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**FINANCIAL MARKET AND CAPITAL FLOW
DYNAMICS DURING THE COVID-19 PANDEMIC**

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The Asian Development Bank refers to "China" as the People's Republic of China.

Abstract

This paper empirically examines the reaction of global financial markets across 38 economies to the COVID-19 outbreak, with a special focus on the dynamics of capital flow across 14 emerging market economies. Using daily data over the period 4 January 2010 to 30 April 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 impact on stocks, bonds, and exchange rates due to COVID-19, as well as abrupt and substantial capital outflows. Our results indicate that fiscal stimulus packages introduced in response to COVID-19, as well as quantitative easing by central banks, have helped to restore overall investor confidence through reducing bond yields and boosting stock prices. 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 in advanced countries, which helped to lower sovereign bond yields and prop up stock markets at home, extended to EMEs, notably in relation to stabilizing capital flow dynamics. 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 some 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

Contents

1. INTRODUCTION

COVID-19 has truly been a 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 insight into the impact of COVID-19 on global financial market and capital flow dynamics. Using a panel regression and panel structural VAR approach with daily data over the period January 2010 to April 2020, 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.

We conduct a comprehensive empirical analysis to contribute to the growing literature on the financial market impact of COVID-19 in three ways. First, our analysis incorporates three asset markets, as well as capital flows, in a consistent econometric set-up. Second, our analysis is applied to 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. 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 in the financial markets that 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 the markets.

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 stocks, bonds, and exchange rates due to COVID-19, as well as abrupt and substantial capital outflows. Fiscal stimulus packages introduced in response to COVID-19, as well as quantitative easing by central banks, helped to restore overall investor confidence through reducing bond yields and boosting stock prices. Our findings underline the role that global factors and developments in the world's leading financial centers have on financial conditions in EMEs. Our results also highlight the major role of central banks in stabilizing financial markets globally during the COVID-19 crisis, through special quantitative easing (QE) measures introduced as well as international central bank swap lines, and interest rate reductions. Importantly, the impact of QE measures by advanced economy central banks also extended to EMEs, notably in relation to stabilizing capital flow dynamics. In addition, QE measures by EME central banks themselves appear to have had significant effects in stabilizing capital flows. 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 some 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 the periods of heightened uncertainty, as well as previous studies on the economic and financial impact 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 related to markets and capital flows.

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 the People's Republic of China (PRC), in line with the traditional response of markets to increase in times of 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 repercussion 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 that occurred since the year 1900, in particular due to the economic ramifications of containment policies. Substantial effects on stock market volatility due to COVID-19 have also been stressed by Zhang et al. (2020). Other papers that focus on the implications of COVID-19 for stock markets include Alfaro et al. (2020) and Landier et al. (2020). Hördahl and Shim (2020) examine the impact of COVID-19 on the relationship between bond portfolio outflows and exchange rates, and between bond outflows and long-term interest rates in 19 EMEs. They find that bond portfolio outflows from EMEs were indeed related to currency depreciations 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. On 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. Related to this, 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).[1]

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. In regard to 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 depreciations and capital outflows. Overall, they find that EMEs with monetary policy

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[1] On international swap lines and the role of the global financial safety net during the COVID-19 crisis, see Gallagher et al. (2020).

frameworks that addressed the feedback loop between exchange rate depreciation and capital outflows had a greater likelihood of mitigating the detrimental impact of COVID-19.

Our paper also contributes 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 are 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 impact of a pandemic is different from those of war, 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 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 observed labor shortages and rising wages. A range of other papers on pandemics tend to examine 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 an 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% prior to the pandemic. The Asian Development Bank (ADB) (2020) estimated that the economic losses of COVID-19 could reach 6.4% of global GDP ($5.8 trillion) under a 3-month containment scenario and 9.7% of global GDP ($8.8 trillion) over 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).

3. DATA AND EMPIRICAL METHODOLOGY

First, using a daily data frequency, we use a fixed-effects panel model over the period from 4 January 2010 to 30 April 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.[2] We consider the following regression in our first stage:

$$y_{i,t}^{j} = \beta COVID19_{i,t} + \gamma x_{i,t-1} + EPU_{t-1} + VIX_{t-1} + \delta_i + \varepsilon_{i,t}, \qquad (1)$$
$$j \in \{Bonds, Stocks, ExchangeRates, EquityFlows, DebtFlows\}$$
$$\#\#\#$$

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

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[2] See Table A1 in Appendix A for the full list of countries by regional sub-group.

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,[3] 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.[4][5] *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. δ_i represents country fixed effects; and $\varepsilon_{i,t}$ is the error term. All the control variables are lagged by one period to mitigate endogeneity concerns.

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:

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

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 et al. 1999), which results in the following matrix A to fit a just-identified model:

$$A = \begin{bmatrix} a_{1,1} & 0 & ... & 0 \\ a_{2,1} & \ddots & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ a_{11,1} & ... & a_{11,10} & a_{11,11} \end{bmatrix} \tag{3}$$

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

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[3]   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, 16 April) and Chile (Flexible Credit Line, 29 May 2020). At the time of writing, South Africa is in negotiations with the IMF.

[4]   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.

[5]   See Table A2 in Appendix A for details of all variables used, including sources. Table B1 in Appendix B provides the dates of the first confirmed cases of COVID-19 for our sample of countries, plus the announcement dates and details of the fiscal and monetary policy measures introduced in response to COVID-19 for our sample period and countries.

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 A). 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 haven 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 the Russian Federation. 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 led to a significant decline in sovereign bond yields in advanced economies. Following this spike, yields generally trended downwards globally. Substantial COVID-19 related fiscal measures were also 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.

In regard to stocks prices, these had started to slump already in February 2020, but then dropped sharply at the global level on Black Monday. Stocks recovered somewhat during April, as containment measures imposed by infected countries began to be relaxed, and liquidity measures by central banks had positive spillover effects on stock markets. On exchange rates and capital flow developments, EMEs as a whole experienced sharp currency depreciations and substantial capital outflows as COVID-19 took hold. This was reflected in 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 number 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 (GCF) (Figure A5). The spike in bond yields after Black Monday was extraordinarily large and steep, but unlike previous episodes of EME turmoil, bond yields returned to their original levels after around a month. Exchange rate devaluation of EMEs was broadly similar to those seen during the GCF, which is also true for stock price changes.

Our panel regression results help to shed more light on the 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.

