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ABSTRACT

This case study compares the importance of prevailing market factors against COVID-19 dynamics and policy responses in explaining the daily evolution of emerging market (EM) sovereign CDS spreads during the first half of 2020. We adopt a two-stage econometric approach. In the first stage, we estimate a multi-factor model for changes in EM CDS spreads over the pre-COVID-19 period of January 2014 through June 2019. Among the factors are a regional and a global one with the former capturing the CDS dynamic of a country's regional EM peers and the latter capturing the CDS dynamic of advanced economies (the US, Eurozone, and Japan). Next, we extrapolate model-implied changes in CDS spreads from July 2019 to June 2020. The model traces the realized sovereign spreads well over the rest of 2019, breaks down in 2020, and sees the biggest deviations from model-implied values during peak COVID in March. In the second stage, we find that the March 2020 divergence is partly accounted for by traditional determinants such as fiscal space, oil shocks, and monetary policies by the FED and the ECB rather than by COVID-specific risks and associated policies. In particular, COVID cases, mortalities, and virus containment policies were no significant drivers of CDS spread adjustments over this period. Overall, the study points to two results: On the one hand, the residuals during COVID suggest a time-varying relationship between sovereign CDS spreads and explanatory variables. On the other hand, the residuals were not driven by COVID-specific risks but rather by traditional drivers of sovereign debt pricing.

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1 Introduction

How much were the sovereign debt markets exposed to international shocks? The 2007-2008 global financial crisis (GFC) was a worldwide shock of unusual severity. Countries around the world suffered massive falls in economic output and employment. Nevertheless, the GFC did not affect all countries to the same extent: The large emerging markets—Brazil, Argentina, India, Thailand, and Malaysia—did relatively well. More importantly, China was comparatively invulnerable and escaped the GFC relatively unscathed. In fact, China was able to put in place big economic stimuli for its domestic economy. Because of China's significance not only as an exporter but also as a buyer on global markets, these stimuli helped the global economy back on its feet. Despite the severity and breadth of the GFC, it took more than twelve months to spread from the overbuilt suburbs of the US and the Iberian Peninsula to the financial centers of the world. In contrast, the coronavirus pandemic has taken just three months to engulf first China and then Europe and North America. Unsurprisingly, EMs were neither immune against the virus nor its economic repercussions. With the risk-off market environment, money invested in EMs ran for the exits, CDS spreads widened (Figure 1), and exchange rates dropped (Figure 2).

As it has swept away from China's shores, the COVID-pandemic triggered an economic crisis with vicious violence. Regional and country-wide shutdowns led to interruptions of global value chains, stay-at-home orders compressed consumer demand and thereby corporate and personal incomes, and the oil price dropped precipitously. In fact, this price drop took place as the US and Europe experienced their first waves of COVID while many emerging countries were in the earlier stages of their infection curves. Hence, for some of the emerging and developing world, the effects of COVID manifested themselves in external trade first and only then in domestic health issues. Particularly the commodity-dependent emerging markets are going through an especially challenging first half of 2020. They were first hit with a "wave" of low oil and other commodities incomes and then with the wave of COVID infections. As such, this double-wave reduced revenues for the heavily commodity-dependent EMs just at the time when shutdowns required governments to step in and support the economy, exacerbating fiscal challenges. The economic outfall caused by the pandemic and the oil price collapse is not the first shock that EMs face, however. In fact, besides the COVID oil price collapse, there have been six previous such collapses since 1970. Additionally, in recent decades, the increased flow of cross-border investment and trade in a more and more intertwined world economy has been subject to repeated interruption. For example, in 2015, there was a relatively contained crisis in China when the stock market tumbled, the Yuan slid, and a lot of foreign investment quickly left the country. A year before that, dropping prices of oil and other commodities sent a shock wave through several commodity-exporting EMs. Furthermore, a general slowdown in EM growth began in 2013 with the Federal Reserve's (FED) taper tantrum: indications of the less accommodative monetary policy caused instability in EMs since investors tried to funnel money back into safer US assets with rising yields.

