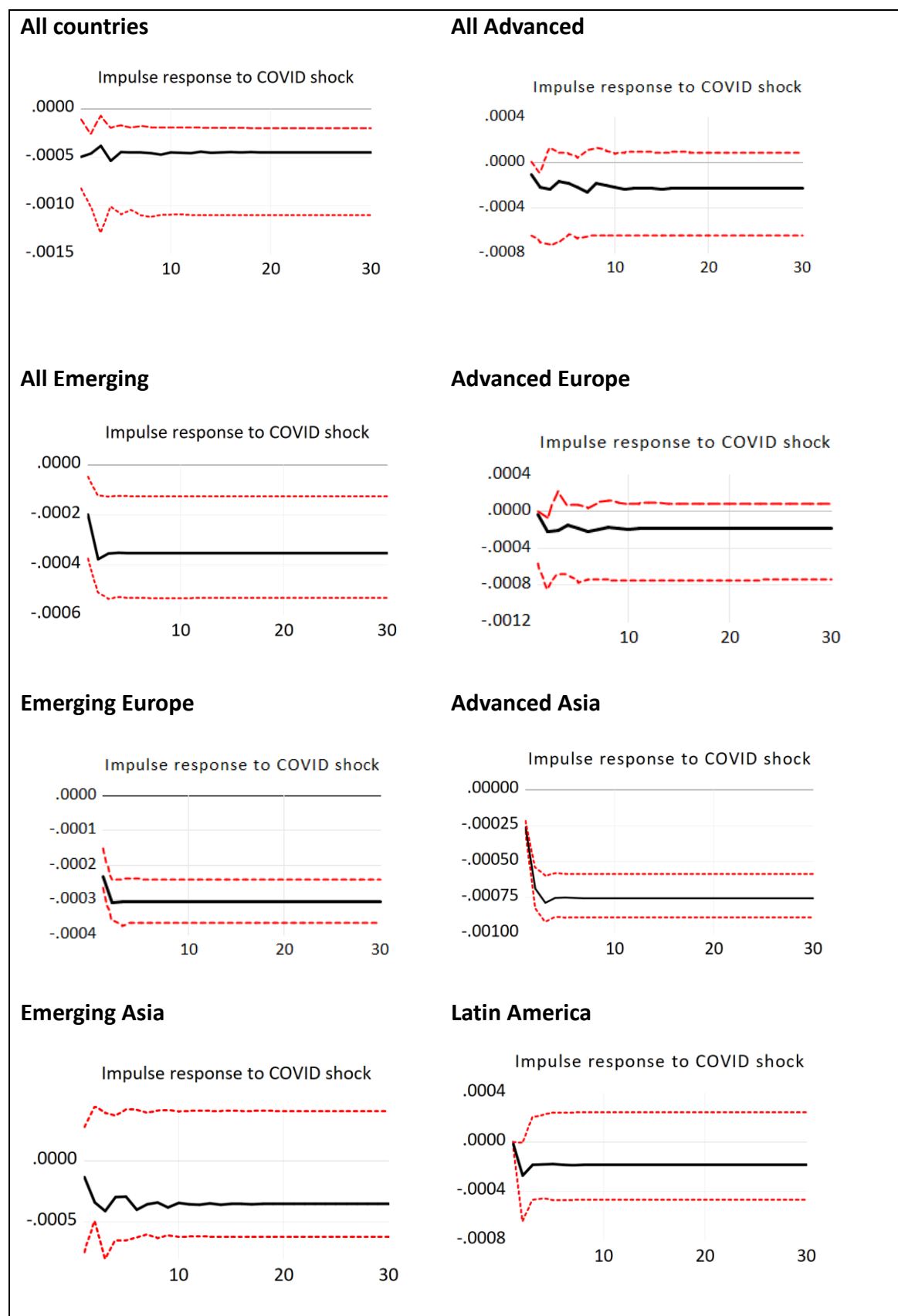


Figure A13: Response of effective exchange rates to COVID shock