Table 1: COVID-19 Impact on Sovereign Bond Yields

	Full Sample	Advanced			Emerging			
	(1)	(2) All	(3) Europe	(4) Asia	(5) All	(6) Europe	(7) Asia	(8) Latin
COVID-19	−0.032***	−0.026***	−0.025***	−0.002***	−0.036***	−0.244***	−0.137***	−0.010***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.015)	(0.026)	(0.003)
Domestic controls								
Stock prices	−1.091***	−0.937***	−0.0738	0.0367	−0.582***	−1.536***	−1.696***	−0.336***
	(0.023)	(0.037)	(0.052)	(0.036)	(0.021)	(0.047)	(0.049)	(0.024)
Exch. rate	−0.769***	−3.741***	−6.667***	1.893***	−0.550***	−0.477	−2.403***	−2.465***
	(0.076)	(0.144)	(0.316)	(0.081)	(0.065)	(0.317)	(0.119)	(0.105)
Policy rate	0.716***	1.478***	2.922***	0.585***	0.554***	0.405***	0.382***	0.396***
	(0.005)	(0.014)	(0.026)	(0.007)	(0.003)	(0.011)	(0.007)	(0.004)
QE	−0.058	−0.593***	−0.414***	0.271	0.328	0.299	−0.049	0.375
	(0.198)	(0.173)	(0.017)	(0.339)	(0.274)	(0.549)	(0.148)	(0.397)
Fiscal	−1.085***	−0.757***	−0.713*	−0.0710	−0.452**	−0.0382	−0.280	−0.291
	(0.194)	(0.274)	(0.429)	(0.116)	(0.190)	(0.480)	(0.215)	(0.467)
CB swap	−1.751***	−0.901**	−0.548	0.112	0.156	n/a	n/a	−0.595
	(0.335)	(0.388)	(0.515)	(0.339)	(0.861)			(0.758)
Inflation	−0.491***	−2.839***	0.859**	−7.507***	−0.313***	−11.62***	1.649***	−4.383***
	(0.074)	(0.204)	(0.344)	(0.126)	(0.057)	(0.407)	(0.092)	(0.102)
Ind. prod.	−2.069***	−3.821***	−5.139***	−0.854***	−0.851***	−2.647***	0.0813	−0.621***
	(0.053)	(0.092)	(0.119)	(0.056)	(0.043)	(0.180)	(0.054)	(0.104)
Citi surprise	0.845***	0.527***	0.268***	0.578***	1.640***	1.997***	1.362***	1.375***
	(0.038)	(0.049)	(0.064)	(0.041)	(0.047)	(0.158)	(0.077)	(0.059)
Global controls								
EPU	0.138***	0.150***	0.0465**	−0.124***	−0.0510***	0.257***	−0.136***	−0.296***
	(0.009)	(0.013)	(0.018)	(0.007)	(0.008)	(0.018)	(0.012)	(0.014)
VIX	0.477***	0.161***	−0.015	−0.021	0.547***	0.267***	0.159***	0.679***
	(0.017)	(0.025)	(0.036)	(0.014)	(0.016)	(0.033)	(0.024)	(0.027)
Adv. QE	n/a	n/a	n/a	n/a	−0.266***	−0.588***	−0.170	0.104
					(0.0947)	(0.190)	(0.133)	(0.174)
Constant	20.17***	52.74***	50.81***	28.35***	6.335***	70.97***	13.90***	35.15***
	(0.623)	(1.086)	(2.283)	(0.498)	(0.545)	(2.526)	(0.836)	(1.125)
Observations	100,945	61,939	40,395	13,465	39,006	8,079	14,769	10,772
R-squared	0.306	0.334	0.413	0.509	0.525	0.808	0.435	0.634
# 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***	−0.002***	−0.001***	−0.002***	−0.006***	−0.027***	−0.008**	−0.011***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.003)	(0.004)	(0.001)
Domestic controls								
Sov. yield	−0.020***	−0.011***	−0.001	0.002	−0.035***	−0.077***	−0.043***	−0.054***
	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.002)	(0.001)	(0.004)
Exch. rate	0.473***	−0.094***	0.650***	−1.491***	0.709***	1.833***	0.752***	0.667***
	(0.010)	(0.016)	(0.030)	(0.015)	(0.015)	(0.068)	(0.018)	(0.043)
Policy rate	−0.024***	−0.020***	−0.110***	−0.025***	−0.011***	−0.008***	−0.002*	−0.019***
	(0.001)	(0.002)	(0.003)	(0.002)	(0.001)	(0.003)	(0.001)	(0.002)
QE	0.084***	0.120***	0.204***	0.273***	0.044	0.035	0.058**	0.144
	(0.026)	(0.040)	(0.050)	(0.080)	(0.035)	(0.123)	(0.024)	(0.159)
Fiscal	0.0243	0.0020	0.085**	0.003	0.081*	0.094	0.046	0.073
	(0.026)	(0.029)	(0.041)	(0.027)	(0.046)	(0.108)	(0.034)	(0.187)
CB swap	0.059	0.064	0.153***	0.0513	0.126	n/a	n/a	0.039
	(0.045)	(0.042)	(0.049)	(0.080)	(0.210)			(0.304)
Inflation	1.084***	2.011***	1.853***	2.338***	1.120***	1.062***	1.128***	0.503***
	(0.009)	(0.020)	(0.032)	(0.027)	(0.013)	(0.095)	(0.012)	(0.044)
Ind. prod.	0.504***	0.678***	0.750***	0.223***	0.312***	0.237***	0.287***	−0.155***
	(0.007)	(0.009)	(0.011)	(0.013)	(0.010)	(0.041)	(0.008)	(0.042)
Citi surprise	0.160***	0.181***	0.174***	0.306***	0.150***	1.006***	0.088***	0.059**
	(0.005)	(0.005)	(0.006)	(0.009)	(0.012)	(0.034)	(0.012)	(0.024)
Global controls								
EPU	−0.016***	−0.027***	−0.020***	0.003**	0.002	0.011***	−0.028***	0.027***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)	(0.002	(0.006)
VIX	−0.087***	−0.094***	−0.052***	−0.111***	−0.037***	−0.037***	−0.080***	0.040***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.007)	(0.004)	(0.011)
Adv. QE	n/a	n/a	n/a	n/a	0.157***	0.181***	0.0795***	0.255***
					(0.023)	(0.043)	(0.021)	(0.070)
Constant	−1.663***	−4.644***	−8.026***	1.920***	−1.471***	−11.78***	−1.583***	5.483***
	(0.0833)	(0.117)	(0.216)	(0.130)	(0.133)	(0.578)	(0.134)	(0.468)
Observations	100,945	61,939	40,395	13,465	39,006	8,079	14,769	10,772
R-squared	0.356	0.417	0.410	0.648	0.359	0.486	0.745	0.135
# 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	Advanced			Emerging			
	(1)	(2) All	(3) Europe	(4) Asia	(5) All	(6) Europe	(7) Asia	(8) Latin
COVID-19	0.001***	0.001***	0.000**	−0.001***	0.001***	−0.006***	−0.004**	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.002)	(0.000)
Domestic controls								
Sov. yield	−0.001***	−0.003***	−0.002***	0.020***	−0.003***	−0.001	−0.011***	−0.019***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Exch. rate	0.046***	−0.006***	0.017***	−0.286***	0.073***	0.045***	0.136***	0.033***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Policy rate	0.006***	0.038***	0.018***	−0.024***	0.002***	0.016***	−0.015***	0.004***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
QE	0.047***	0.016	0.019**	−0.121***	0.059***	0.003	0.015	0.025
	(0.008)	(0.011)	(0.008)	(0.035)	(0.011)	(0.019)	(0.010)	(0.036)
Fiscal	0.016*	0.014*	0.018***	−0.028**	−0.009	0.019	0.001	−0.095**
	(0.008)	(0.008)	(0.007)	(0.012)	(0.015)	(0.017)	(0.015)	(0.042)
CB swap	0.029**	0.025**	0.026***	−0.003	−0.197***	n/a	n/a	−0.110
	(0.014)	(0.011)	(0.008)	(0.035)	(0.068)			(0.068)
Inflation	−0.385***	0.325***	0.0157***	1.228***	−0.519***	0.068***	−0.254***	−0.805***
	(0.003)	(0.006)	(0.005)	(0.010)	(0.004)	(0.015)	(0.006)	(0.006)
Ind. prod.	0.069***	−0.035***	−0.036***	0.049***	0.149***	−0.175***	0.036***	0.061***
	(0.002)	(0.003)	(0.002)	(0.006)	(0.003)	(0.006)	(0.004)	(0.009)
Citi surprise	−0.049***	−0.011***	−0.026***	0.079***	−0.018***	0.040***	−0.051***	0.012**
	(0.002)	(0.001)	(0.001)	(0.004)	(0.004)	(0.006)	(0.005)	(0.005)
Global controls								
EPU	0.007***	0.001**	0.001*	0.012***	0.012***	0.005***	−0.002**	0.012***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
VIX	−0.015***	−0.011***	−0.004***	−0.023***	−0.012***	−0.007***	0.014***	−0.057***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Adv. QE	n/a	n/a	n/a	n/a	−0.004	0.021***	−0.008	0.007
					(0.007)	(0.007)	(0.009)	(0.016)
Constant	5.978***	3.388***	4.723***	0.618***	5.758***	4.420***	4.894***	7.887***
	(0.0178)	(0.0276)	(0.0271)	(0.0575)	(0.0313)	(0.0784)	(0.0409)	(0.0721)
Observations	100,945	61,939	40,395	13,465	39,006	8,079	14,769	10,772
R-squared	0.164	0.185	0.065	0.607	0.375	0.600	0.372	0.668
#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	−0.009***	−0.012***
	(0.002)	(0.001)
Domestic Controls		
Exchange rate	0.492***	−0.344***
	(0.013)	(0.044)
Stock prices	−0.413***	−0.681***
	(0.007)	(0.020)
Government bond yield	−0.033***	−0.055***
	(0.001)	(0.005)
Policy rate	−0.001*	−0.027***
	(0.001)	(0.004)
QE	0.142***	0.155**
	(0.022)	(0.063)
Fiscal	0.091***	−0.044
	(0.030)	(0.130)
CB swap	0.0122	n/a
	(0.087)	
Inflation	0.967***	3.354***
	(0.012)	(0.042)
Industrial production	0.293***	0.702***
	(0.008)	(0.040)
Citi macro surprise	−0.034***	−1.430***
	(0.009)	(0.043)
Global controls		
EPU	−0.024***	−0.008
	(0.002)	(0.006)
VIX	−0.069***	−0.248***
	(0.003)	(0.011)
Advanced QE	0.023***	0.266***
	(0.007)	(0.066)
Constant	7.865***	8.116***
	(0.098)	(0.371)
Observations	21,579	13,442
R-squared	0.396	0.676
#countries	9	5
Country Fixed Effects	Yes	Yes

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

In terms of the magnitude 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 control for a vast number of domestic and global factors, the coefficient signs of which (where significant) are largely in alignment with priors.[6]

On sovereign bond yields, Table 1 shows that COVID-19 has had a significant dampening effect across all advanced and emerging economies. The results in column (1) indicate that for every additional new confirmed case of COVID-19 per million of the population, bond yields have declined across our global sample of 38 economies by around 0.03 percentage points.[7] This effect on yields also applies to the advanced economy sub-groups in our sample. However, the largest effect on yields can be seen in EMEs. In particular, 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.[8] This finding 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 policies in most places, with slashes in interest rates and new rounds of QE policies in all major advanced economies. As can be seen from the regression results, these measures, as well as central bank swap line announcements, were highly effective in bringing down sovereign bond yields in advanced economies. Indeed, the QE measures by advanced economy central banks also exhibited significant positive spillover effects to EMEs, lowering EME bond yields. Fiscal stimulus packages announced by national governments also helped to lower bond yields globally, both in advanced economies and EMEs. Interestingly, 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. 2020). 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.

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

[7] 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.

[8] See Table A3 in Appendix A 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.

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. Table 2 shows a strong impact of expansionary monetary policies (both through QE, swap arrangements, and interest rate reductions), on propping up stock markets. As in the case of the sovereign bond market, we find significant positive spillover effects of advanced economy COVID-19 related QE to 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. The controls are also in accordance with priors, e.g., a positive relationship with inflation and industrial production and a 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 is not as large overall when compared to the effects on stock and bond markets. QE and swap announcements by central banks in advanced and emerging economies overall appear to have been effective in supporting exchange rates, while the effect of fiscal stimulus packages on exchange rates is largely confined to advanced economies.

In regard to EME capital flows, Table 4 indicates that COVID-19 has led to significant outflows of both equities and bonds, reflecting investors' flights to safety. It is noteworthy that the QE measures announced by EMEs central banks has a significant effects on averting capital outflows, while positive QE spillovers are 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.

Turning to the impulse responses from our panel structural VAR models (Figures A11 to A14 in Appendix A), 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. 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. Moreover, these impulse responses also control for the same full set of domestic and global factors. In addition, the duration at which the shocks become permanent on markets and capital flows lies somewhere in the range of 5 to 10 days. Finally, and also in line with the panel analysis, these permanent effects 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. 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.

Our results provide evidence that fiscal stimulus packages introduced by governments, along with comprehensive stabilization measures taken by central banks, have helped to alleviate the extent of the negative effects of COVID-19 on financial market and capital flow dynamics. In particular, our findings highlight the major role of central banks in stabilizing financial markets globally during the COVID-19 crisis, through interest rate reductions, QE, and international swap lines. Importantly, the impact of expansionary monetary policy in advanced countries, which helped to lower sovereign bond yields and prop up stock markets at home, extended also to EMEs, notably in relation to stabilizing capital flow dynamics. This, as well as the impact of global factors such as EPU and VIX, underlines the interconnectedness of the global financial system, and the impact that developments in the world's leading financial centers have on the financial conditions of EMEs.[9]

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 on quantitative easing for the first time. Our results would suggest that these monetary policy measures have been effective in the case of Asian EMEs, supporting stock prices. Importantly, these measures also helped to stabilize capital flows.

Moreover, given the scale of bond and equity capital outflows from EMEs, 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.

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[9] These findings are in line with previous research investigating the role of global factors on capital flows to EMEs (e.g., Belke and Volz 2019).