In light of the current and previous challenges for EMs, it is interesting to investigate to what extent the pricing of EM sovereign risk during the COVID-pandemic was based on country-specific factors and on the global factors. However, studies on sovereign CDS spreads and their determinants are not new. This interest is partly due to the subject's importance for policymaking because sovereign spreads affect the cost of borrowing, and it is crucial to understand which factors govern these spreads. The plethora of potential determinants that could influence sovereign spreads can be divided into two groups. On the one hand, country-specific characteristics such as fiscal space, growth dynamics, and the political system could affect the perception of lenders of the riskiness of a potential borrower and thus the borrowing cost. On the other hand, a “global factor” may determine the borrowing cost of a specific sovereign borrower. The idea behind this is that there could be a global financial cycle driven by the monetary policy in the center countries, affecting the leverage of global banks, capital flows, and credit growth in the international financial system and thus the borrowing costs of countries.

In this paper, we contribute to the discussion on the relative importance of country-specific and global factors. Specifically, we compare the importance of prevailing market factors against COVID-19 dynamics and policy responses in explaining the evolution of emerging market sovereign CDS spreads during the first half of 2020. In doing so, we disentangle the effects of global economic and financial turmoil from the effects of oil price decays and country-specific epidemic dynamics for emerging markets. The analysis focuses on daily EM sovereign CDS spreads, comparing the impact of prevailing market factors against COVID-19 dynamics, ECB’s & FED’s policies**,** and countries’ fiscal policies on sovereign spreads and the overall financial and fiscal adjustments to the collapsing demand. We adopt a multi-stage econometric approach, leveraging an EM cross-country panel dataset. In the first stage, we estimate a heterogenous multi-factor model for changes in CDS spreads over several years before the outbreak of COVID-19. Specifically, we run the model for January 2014 through June 2019, the “pre-COVID” period. In the second stage, we use the estimated coefficients from the first stage to extrapolate model-implied changes in the CDS spreads from July 2019 through June 2020. This approach facilitates the statistical derivation of the “COVID residual,” i.e. the difference between the actual CDS adjustment and the change implied by the model. In the second stage, we also explain the model implied and the actual CDS changes through COVID-related factors. That is, we examine the residuals and explain them through a panel analysis that uses COVID-related factors from three different areas: epidemiological, economic, and political factors.

We find that, firstly, the multi-factor model traces the realized sovereign spreads well over the rest of 2019, breaks down in 2020, and experiences the biggest deviations from model-implied values during peak COVID in March. Secondly, we find that the March 2020 divergence is partly accounted for by traditional determinants such as fiscal space, oil income effects, and monetary policies by the FED and the ECB rather than COVID-specific risks and associated policies. In particular, COVID infections, mortalities, and virus containment policies were no significant drivers of CDS spread adjustments over this period. Overall, the study points to two results: On the one hand, the emerging residuals during COVID suggest a time-varying relationship between sovereign CDS spreads and explanatory variables. On the other hand, the residuals were not driven by COVID-specific risks but rather by traditional drivers of sovereign risk pricing.

We provide some synthesis of the related studies in Section 2. Section 3 looks at mortality patterns and fiscal policies in emerging markets. Section 4 discusses the data, methodology, and results. Section 5 concludes.

2 Recent literature

Our paper contributes to the literature that tries to understand the relative importance of global factors and country-specific factors. We do not try to give a general review of the previous scholarship and instead refer readers to Augustin (2014) for a recent enumeration of related studies. Intuitively, one would expect sovereign risk pricing to be driven by country-specific factors but there is evidence that shows that some of the variation in sovereign CDS spreads is determined by global variables and unrelated to the country-specific setting. This is particularly true at higher trading frequencies, albeit as we will see not during all periods. Ultimately it is an empirical question whether global factors, country-specific factors, or both together are responsible for CDS spread dynamics. To get an overview of previous empirical findings, we review the main academic results from three different camps: the "pro-global", the "pro-local", and the agnostic camp and focus specifically on scholarship dealing with emerging markets CDS spreads. This puts our results in perspective and demonstrates the practical use of our method.