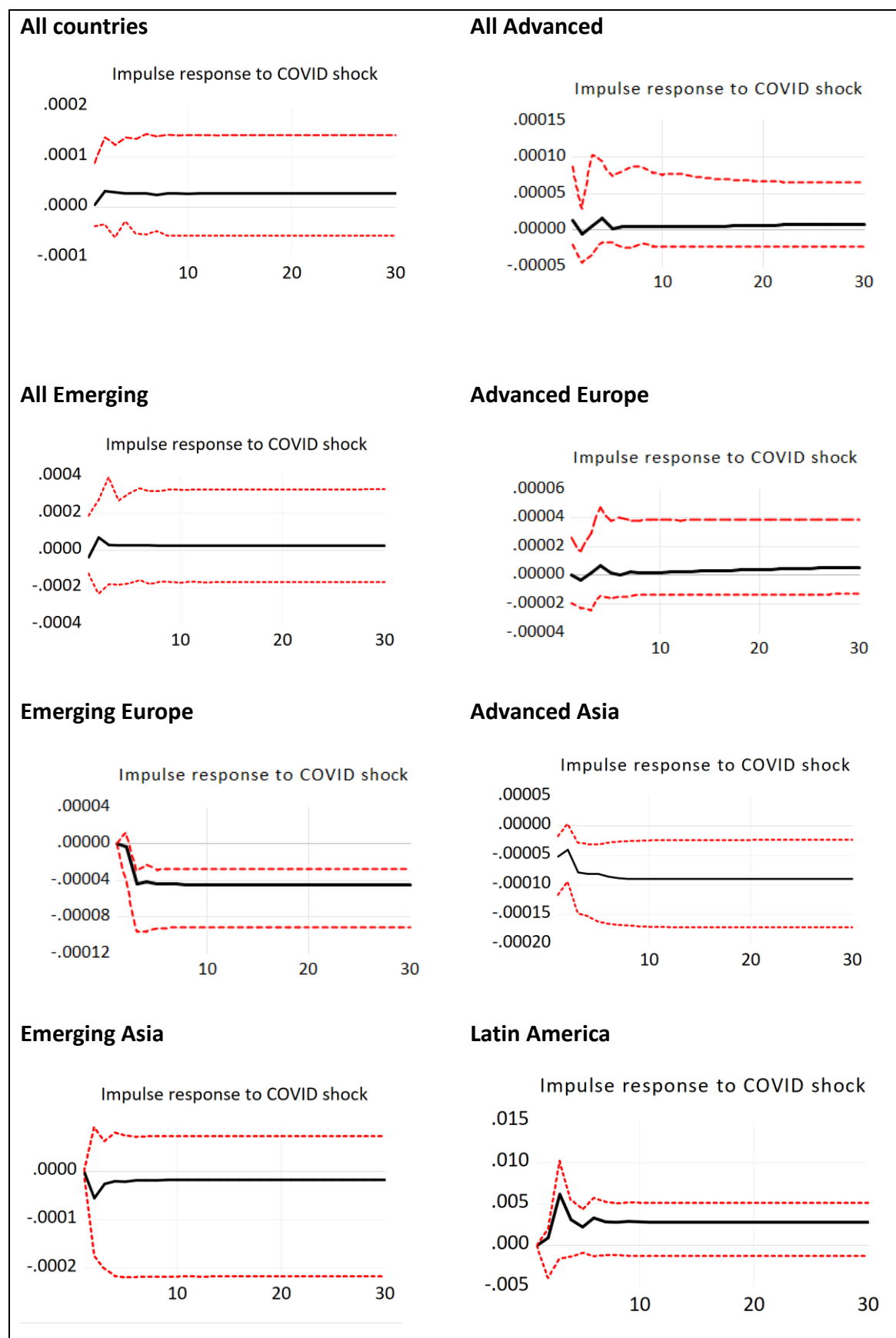
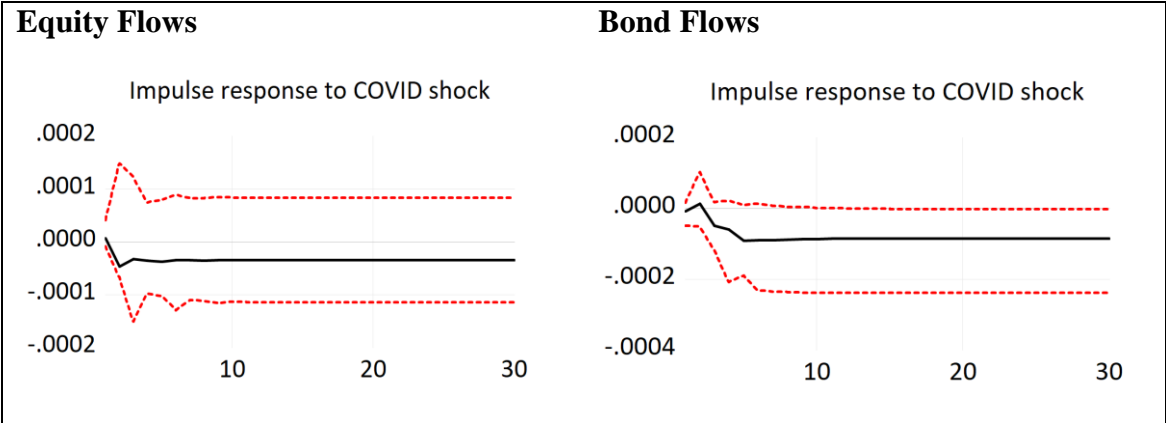