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APPENDIX A

Table A1: Sample of Economies

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

Note: The EME economy sample for capital flows comprises the following for equity flows – Brazil, the People's Republic of China, India, Indonesia, Pakistan, the Philippines, South Africa, the Republic of Korea, and Taipei,China; 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 central banks	Dummy variable defined as 1 for announcement date of quantitative easing measures introduced 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 central banks	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 Policy Uncertainty	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	−0.075***
	(0.015)
Domestic controls	
Stock prices	−0.674***
	(0.039)
Exchange rate	−0.807***
	(0.082)
Bond flows	−0.223***
	(0.022)
Policy rate	0.759***
	(0.006)
QE	0.156
	(0.118)
Fiscal	−0.201
	(0.241)
Inflation	2.616***
	(0.100)
Industrial production	−0.696***
	(0.076)
Citi macro surprise	2.959***
	(0.079)
Global controls	
EPU	−0.013
	(0.011)
VIX	0.378***
	(0.021)
Advanced QE	−0.407***
	(0.122)
Constant	−10.68***
	(0.691)
Observations	13,442
#countries	5
R-squared	0.760
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 and COVID-19
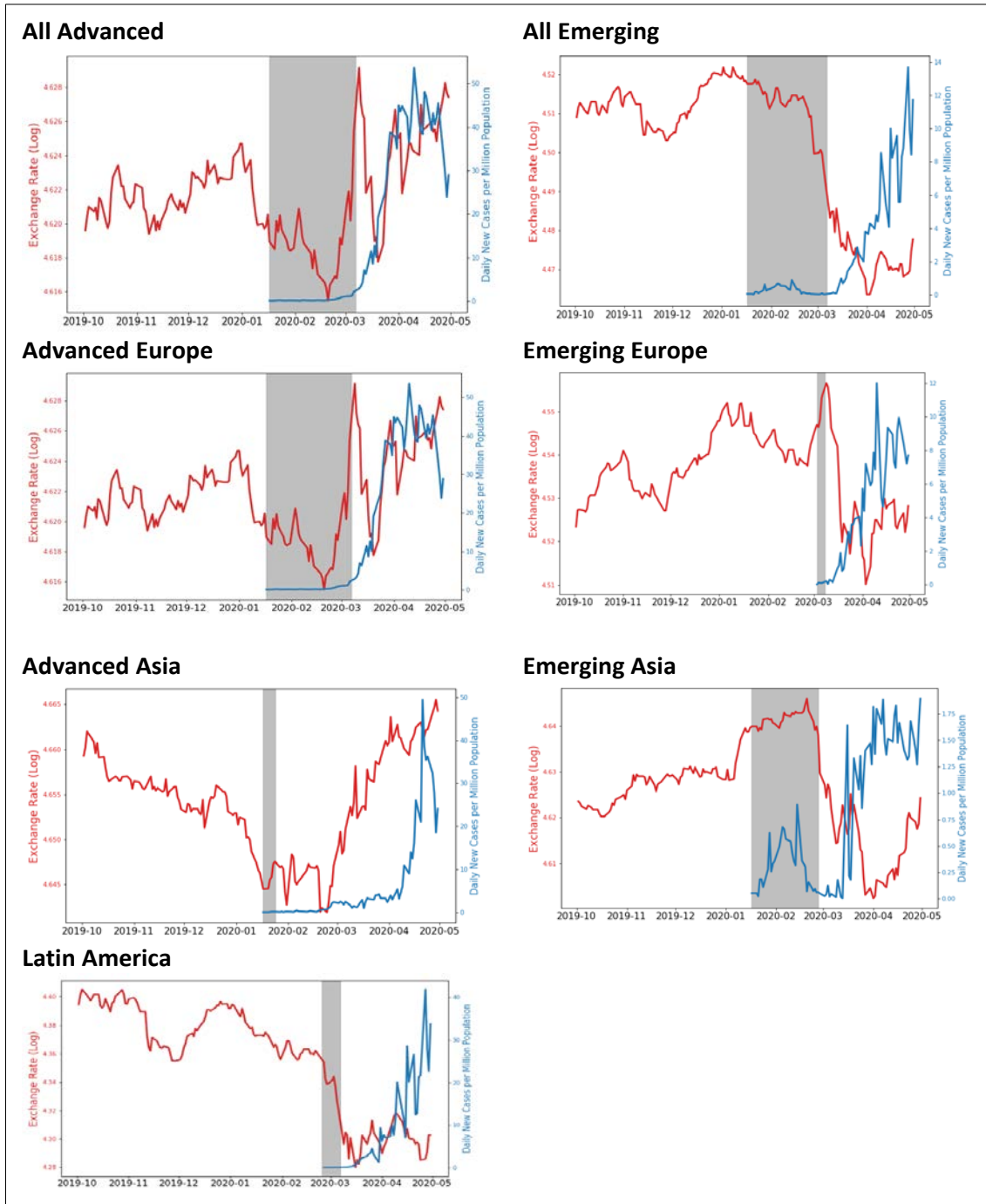(1 October 2019 to 30 April 2020)
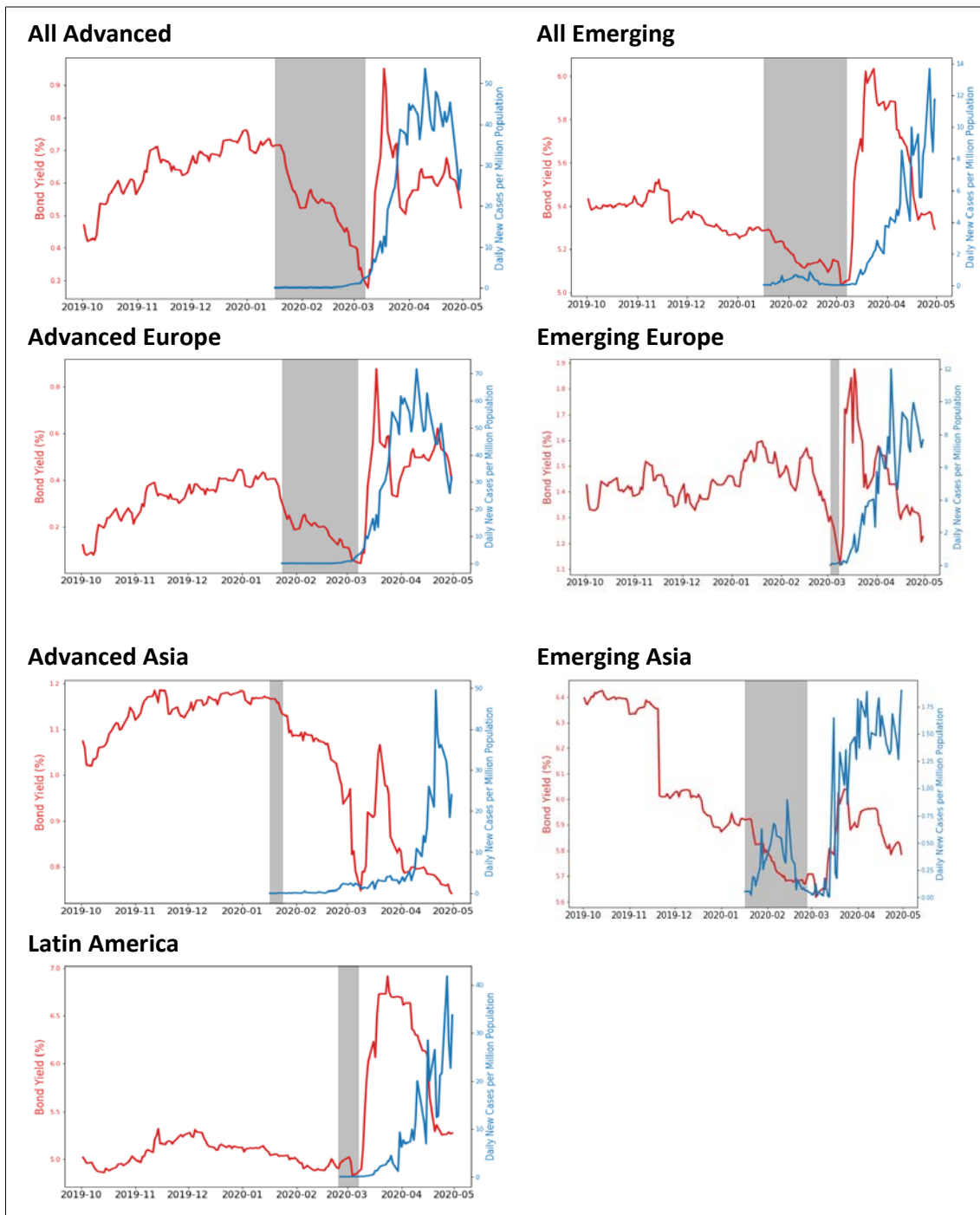
Note: the shaded area denotes the period of the first confirmed COVID-19 case for countries in their respective regions.