2.1 Local risk factors

Using data for 2003 to 2012, Ertugrul & Ozturk (2014) investigate the relationship between CDS spreads and financial market indicators belonging to bond, equity, and foreign exchange markets for selected EM countries. Their results suggest that the CDS spreads have a cointegrating relationship with the remaining financial market indicators for the whole sample. Another finding that deserves particular attention is that in the long run, the CDS spread is negatively related with the CDS market uncertainties. They argue that this negative relationship indicates low liquidity in elevated uncertainty, which decreases CDS prices. The time-varying effects of each variable on the CDS spread are in line with the results obtained from the cointegration analyses.

Covering the so-called taper-tantrum episode of 2013 and seven other episodes of severe EM wide financial stress since the mid-1990s, Ahmed et al. (2017) assess the importance of economic fundamentals in the transmission of international shocks to financial markets in general across various EM economies. Cross-country regressions lead them to the following results: 1) EMs with relatively better economic fundamentals suffered less deterioration in financial markets during the 2013 taper-tantrum episode. 2) Differentiation among emerging markets set in relatively early and persisted through this episode. 3) During the taper tantrum, while controlling for the emerging markets' economic fundamentals, financial conditions also deteriorated more in those countries that had earlier experienced larger private capital inflows and greater exchange rate appreciation. 4) During emerging markets crises of the 1990s and early 2000s, they find little evidence of investor differentiation across emerging markets being explained by differences in their relative vulnerabilities. 5) However, differentiation across EMs based on fundamentals does not appear to be unique to the 2013 episode; it also occurred during the global financial crisis of 2008 and, subsequently, during financial stress episodes related to the European sovereign crisis in 2011 and China's financial market stresses in 2015. In summary, this paints the picture that global and regional factors play a different role at different times and may indeed be affecting individual countries differently.

Kocsis & Monostori (2016) investigate the determinants of sovereign CDS spreads on a sample of Poland, Russia and Turkey. They use a dynamic hierarchical factor model to aggregate information in indicators of economic fundamentals. CDS spreads are then regressed on forecasts of factors. They find that domestic fundamentals explain more of CDS spread variance than global factors, largely due to their ability to explain differences in sovereign risk across countries. The effects on CDS spreads are again found to be time-varying. In terms of economic significance, the factor of institutional-political strength stands out.

2.2 Global risk factors

The importance of global risk factors in explaining sovereign CDS spreads is usually motivated by the observation that spreads from different countries tend to move in close lockstep over longer periods of time. While there are a number of papers pointing out exactly this observation, none of them have gained as much attention as the recent contribution by Hélène Rey with her notion of a "global financial cycle." Rey argues that "Risky asset prices around the globe, from stocks to corporate bonds, have a strong common component. So do capital flows … Global financial cycles are associated with surges and retrenchments in capital flows, booms and busts in asset prices and crises. The picture emerging is that of a world with powerful global financial cycles characterized by large common movements in asset prices, gross flows, and leverage … The global financial cycle can be related to monetary conditions in the center country and to changes in risk aversion and uncertainty … capital flows, especially credit flows, are largely driven by a global factor…" (Rey, 2013). There was a big hype around this theory but follow-up questions emerged soon, especially in the context of the European sovereign debt crisis. Were CDS spreads driven by a global factor during the Euro crisis or were country specifics relevant? What is the center country?[1] What influences global aversion to risk and uncertainty? What about during the COVID-pandemic; Are different countries heterogeneously affected by global factors?

The interest in the global financial cycle is not confined to Rey, however. For instance, Forbes & Warnock (2012) analyze waves in international capital flows and develop a new methodology for identifying episodes of extreme capital flow movements using data that differentiates activity by foreigners and domestics. They identify episodes of "surges" and "stops" (sharp increases and decreases, respectively, of gross inflows) and "flight" and "retrenchment" (sharp increases and decreases, respectively, of gross outflows). Their approach yields different results than the previous literature that used measures of net flows. Global factors, especially global risk, are significantly associated with extreme capital flow episodes and hence movement in CDS spreads. Contagion, whether through trade, banking, or geography, is also associated with stop and retrenchment episodes. Domestic macroeconomic characteristics are generally less important, and they find little association between capital controls and the probability of having surges or stops driven by foreign capital flows.