Figure A14: Response of capital flows to COVID shock



Appendix II Key Dates of Countries' Fiscal and QE Responses to COVID-19

Country	Covid-19 First Case	Key Fiscal Policies		Quantitative Easing (QE)	Central Bank Swaps (CBS)
		Date	Measures		
Advanced Asia					
Japan	16 Jan	13 Feb 10 Mar 7 Apr 20 Apr	<ul style="list-style-type: none"> JPY 15.3bn emergency fund JPY 10bn aid for businesses JPY 117.1trn emergency economic package Partial revision to 7 Apr package 	26 Apr 1 May	15 Mar 20 Mar 31 Mar 1 Jul
Hong Kong	22 Jan	21 Feb 8 Apr	<ul style="list-style-type: none"> HKD 30bn anti-epidemic fund HKD 137.5bn stimulus package 	No QE	No CBS
South Korea	20 Jan	17 Mar 22 Apr 30 Apr	<ul style="list-style-type: none"> 1st Supplementary Budget that includes KRW 10.9trn for health spending and support for households and businesses KRW 10.1trn wage subsidies and assistance for unemployed people 2nd Supplementary Budget that includes KRW 14.3trn cash transfers to households 	9 Mar 9 Apr	19 Mar
Singapore	23 Jan	18 Feb 26 Mar 6 Apr	<ul style="list-style-type: none"> 1st Stimulus Package: SGD 6.4bn 2nd Stimulus Package: SGD 17bn 3rd Stimulus Package: SGD 5.1bn 	No QE	19 Mar
Taiwan	21 Jan	25 Feb	TWD 2bn fiscal stimulus package	No QE	No CBS
Emerging Asia					
China	2 Jan	5 Feb 25 Feb 3 Mar 31 Mar	<ul style="list-style-type: none"> VAT exemption, loan subsidies RMB 500bn loans for small businesses Accelerated transfer payments for provincial governments Cash transfers to poor households 	No QE	No CBS
India	30 Jan	26 Mar	Stimulus package amounted 0.8% of GDP	18 Mar 20 Mar 23 Apr	No CBS
Indonesia	2 Mar	25 Feb 13 Mar 31 Mar	<ul style="list-style-type: none"> IDR 10.3trn fiscal stimulus IDR 120trn fiscal stimulus IDR 405.1trn fiscal stimulus in the revised budget 	23 Jan 1 Apr	No CBS
Malaysia	25 Jan	27 Feb 27 Mar 6 Apr	<ul style="list-style-type: none"> 1st Stimulus Package: RM 6bn 2nd Stimulus Package: RM 25bn 3rd Stimulus Package: RM 10bn 	No QE	No CBS
Pakistan	26 Feb	24 Mar	PKR 1.2trn fiscal package	No QE	No CBS
Philippines	30 Jan	16 Mar	PHP 595.6 fiscal package	10 Mar 23 Mar	No CBS
Advanced Europe					
Belgium	4 Feb	6 Mar 20 Mar 22 Mar	EUR 10.2bn fiscal stimulus	18 Mar	15 Mar 20 Mar 15 Apr