Figure A2: Stock Price Indices and COVID-19
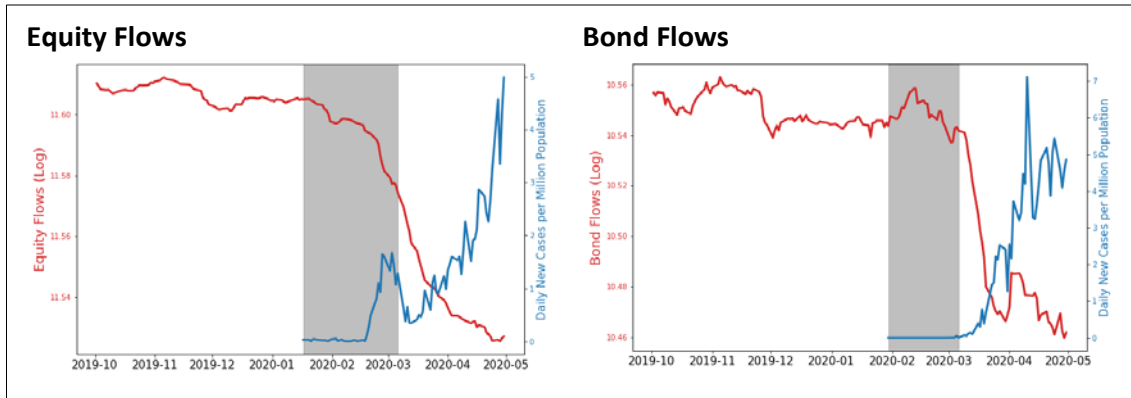(1 October 2019 to 30 April 2020)
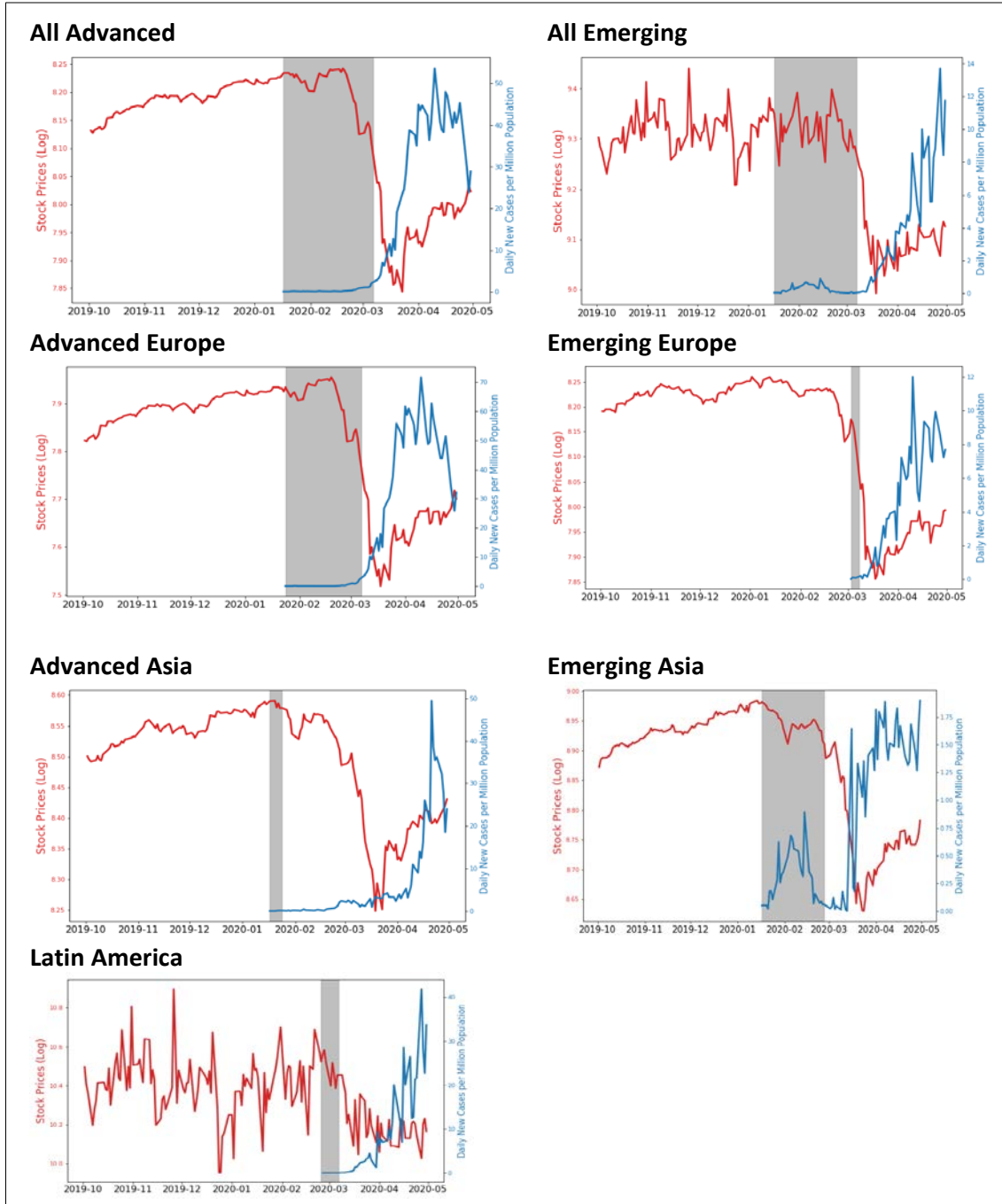
Note: the shaded area denotes the period of the first confirmed COVID-19 case for countries in their respective regions.

Figure A3: Effective Exchange Rates and COVID-19
(1 October 2019 to 30 April 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 and COVID-19
(1 October 2019 to 30 April 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
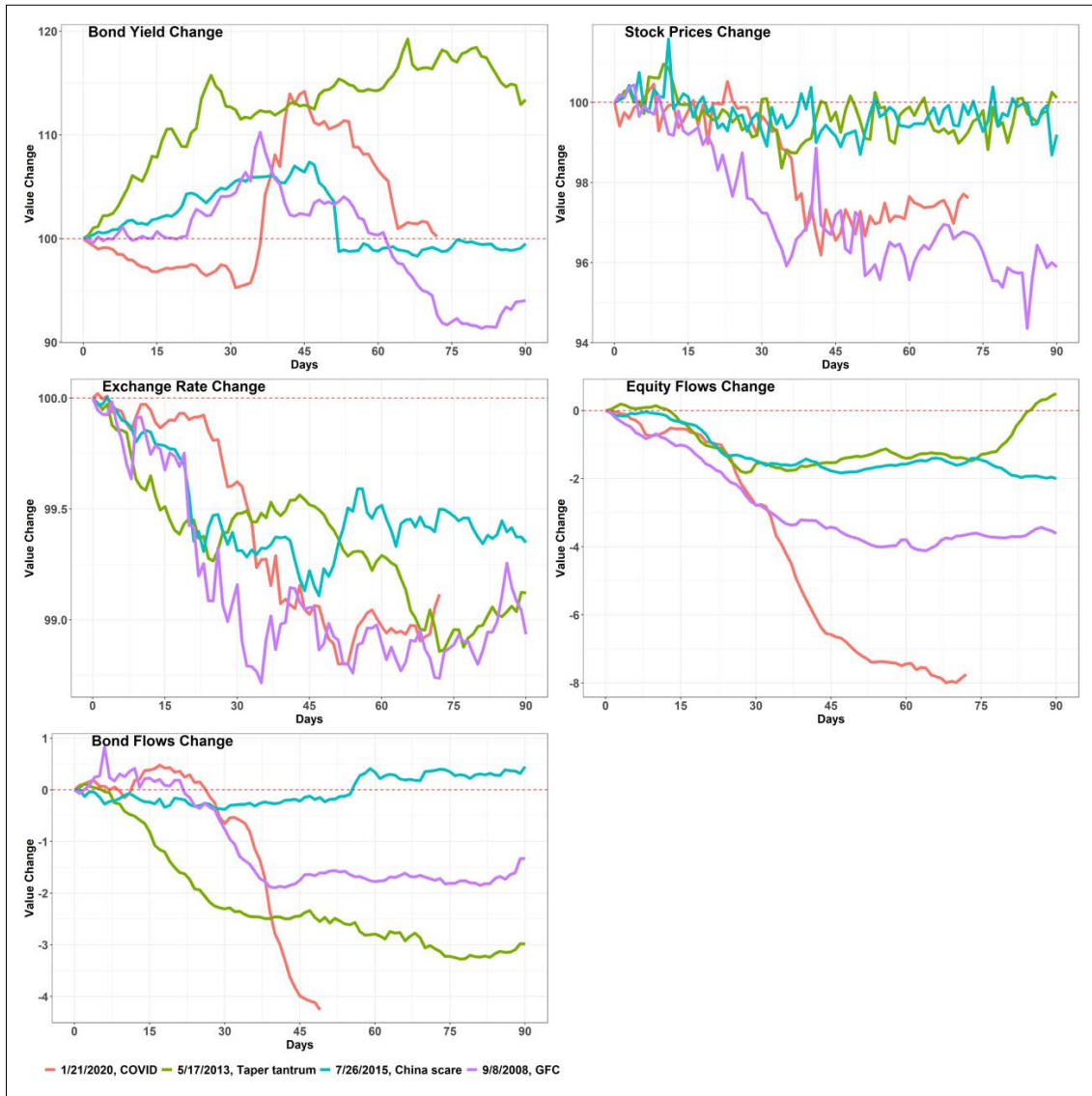
Note: The initial values are set to 100 as baseline index for government bond yields, stock prices, and effective exchange rates; the unit of cumulative capital flows data is one billion US dollars; the horizontal axis refers to the days after the starting date of the market turmoil.
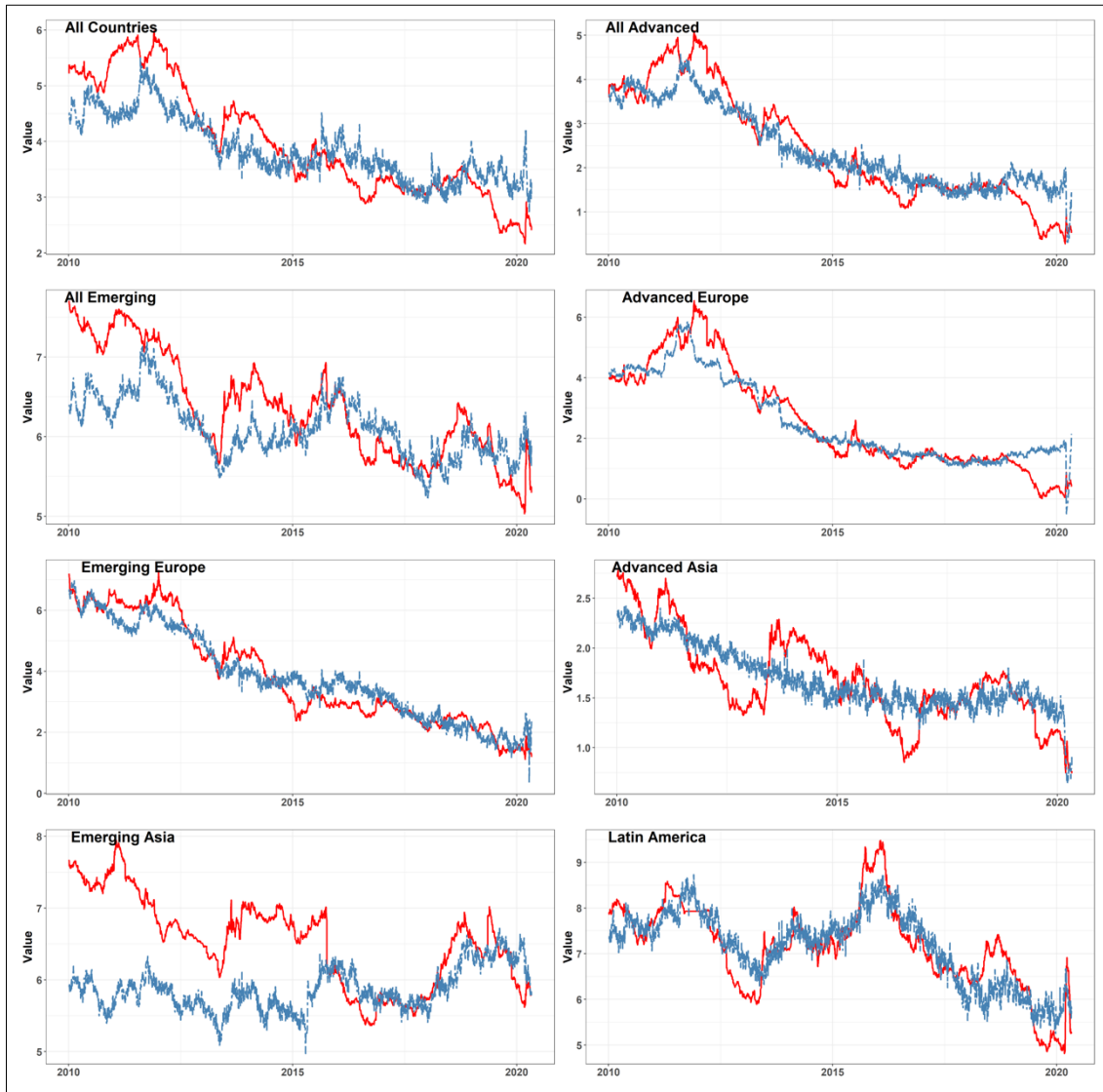
Sources: Authors' calculations with data from Bloomberg, BIS and IIF.