Taking a slightly softer stance than Rey and Forbes & Warnock, Fender et al. (2012) study the determinants of daily spreads for EM sovereign CDS over the period April 2002 to December

[1] Because of the importance that Forbes & Warnock (2012) ascribe to "global risk", we base the global factor in our first-stage regression not only on the US but instead on a weighted combination of the US, Eurozone countries and Japan. This not only captures "global" risks better but also takes into account that there could be contagion through geography.

2011. Using GARCH models, they find that daily CDS spreads for emerging market sovereigns are more related to global and regional risk premia than to country-specific risk factors. This result is particularly evident during the second subsample (August 2007–December 2011), where neither macroeconomic variables nor country ratings significantly explain CDS spread changes. Second, measures of US bond, equity, and CDX High Yield returns, as well as emerging market credit returns, are the most dominant drivers of CDS spread changes. Finally, their analysis suggests that CDS spreads are more strongly influenced by international spillover effects during periods of market stress than during normal times, thus leaving some room for country-specific factors.

2.3 Global and local risk factors

While scholarship in the "pro-global" and "pro-local" camps generally acknowledge each other's points, it does so in a more or less casual way. However, based on the intuition that financial asset prices are driven by both country-specific fundamentals as well as investor's appetite for risk, Remolona et al. (2008) decompose monthly 5-year emerging market sovereign CDS spreads over the period 2002 to mid 2006 into a market-based measure of expected loss and a risk premium. They analyze how each of these two elements is linked to measures of country-specific risk and measure of global risk aversion/risk appetite. Fundamental variables include inflation, industrial production, GDP growth consensus forecasts, and foreign exchange reserves. Proxies for global risk aversion are taken as the Tsatsaronis & Karamptatos (2003) effective risk appetite indicator, the VIX and a Risk Tolerance Index by JP Morgan Chase. They find empirical evidence that global risk aversion is the dominant determinant of sovereign risk premium, while country-specific fundamentals and market liquidity matter more for sovereign risk. Both components thus behave differently.

Ismailescu & Kazemi (2010) examine the effect of sovereign credit rating change announcements—which have to do with country-specific factors more than with global factors—on the CDS spreads of the event countries, and their spillover effects on other emerging economies' CDS premiums between 2001 and 2009. They find that positive events have a greater impact on CDS markets in the two-day period surrounding the event, and are more likely to spill over to other emerging countries. Alternatively, CDS markets anticipate negative events, and previous changes in CDS premiums can be used to estimate the probability of a negative credit event. The transmission mechanisms for positive events are the common creditor and competition in trade markets.

Finally, Aizenman et al. (2013) study the relationship between 5-year sovereign CDS spreads and fiscal space using the deficit-to-tax and public debt-to-tax ratios for 60 countries over the period 2005 to 2010, but they focus their analysis on the GIIPS countries. They confirm the importance of fiscal space in explaining sovereign spreads. Quantitatively, their results indicate that a 1 percentage point rise in the debt-to-tax ratio increases 5-year spreads by between 15 and 81 basis points, while a 1 percentage point rise in the fiscal balance to tax ratio predicts a decrease in spreads by 194 to 829 basis points.