		31 Mar			22 Apr 1 Jul 28 Aug
Finland	29 Jan	20 Mar 26 Mar 7 Apr 16 Apr	<ul style="list-style-type: none"> • 1st Supplementary Budget • 2nd Supplementary Budget 	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 July 28 Aug
France	24 Jan	12 Mar 24 Mar 26 Mar 24 Apr 14 May 26 May 10 June	<ul style="list-style-type: none"> • EUR 45bn emergency fund • EUR 110bn stimulus in the budget 	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 Jul 28 Aug
Germany	27 Jan	9 Mar 13 Mar 23 Mar 24 Mar 27 Mar 3 Jun	• EUR 750bn first fiscal package	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 July 28 Aug
Greece	26 Feb-20	30 Mar	EUR 6.8bn fiscal package	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 Jul 28 Aug
Ireland	29 Feb	9 Mar 24 Mar 23 Jul	<ul style="list-style-type: none"> • EUR 3bn fiscal support • Income support scheme 	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 Jul 28 Aug
Italy	30 Jan	17 Mar 8 Apr 19 May	• EUR 25bn emergency package	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 Jul 28 Aug
Netherlands	27 Feb	7 Mar 4 Apr 15 Apr 7 May 20 May	<ul style="list-style-type: none"> • Financial support and tax relief measures for businesses • Additional financial support and tax relief measures for businesses 	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 July 28 Aug
Portugal	2 Mar	3 Mar 19 Mar 26 Mar 6 Apr	Financial support and tax relief measures for businesses	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 Jul 28 Aug
Slovakia	6 Mar	12 Mar	Financial support and tax relief measures for businesses	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 Jul 28 Aug
Spain	31 Jan	10 Mar 12 Mar 17 Mar 31 Mar 2 Apr 16 Jun	<ul style="list-style-type: none"> • EUR 18.2bn exceptional measures • EUR 220bn fiscal package 	18 Mar	15 Mar 20 Mar 15 Apr 22 Apr 1 July 28 Aug
Denmark	27 Feb	15 Mar 18 Apr 15 Jun	DKK 60bn discretionary fiscal support	13 Mar	19 Mar 20 Mar
United Kingdom	31 Jan	11 Mar	GBP 330bn fiscal stimulus	19 Mar	15 Mar

		18 Mar 20 Mar 23 Mar 26 Mar 31 Mar 8 Apr 20 Apr 24 Apr 27 Apr 30 April 4 Jun 30 Jun 8 July			20 Mar 1 July
Czech	1 Mar	12 Mar 9 Jun	CZK 270bn fiscal package	26 Apr	No CBS
Sweden	31 Jan	16 Mar	SEK 300bn fiscal package	16 Mar	19 Mar
Emerging Europe					
Bulgaria	8 Mar	6 Apr	Budget deficit target increased to allow for more spending related to the Covid-19 mitigation	To be launched	22 Apr
Hungary	4 Mar	17 Mar 23 Mar 7 Apr	HUF 9.2trn fiscal stimulus package	24 Mar 7 Apr 28 Apr	No CBS
Poland	4 Mar	18 Mar 21 Mar 31 Mar 8 Apr 30 Apr 24 Jun 21 Jul	<ul style="list-style-type: none"> • PLN 212bn economic stimulus package • Additional PLN 100bn for businesses 	17 Mar 8 Apr	No CBS
Latin America					
Brazil	25 Feb	16 Mar	BRL 150bn fiscal package	7 May	19 Mar
Chile	3 Mar	19 Mar	USD 11.8bn-worth fiscal package	19 Mar 8 Apr	No CBS
Colombia	6 Mar	18 Mar	COP 14.8trn peso fiscal package	23 Mar	No CBS
Peru	6 Mar	29 Mar	PEN 90bn fiscal package	18 Mar	No CBS
Other Emerging					
Tunisia	2 Mar	22 Mar	TND 2.5bn fiscal package	16 Mar	No CBS
South Africa	5 Mar	22 Apr	ZAR 500bn fiscal package	25 Mar	No CBS
Other Advanced					
Australia	25 Jan	1 Apr 4 Jun	AUD 194bn fiscal package \$259 billion	19 Mar	19 Mar
New Zealand	28 Feb	17 Mar	NZD 12.1bn fiscal package	23 Mar	19 Mar
United States	20 Jan	6 Mar 18 Mar 26 Mar 23 Apr	<ul style="list-style-type: none"> • USD 8.3bn emergency spending • USD 484bn economic relief package 	16 Mar 23 Mar 9 Apr 27 Apr 3 Jun 10 Jun	15 Mar 19 Mar 20 Mar • 1 Jul

Source: IMF, BIS, Bruegel, Wikipedia, various online media