Figure A6: COVID-19 Fiscal Stimulus Measures
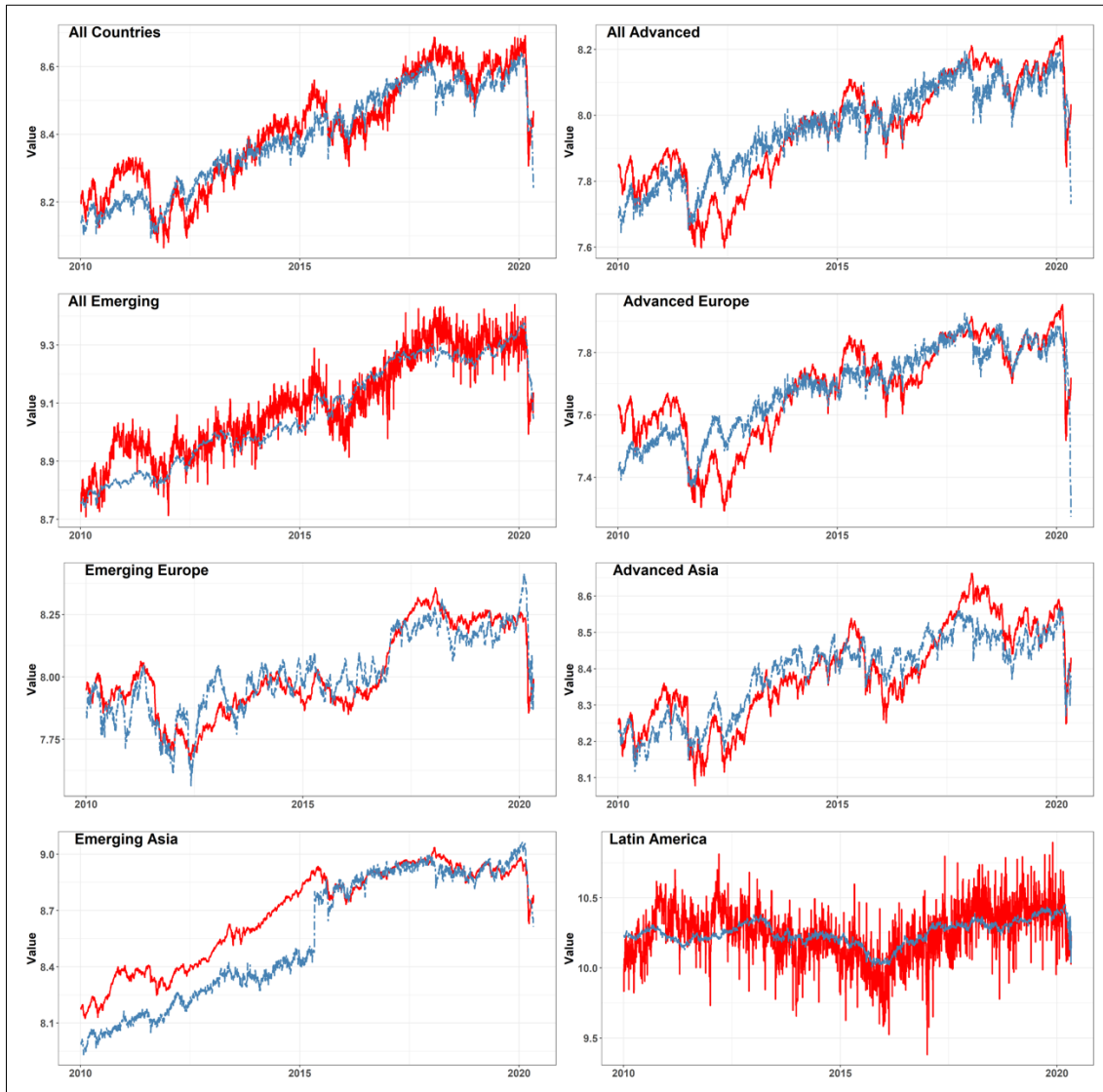(total as % of GDP as at end April 2020)
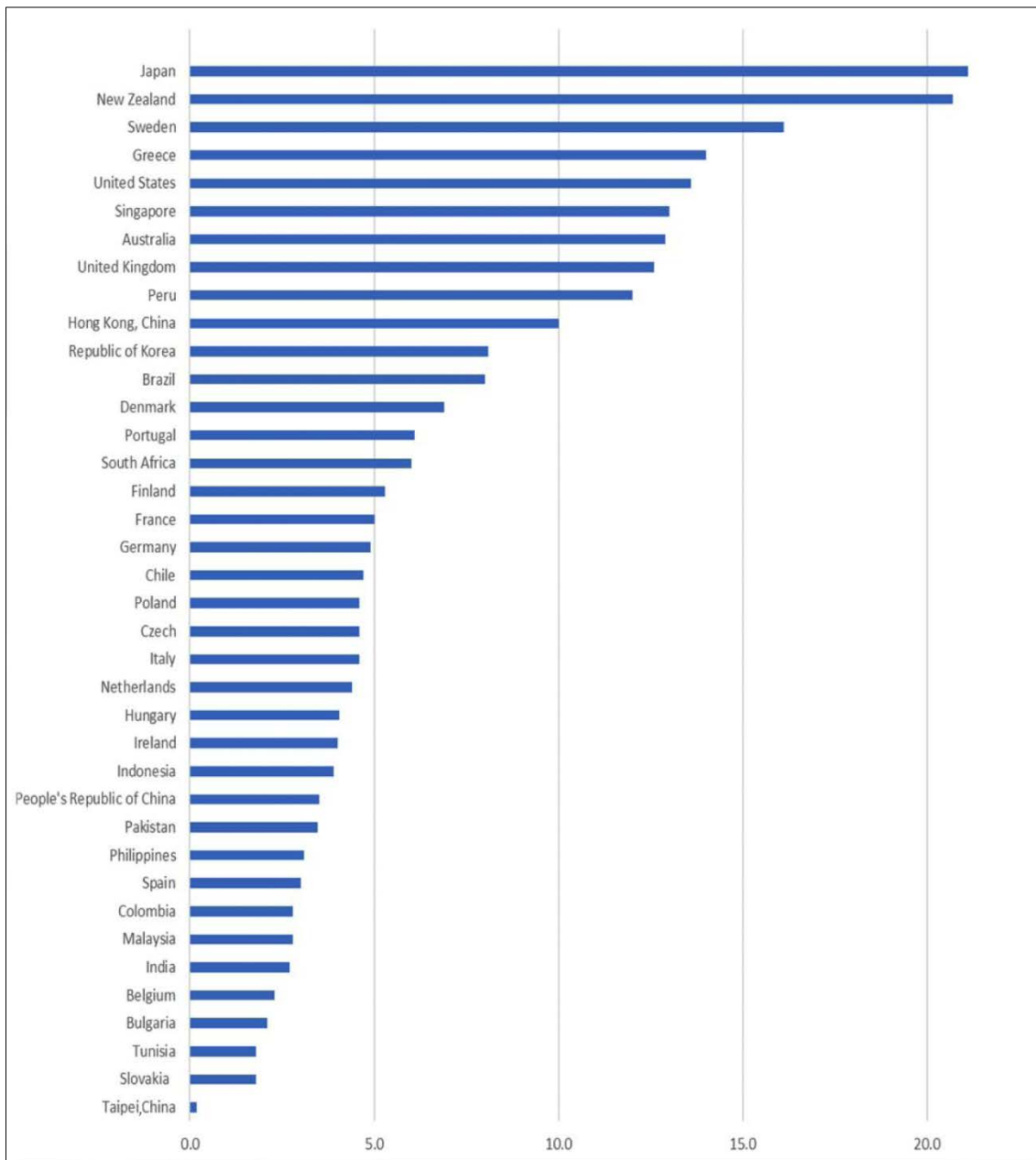
Source: IMF and CSIS.

Figure A7: Bond Yields vs Fitted

Note: Red line represents actual value of government bond yield in percentage. Dark blue dashed line represents its fitted value.

Figure A8: Stock Prices vs Fitted

Note: Red line represents actual value of stock prices in log form. Dark blue dashed line represents its fitted value.