2.4 How this paper fits in the literature

In summary, there is an active debate on whether the "global financial cycle" is a more important factor for (EM) CDS spreads or whether country-specific factors such as fiscal space and financial integration are the main drivers behind CDS spread variation across countries. The truth probably lies somewhere between the two extreme poles, which is why we do not rule out either explanation from the get-go. Instead, our paper addresses two main issues. On the one hand, we intend to contribute to the ongoing discussion in the literature that assesses the relative importance of global and country-specific factors in explaining emerging market sovereign CDS spreads. On the other hand, we make use of the previous finding that country-specific factors matter particularly in times of crisis. Thus, we focus on the COVID period and try to differentiate between country-specific exposure to the oil price crash, to the severity of COVID eruption, and to the economic standing at the outset of the crisis. Our key innovation is the use of a two-stage econometric approach in which we use a heterogenous factor model which aggregates the information in our wide set of noisy fundamental variables. The model assumes that country fundamental factors are determined partly by global factors common to all emerging countries but also by regional factors common to regional clusters of emerging markets and partly by components particular to the given country. Contrary to some recent scholarship in the field, we base the global factor not only on the US but on advanced economies more generally. That is, we model the global factor as being based on the US, the Eurozone and Japan. In the first stage, we regress daily CDS spreads changes on the changes of the previous day as well as changes in the regional CDS spreads and in the global CDS spreads instead of directly using fundamental variables in regressions, which is the typical mainstream approach. We argue that our technique helps circumvent some of the problems that arise in the analysis CDS spreads and its regional or global determinant. For example, our factor model offers a solution to two common problems that arise when including all possible determinants of sovereign CDS spreads. One problem is that by including all possible variables, there may be collinearity problems so that regression results become unstable. Another problem is that reducing the number of explanatory variables to avoid multicollinearity inherently asks for the researchers' judgments on what variables to exclude and may lead to bias of omission. A factor model alleviates these difficulties by reducing the dimensionality of the data while still retaining much of the information content of the data. Secondly, by using a factor model in the first stage of our econometric approach, we can partly side-step data-related problems such as mixed data periodicities, lags in data publication, and data unavailability, which are particularly pressing issues when focusing on emerging markets. While our second-stage regressions do make use of fundamental variables, we acknowledge that there are two difficulties attached to this procedure: First, Kocsis & Monostori (2016) criticize that most macroeconomic variables are reported with a publication lag and are thus not available at the time of CDS spread quotes. Second, it should be the expectation of future fundamentals and not contemporary fundamentals that should affect CDS spreads, because CDS spreads price the future probability of sovereign default and are therefore forward-looking in nature. Thus, ideally, we would use forecasted explanatory variables. While this may make sense for explanatory variables form the economic realm (GDP, debt levels, etc.) it is impossible to make predictions about our core explanatory variables which are supposed to capture the exposure of countries to COVID.

3 Emerging markets and COVID-19

3.1 Mortality patterns across EM

The COVID-19 pandemic hit the entirety of the emerging and developing market countries. However, mortality dynamics were heterogenous, both between developed and emerging

markets and within emerging markets. Figure 3 and Figure 4 illustrate the discrepancies in mortality per capita and deaths per million residents across emerging markets.
As per the end of April 2020, Peru, Brazil, Panama, Romania and Turkey were among the emerging market countries with the highest mortality rates whereas Bahrain, Qatar, Sri Lanka, China, and Thailand were at the lower end. A similar picture emerges for the total deaths per million inhabitants: as per the end of April 2020 Hungary, Panama, Peru, Turkey, Romania were the 5 emerging market countries with the highest death toll whereas Bahrain, China, Qatar, Sri Lanka, and Thailand had the lowest death tolls. Of course, some of this heterogeneity can be attributed to differing reporting standards across regimes. Nevertheless, Jinjarak et al. (2020) provide evidence that the government pandemic policy interventions, i.e. their strictness, duration, etc., along with initial country characteristics such as demographics may have influenced both the mortality growth rates and the dynamic trajectory of its development. They explore several demographic and structural features across a large sample of both advanced and emerging economies from 1/23/2020 to 4/28/2020 and find that with a lag more stringent pandemic policies were associated with lower mortality growth rates. Additionally, the association between stricter pandemic policies and lower future mortality growth was more pronounced in countries with a greater proportion of the elderly population, greater democratic freedom, larger international travel flows, and further distance from the equator. In addition, they document that the extent to which the peak mortality rates were explained by government pandemic policies and country-specific structural features is heterogeneous.
The different picture in the mortality rates and the deaths per million across countries provides us with variation that we can use to estimate the effect of country-specific factors on sovereign CDS spreads. Before jumping into estimating these effects, let's have a look at another source of variation: policy responses of emerging markets to COVID-19.

3.2 EM responses to COVID-19

Unlike in previous crises, the response of emerging markets to the impact of COVID-19 has been decisive: Except for Saudi Arabia, all EMs engaged in some sort of fiscal stimulus packages as illustrated by Figure 5. The packages include both budgetary and non-budgetary measures. While the stimuli of EM economies look impressive at first sight, Alberola et al. (2020) point out that they are not that big when compared to advanced economies. In fact, budgetary measures in advanced economies have reached 8.3% of GDP—6.6 percentage points (pp) higher than in the aftermath of the GFC—while for EMs they represent just 2.0% of GDP, even less than in the GFC. The contrast is starkest for credit guarantees: 6.6% of GDP in advanced economies and only 0.4% in emerging markets. The gap for funding facilities is narrower: 4% of advanced economies' GDP versus 1.3% in the case of emerging markets. The difference in fiscal stimulus packages between advanced and emerging markets may be an indication of a lack of fiscal space for the latter. Most likely, however, fiscal constraints only explain a part of the difference; Another possible reason for the smaller fiscal packages may be the difference in the prevalence of the pandemic: COVID-19 has affected advanced economies earlier and more strongly than emerging markets with the exception of a few Asian emerging markets.

In contrast to the fiscal constraints, EMs seem to have had some leeway in terms of conventional monetary policy over advanced economies. In fact, emerging markets have been able to take advantage of more room to cut policy rates than their advanced economy counterparts. At the start of 2020, policy rates in emerging markets were on average 4.9%

(excluding Argentina) whereas the average policy rates in advanced economies were at 0.4%. Since then, EMs have cut policy rates by around 114 basis points (excluding Argentina) compared with a 40 basis points cut for advanced economies. However, Figure 6 makes it clear that rate cuts alone are no silver bullet for EMs. Particularly for the oil exporting countries (except for Mexico, which largely hedges oil revenues), rate cuts had to go hand-in-hand with interventions in foreign exchange markets.

3.3 Sovereign CDS spreads across EM

Similar to the variance in foreign reserve changes and fiscal stimulus size across EMs, there was a divergence in sovereign CDS spreads as illustrated in Figure 7. Interestingly, the time and cross-country variance in sovereign CDS spreads among emerging markets is more pronounced than for developed economies (Figure 8). The larger amplitude for emerging markets may be the opposite side of the coin of smaller fiscal space than those of advanced economies: more narrow fiscal space may imply more rapidly increasing CDS spreads because countries are approaching a financing edge.

4 Analysis of COVID dominance

In this section, our primary goal is to investigate whether and to what degree COVID-related developments and associated policy responses by countries, central banks, and the IMF influenced the pricing of sovereign risk across EMs. In this context, we ask whether and to what degree prevailing factors and to what degree COVID-related dynamics influenced sovereign risk pricing through the pandemic. We propose a two-stage econometric analysis that takes advantage of a daily cross-country panel dataset.

In the first stage, we estimate a dynamic heterogeneous multi-factor model for changes in 5-year CDS spreads over the period January 1, 2014, through June 30, 2019. Then, using the estimated model parameters, we apply a synthetic control-type procedure to extrapolate the model-implied change in the CDS spreads—given realized values of the factors—from July 1, 2019, through June 30, 2020. This approach allows us to calculate the "COVID residual," i.e. the difference between the realized CDS adjustment against the change implied by the model at both the individual country and aggregate EM levels, over the COVID pandemic period.
In the second stage, focusing specifically on the 2020 pandemic period, we explore whether daily COVID mortalities, announced policy responses, or other country fundamentals, help to explain variation in the COVID residual.

We take several steps to come as close as possible to a causal interpretation of our results. First, we control for a variety of alternative explanatory variables that could distort our results. Second, we use several specifications and our findings remain robust to augmenting the specification with fixed effects. This shows that these results are not driven by factors that are time-invariant in our sample such as the advantage that some countries enjoy with being democratic/non-democratic, having a specific currency, etc.

4.1 First stage estimation, January 2014 – June 2019

In the first stage, we estimate and evaluate a heterogeneous multi-factor model. Our empirical analysis uses daily data for 30 emerging market sovereigns for a period of 6.5 years from

January 1, 2014 to June 30, 2020. We chose 30 EMs based on their investibility and data availability of the dependent variable where investibility is defined by a country's representation in the reference index for EM sovereigns, the J.P. Morgan Emerging Markets Bond Index.[2] We chose this specific time period because it begins after the structural break of the taper tantrum and to have enough data to calibrate and test the model in both normal and COVID-times.