Figure A9: Effective Exchange Rates vs Fitted
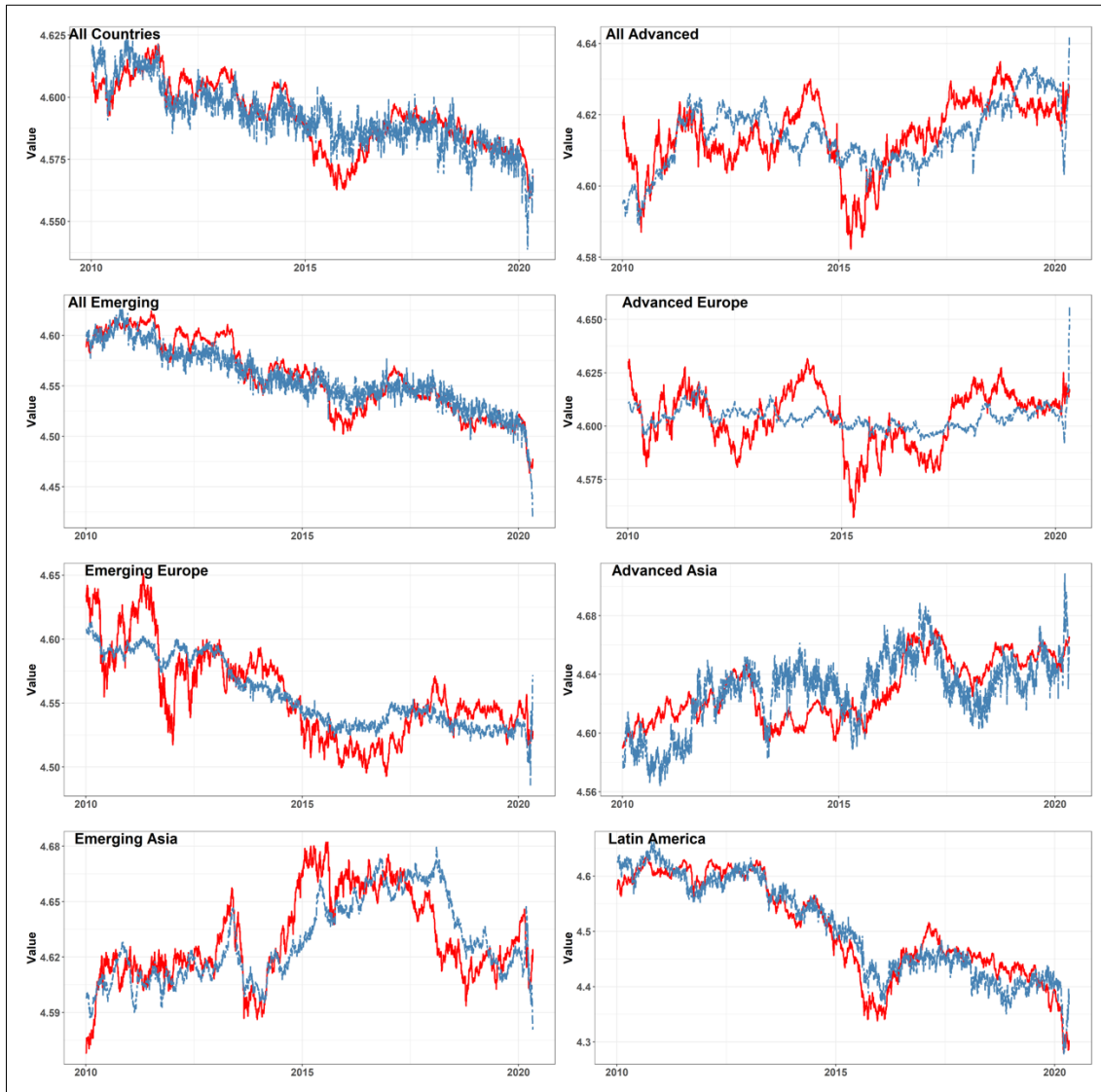
Note: Red line represents actual value of nominal effective exchange rate in log form. Dark blue dashed line represents its fitted value.

Figure A10: Capital Flows vs Fitted

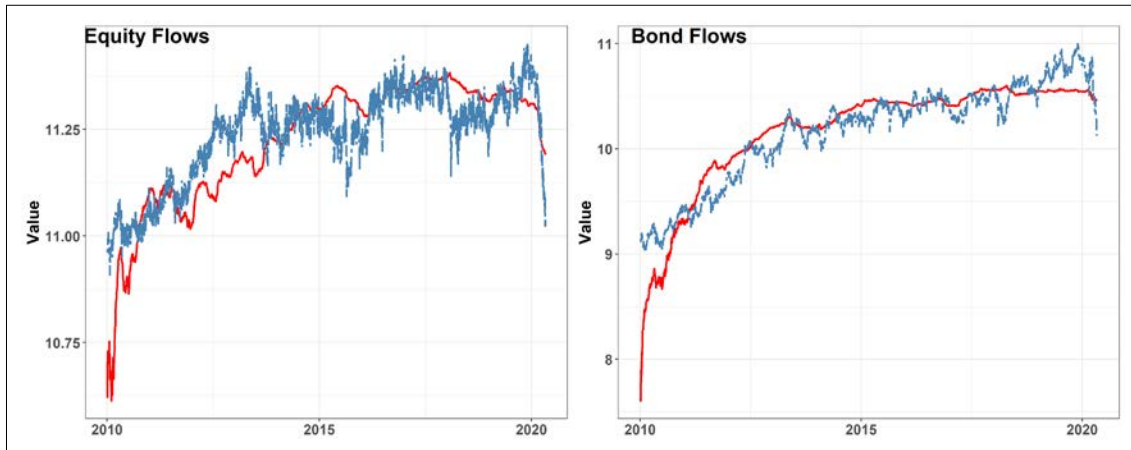Note: Red line represents actual value of capital flows in log form. Dark blue dashed line represents its fitted value.

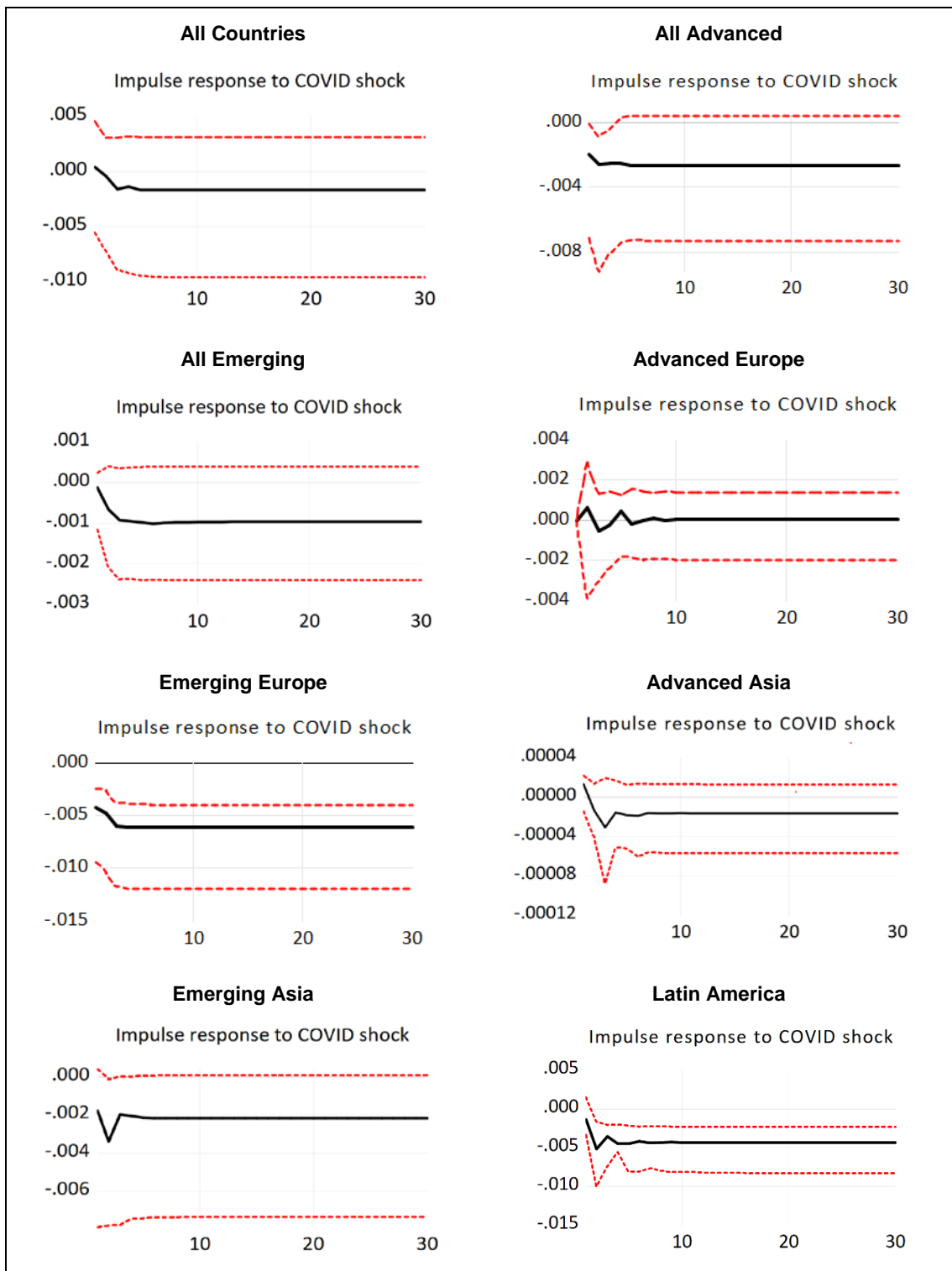**Figure A11: Response of Sovereign Bond Yields to COVID Shock**
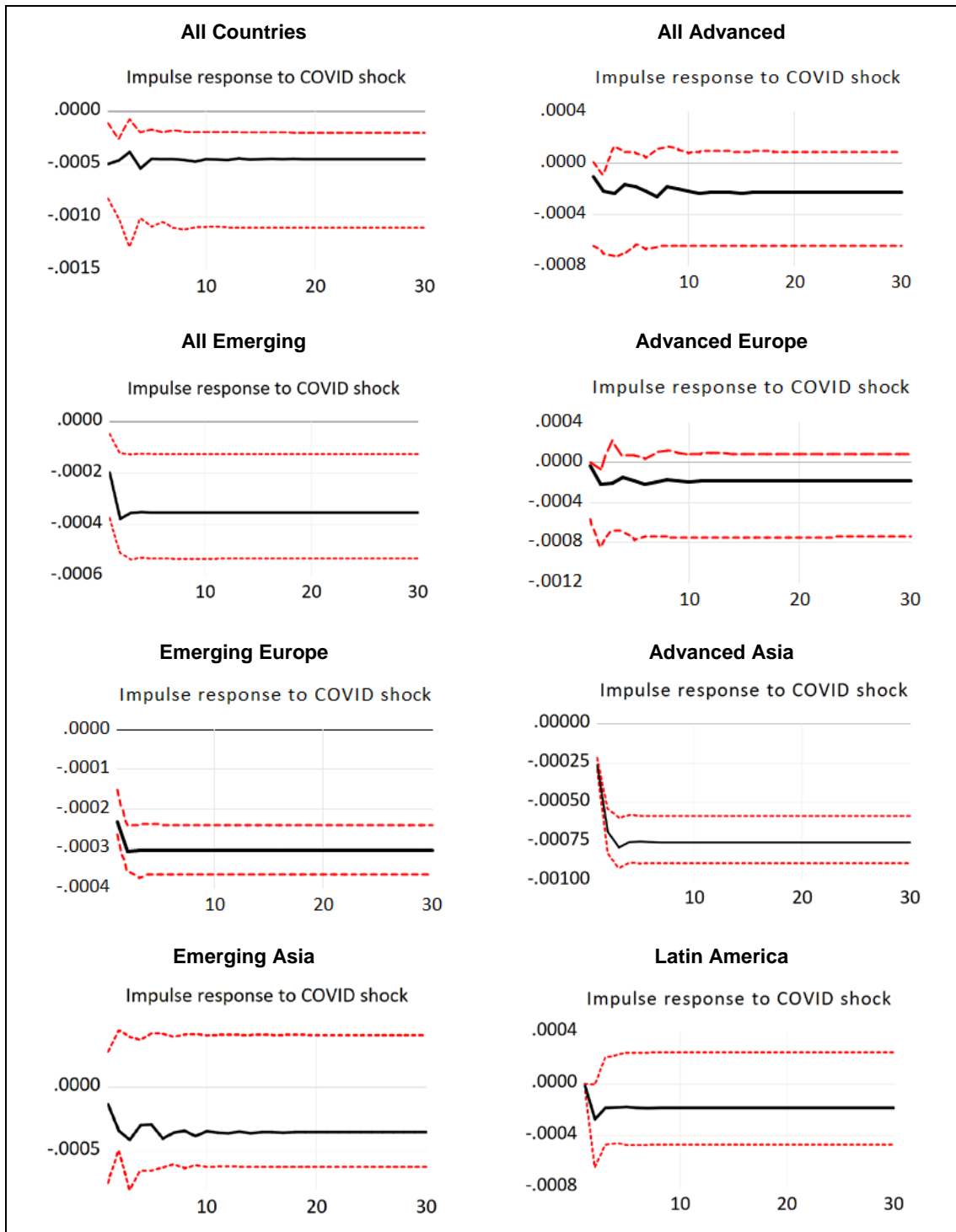
Figure A12: Response of Stock Prices to COVID Shock