4.1.1 Data

We use the following data:

- *Sovereign Credit Default Swap spread (CDS spread).* We use the daily 5-year CDS spreads reported by Eikon Refinitiv and convert the levels into daily log changes.
- *Gross domestic product (GDP)*. We use GDP data in current $ reported by the World Bank.

4.1.2 Specification

In the first stage, we estimate a dynamic factor model on the pre-COVID period data of the following form:

$$\Delta cds_{i,t} = \alpha_i + \phi_i \Delta cds_{i,t-1} + \beta_{i1}\Delta GCDS_t + \beta_{i2}\Delta RCDS_{i',j,t} + \varepsilon_{i,t} \qquad (1)$$

$$Jan\ 1, 2014 \leq t < July\ 1, 2019$$

where $\Delta cds_{i,t} = ln \frac{CDS_{i,t}}{CDS_{i,t-1}}$

Our outcome variable is the daily change in the log CDS spread of country i. On the right-hand side, we include the lagged dependent variable, along with two factors. A global factor, $\Delta GDCS_t$ and a regional EM factor $\Delta RDCS_{i',j,t}$. The global factor is constructed as the GDP-weighted cross-section average of daily log CDS changes over a reference group of 20 advanced economies; the US, Japan, and 18 Eurozone member states.[3] It therefore captures the common component of sovereign risk fluctuations at the global level.[4] The regional factor is constructed slightly differently. It is the GDP-weighted cross-section average of daily log CDS changes over a country's reference sovereigns in its region. That is, the 30 emerging markets were first sorted into seven reference groups based on geographic proximity and oil-export dependence. These groups and their constituent emerging markets can be found in Table 3.

We estimate the model over the pre-COVID period of January 1, 2014 through June 30, 2019. Instead of estimating the model through the end of 2019, we choose this particular window

[2] The 30 countries are what we refer to as the "full" sample. See Table 1 for a list of these countries.
[3] The CDS data for Luxemburg was not available.
[4] The weighting of countries for the global factor is based on 2019 GDP. This results in the following weights: US 53.9%, Japan 12.8%, Eurozone 33.3%. See Table 2 for an overview.

because it leaves July to December 2019 to validate the out-of-sample accuracy of our model before the COVID shock hit in 2020. Finally, the COVID residual is defined as

$$\Delta cr_{it} = \Delta cds_{it} - [\hat{\alpha}_i + \hat{\phi}_i \Delta cds_{i,t-1} + \hat{\beta}_{i1} \Delta GCDS_t + \hat{\beta}_{i2} \Delta RCDS_{i',j,t}] \qquad (2)$$

$$t \geq July\ 1, 2019,$$

simply comparing the realized change in log CDS to the model-expected value, given the true realization of the factors and lagged log CDS change.

4.1.3 Global and regional risk exposures and emerging market fiscal fundamentals

Figure 9 plots public debt/GDP of EMs against their estimated global betas and regional betas. The public debt/GDP measure is an average over annual data spanning from 2014-2018, whereas we estimated the betas from January 2014 to June 2019. The association between public debt levels and global betas are negative and relatively weaker, while public debt levels are also negatively associated with regional betas across EM countries. The negative correlation between regional betas and fiscal space is significant at the 10% level. We also note that countries with large negative global betas tend to be those with large regional betas. While Argentina is an exceptional case, several of these countries are large EM, i.e., Brazil, Mexico, Russia, South Africa, and Turkey.

Figure 10 shows the correlation between COVID-related fiscal stimulus announced in 2020 and country-specific global and regional betas (again estimated over January 2014 to June 2019). Both regional and global betas positively associate with COVID-related fiscal stimulus size across emerging markets but not significantly so. This opens up two interpretations: On the one hand, since the coefficients are not statistically significant, we cannot rule out that systematically riskier countries (higher regional betas) issued less stimulus/GDP because of considerations of lacking fiscal space. On the other hand, if we removed the outlier Saudi Arabia from the sample, the coefficients would potentially become significant. This in turn could imply that even though countries with high betas would typically have a hard time to engage in deficit spending, the severity of the situation together with the low interest environment could mean that countries which would otherwise be perceived as risky were able to engage in stimulating the economy.