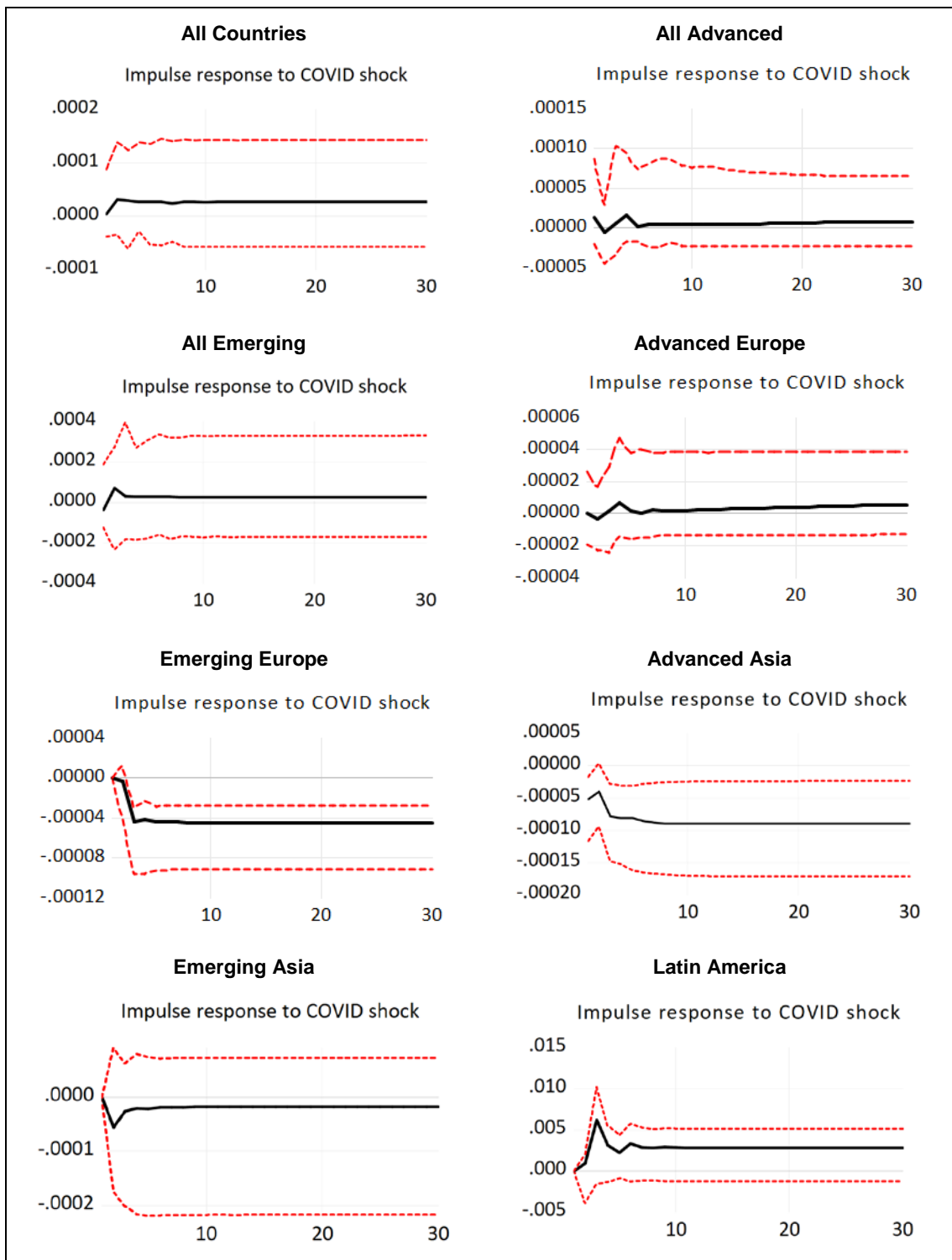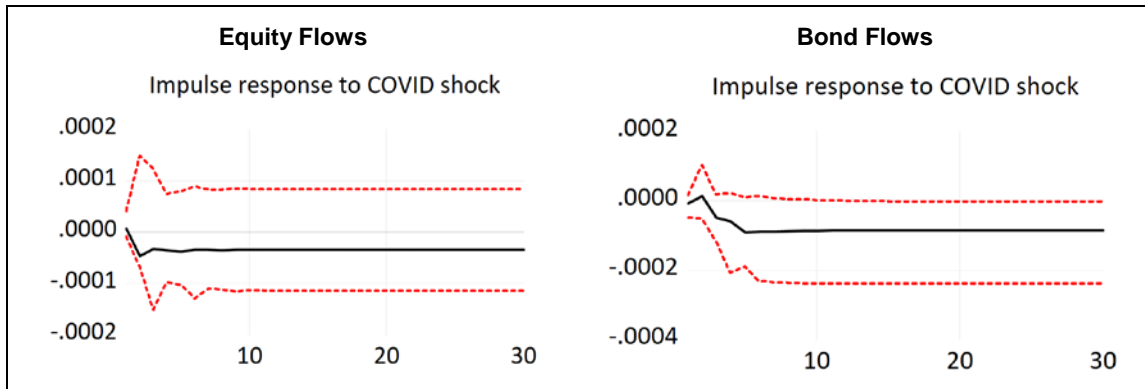## Figure A13: Response of Effective Exchange Rates to COVID Shock

Figure A14: Response of Capital Flows to COVID Shock

APPENDIX B

Table B1: Dates of COVID-19 First Confirmed Cases and Announcements by Governments and Central Banks on Fiscal and Monetary Policy Responses to COVID-19

Economy	COVID-19 First Case	Fiscal Stimulus Date	Fiscal Stimulus Notes	Quantitative Easing (QE) Date	Quantitative Easing (QE) Notes	Central Bank Swaps (CBS) Date	Central Bank Swaps (CBS) Notes
Advanced Asia
Japan	16 Jan-20	• 13 Feb-20 • 10 Mar-20 • 7 Apr-20 • 20 Apr-20	• JPY 15.3bn emergency fund • JPY 10bn aid for businesses • JPY 117.1trn emergency economic package • Partial revision to 7 Apr-20 package	• 27 Apr-20	• The Bank of Japan (BOJ) pledged to purchase a necessary amount of government bonds without setting an upper limit. The BOJ raised the upper limit of corporate bonds and commercial paper to JPY 20trn	• 15 Mar-20 • 20 Mar-20	• BOC (Canada), BOE, BOJ, ECB, US Federal Reserve, and SNB agreed to lower the standing USD liquidity swap arrangements by 25 bps • The six central banks agreed to increase the frequency of 7-day maturity operations from weekly to daily
Hong Kong, China	22 Jan-20	• 21 Feb-20 • 8 Apr-20	• HKD 30bn anti-epidemic fund • HKD 137.5bn stimulus package	No QE		No CBS	
Republic of Korea	2 Jan-20	• 28 Feb-20 • 17 Mar-20 • 8 Apr-20 • 30 Apr-20	• KRW 20trn support package • 1st Supplementary Budget: KRW 11.7trn • KRW 53.7trn additional relief package • 2nd Supplementary Budget: KRW 12.2trn	• 26 Mar-20 • 2 Apr-20	• The Bank of Korea (BOK) offered "unlimited repos" for 3 months, where the repo auction would be conducted every week. • The BOK conducted 1st round of "unlimited repos", worth of KRW 5.2trn	• 19 Mar-20	• BOK signed temporary USD 60bn swap lines agreement with the US Fed. The BOK said that the fund would be immediately injected the USD obtained to the FX market
Singapore	23 Jan-20	• 18 Feb-20 • 26 Mar-20 • 6 Apr-20	• 1st Stimulus Package: SGD 6.4bn • 2nd Stimulus Package: SGD 48bn • 3rd Stimulus Package: SGD 5.1bn	No QE		No CBS	
Taipei,China	21 Jan-20	• 25 Feb-20	• TWD 1bn fiscal stimulus package (5% of 2019 nominal GDP)	No QE		No CBS	

Table B1 *continued*

Economy	COVID-19 First Case Date	Fiscal Stimulus Date	Fiscal Stimulus Notes	Quantitative Easing (QE) Date	Quantitative Easing (QE) Notes	Central Bank Swaps (CBS) Date	Central Bank Swaps (CBS) Notes
Emerging Asia							
People's Republic of China	2 Jan-20	• 5 Feb-20 • 25 Feb-20 • 3 Mar-20 • 31 Mar-20 • 22 May-20	• VAT exemption, loan subsidies • RMB 500bn loans for small businesses • Accelerated transfer payments for provincial governments • Cash transfers to poor households • RMB 3.6trn fiscal stimulus package in the government budget	No QE		No CBS	
India	30 Jan-20	• 26 Mar-20	• Stimulus package announced	• 20 Mar-20 • 27 Mar-20 • 17 Apr-20	• RBI would conduct INR 450bn Open Market Operations (OMOs) by buying government bonds in March 2020 • RBI would conduct INR 750bn Targeted Long-Term Repo (TLTRO) in March and April, including OMOs announced on 20 Mar-20 • RBI would conduct INR 500bn TLTRO 2.0	No CBS	
Indonesia	2 Mar-20	• 25 Feb-20 • 13 Mar-20 • 31 Mar-20	• IDR 10.3trn fiscal stimulus • IDR 120trn fiscal stimulus • IDR 405.1trn fiscal stimulus in the revised budget	• Jan-20 (no official announcement)	• On 29 April 2020, Bank Indonesia (BI) stated that from January to April 2020 it had conducted QE of IDR 386trn in total. It would continue with IDR 117trn QE in May 2020	No CBS	
Malaysia	25 Jan-20	• 27 Feb-20 • 27 Mar-20	• 1st Stimulus Package: RM 6bn 2nd Stimulus Package: RM 25bn • 3rd Stimulus Package: RM 10bn	No QE		No CBS	
Pakistan	26 Feb-20	• 24 Mar-20	• PKR 1.2trn fiscal package	No QE		No CBS	
Philippines	30 Jan-20	• 16 Mar-20	• PHP 595.6 fiscal package	• 23 Mar-20	• Bangko Sentral ng Pilipinas (BSP) would buy PHP 300bn government bond repos	No CBS	

Table B1 *continued*

Economy	COVID-19 First Case Date	Fiscal Stimulus Date	Fiscal Stimulus Notes	Quantitative Easing (QE) Date	Quantitative Easing (QE) Notes	Central Bank Swaps (CBS) Date	Central Bank Swaps (CBS) Notes
Advanced Europe							
Belgium	4 Feb-20	• 20 Mar-20	• EUR 10.2bn fiscal stimulus	• 18 Mar-20	• The ECB launched the EUR 750bn Pandemic Emergency Purchase Programme (PEPP)	• 15 Mar-20	• BOC (Canada), BOE, BOJ, ECB, US Federal Reserve, and SNB agreed to lower the standing USD liquidity swap arrangements by 25 bps
Finland	29 Jan-20	• 26 Mar-20 • 16 Apr-20	• 1st Supplementary Budget • 2nd Supplementary Budget			• 20 Mar-20	• The six central banks agreed to increase the frequency of 7-day maturity operations from weekly to daily
France	24 Jan-20	• 18 Mar-20 • 25 Apr-20	• EUR 45bn emergency fund • EUR 110bn stimulus in the budget				
Germany	27 Jan-20	• 23 Mar-20	• EUR 750bn first fiscal package				
Greece	26 Feb-20	• 30 Mar-20	• EUR 12.5bn fiscal package, which was increased to EUR 24bn in April 2020				
Ireland	29 Feb-20	• 9 Mar-20	• EUR 3bn fiscal support				
Italy	30 Jan-20	• 17 Mar-20	• EUR 25bn "Cura Italia" emergency package				
Netherlands	27 Feb-20	• 17 Mar-20	• Fiscal package announced				
Portugal	2 Mar-20	• 26 Mar-20	• EUR 6.2bn fiscal stimulus				
Slovakia	6 Mar-20	• 12 Mar-20	• Fiscal package and other measures				
Spain	31 Jan-20	• 17 Mar-20	• EUR 220bn fiscal package				
Denmark	27 Feb-20	• 18 Mar-20 • 9 Apr-20	• DKK 60bn discretionary fiscal support • Additional DKK 30.7hn fiscal support	No QE		• 19 Mar-20	• USD 30bn temporary swap lines agreement between the Danmarks Nationalbank (DNB) and the US Federal Reserve
United Kingdom	31 Jan-20	• 17 Mar-20	• GBP 330bn fiscal stimulus	• 19 Mar-20	• The Bank of England (BOE) would purchase GBP 200bn government bonds this year	• 15 Mar-20	• BOC (Canada), BOE, BOJ, ECB, US Fed, and SNB agreed to lower the standing USD liquidity swap arrangements by 25 bps
						• 20 Mar-20	• The six central banks agreed to increase the frequency of 7-day maturity operations from weekly to daily
Czech	1 Mar-20	• 12 Mar-20	• CZK 270bn fiscal package	No QE		No CBS	
Sweden	31 Jan-20	• 16 Mar-20	• SEK 200bn fiscal stimulus	• 16 Mar-20	• The Riksbank would purchase SEK 300bn government bonds this year	• 19 Mar-20	• USD 60bn temporary swap lines agreement between the Sveriges Riksbank and the US Federal Reserve

Table B1 *continued*

Economy	COVID-19 First Case	Fiscal Stimulus Date	Fiscal Stimulus Notes	Quantitative Easing (QE) Date	Quantitative Easing (QE) Notes	Central Bank Swaps (CBS) Date	Central Bank Swaps (CBS) Notes
Emerging Europe							
Bulgaria	8 Mar-20	• 6 Apr-20	• Fiscal stimulus package	No QE		No CBS	
Hungary	4 Mar-20	• 7 Apr-20	• Fiscal stimulus package	• 28 Apr-20	• The Magyar Nemzeti Bank would purchase HUF 1trn government bonds and HUF 300bn mortgage bonds	No CBS	
Poland	4 Mar-20	• 18 Mar-20 • 8 Apr-20	• PLN 212bn economic stimulus package • Additional PLN 100bn for businesses	• 17 Mar-20 • 8 Apr-20	• The Narodowy Bank Polski (NBP) bought unspecified amount of government bonds • The NBP bought unspecified amount of government bonds	No CBS	
Latin America							
Brazil	25 Feb-20	• 16 Mar-20	• BRL 150bn emergency measures	• To be launched	• The Brazilian parliament has allowed the Banco Central do Brasil (BCB) to conduct quantitative easing.	• 19 Mar-20	• The BCB signed USD 60bn temporary swap lines agreement with the US Federal Reserve
Chile	3 Mar-20	• 19 Mar-20	• USD 11.8bn fiscal package	• 16 Mar-20	• Banco Central de Chile (BCC) introduced USD 4bn banking bond purchase programme. In May 2020, the BCC stated that it planned to increase the purchase amount to USD 8bn.	No CBS	
Colombia	6 Mar-20	• 18 Mar-20	• COP 14.8trn national emergency mitigation fund	• 23 Mar-20	• Banco de la República would purchase COP 10trn government and corporate bonds.	No CBS	
Peru	6 Mar-20	• 20 Mar-20	• PEN 90bn fiscal package	• 20 Mar-20	• Banco Central de Reserva del Perú (BCRP) said that for the next two years would inject PEN 400bn by purchasing repos from financial institutions.	No CBS	

Table B1 *continued*

Economy	COVID-19 First Case	Fiscal Stimulus		Quantitative Easing (QE)		Central Bank Swaps (CBS)	
		Date	Notes	Date	Notes	Date	Notes
Other Emerging							
Tunisia	2 Mar-20	• 22 Mar-20	• TND 2.5bn fiscal package	No QE		No CBS	
South Africa	5 Mar-20	• 22 Apr-20	• ZAR 500bn fiscal package	• 25 Mar-20	• The South African Reserve Bank (SARB) pledged to buy government bonds (no amount mentioned).	No CBS	
Other Advanced							
Australia	25 Jan-20	• 1 Apr-20	• AUD 194bn fiscal package	• 19 Mar-20	• The Reserve Bank of Australia (RBA) pledged to buy unlimited amount government bonds.	19 Mar-20	• The RBA signed USD 60bn temporary swap lines agreement with the US Federal Reserve
New Zealand	28 Feb-20	• 17 Mar-20	• NZD 12.1bn fiscal package • Additional NZD 4bn financial aid for workers and businesses	• 17 Mar-20 • 23 Mar-20	• The Reserve Bank of New Zealand (RBA) pledged to buy NZD 30bn government bonds.	• 19 Mar-20	• The RBNZ signed USD 30bn temporary swap lines agreement with the US Federal Reserve
United States	20 Jan-20	• 6 Mar-20 • 18 Mar-20 • 27 Mar-20 • 24 Apr-20	• First relief package: USD 8.3bn • Second relief package: USD 3.4bn • Third relief package: USD 2.3bn • USD 484bn supplementary stimulus package	• 16 Mar-20 • 23 Mar-20	• The US Federal Reserve pledged to purchase USD 700bn government bonds and mortgage-backed-securities (MBS) • The US Federal Reserve set unlimited amount to purchase government bonds, MBS, and corporate bonds	• 15 Mar-20 • 19 Mar-20 • 20 Mar-20	• BOC (Canada), BOE, BOJ, ECB, US Federal Reserve, and SNB agreed to lower the standing USD liquidity swap arrangements by 25 bps • US Federal Reserve established temporary USD 60bn bilateral USD swap lines agreement each for the RBA, BCB, BOK, Banco de Mexico, the MAS (Singapore), and Sveriges Riksbank; and USD 30bn each for the DNB, Norges Bank, and RBNZ. • BOC (Canada), BOE, BOJ, ECB, US Federal Reserve, and SNB agreed to increase the frequency of 7-day maturity operations from weekly to daily

c Source: Authors' calculation, IMF, Hartley and Rebucci (2020), ING, BNP Paribas, central banks websites, Wikipedia, Investopedia, Reuters, Bloomberg, various online media.