Interestingly, these findings support the view that 1) The risk associated with limited fiscal space is priced into EM sovereign spreads during “normal times” and 2) country risk didn’t constrain, at least to some degree, the size of COVID stimulus which was able to be deployed. However, because of the small sample size of these associations, the interpretation of such relationships is made cautiously.

4.1.4 Model-implied spreads and COVID residuals, July 2019 to June 2020

After estimating/calibrating the factor model from January 2014 through June 2019, we extrapolate the model based on realized values from July 2019 through June 2020 which spans

the COVID period. The upper-left panel of Figure 11 traces the EM average cumulative log CDS change over this period (solid line) against that implied by the model (dashed line). Firstly, note that the model does a near perfect job from the beginning of July 2019 through to the end of 2019, the validation period of the model. At the beginning of 2020, the two series start to fluctuate a bit and a lift-off in both model-implied and actual values takes place in March 2020, albeit the actual values sore considerably more than would be predicted by the model. Thus, this is also the point in time at which the realized values start to diverge from the model-implied values, triggered by panic over the COVID-pandemic. Hence, at the aggregate EM level, the factor model on its own could not explain all of the variation in CDS adjustment due to the COVID shock. CDS spread widening ceased in mid to end of March when countries and central banks around the world announced massive economic support and relief packages, but the divergence between actual and model-implied changes persisted.
Figure 11 upper-right charts the cross-sectional dispersion of CDS spreads over the same period. While the dispersion rose over the second half of 2019, it experienced an uptick in March 2020, highlighting the sharp rise in volatility amid the COVID pandemic.
The lower charts compare the top 5 mortality versus the bottom 5 mortality EM countries (by end of April). The bottom-left chart indicates that the change in actual CDS values was more marked for high mortality countries than for low mortality countries, suggesting two things. On the one hand, COVID-specific risks are likely partially responsible for the spike in CDS spreads. On the other hand, this divergence may also indicate that country-specific risks are drivers of CDS spreads rather than just global and regional factors.

The bottom-right chart also suggests two things: On the one hand, high mortality countries experienced more volatility in their CDS spreads than their low mortality counter parts. Equally, the residuals for low mortality countries were positive for the whole period and turned sharply positive in March 2020, which stands in contrast to high mortality countries' residuals which turned sharply negative in March 2020 and then started to approach the low mortality residuals by the end of the evaluation period.

A graphical inspection shows that for a number of countries individually the model does not do well even for the time period before COVID, i.e. for July 2019 to February 2020 (see Figure 12). A major factor behind this discrepancy may be credit events and restructurings some countries have with the IMF, World Bank or China. Including such outliers in the second stage would distort our results. Thus, we drop countries from the sample based on correlation coefficients between actual vs fitted values below 0.25, which results in our new "reduced" sample of 20 emerging markets (see Table 4 for a list of the countries in the reduced sample). Figure 13 depicts the actual and estimated series for this reduced sample. It shows that for the remaining countries in the sample, the model does a good job for the out-of-sample period before COVID.

4.2 Second stage estimation, January – June 2020

For the second stage estimation, we separate the out-of-sample period January - June 2020 into three COVID-subperiods:

- January-February 2020 (early COVID)
- March 2020 (peak COVID)
- April-June 2020 (late COVID)

By separating the out-of-sample period, we document that March is the period during which the realized values of daily CDS spread changes diverged the most from the model-implied values, while the dynamic factor model does an excellent job of tracing the realized values before and after that (Figure 14). Furthermore, we observe that daily CDS spread changes were remarkably higher and more volatile in March 2020 than in the early and late COVID periods. As such, in the second stage estimation we focus on the peak COVID period to test whether COVID-specific indicators and or commodity related variables may account for the variation in CDS adjustment that is not explained by the factor model. To do so, we first broaden the realm of explanatory variables to no longer include only past log CDS changes and regional/global log CDS changes but a host of COVID-related variables as well as a variety of other controls. The following data is used:[5]

4.2.1 Data

- *Infections.* We use the daily infections per country reported by the Johns Hopkins University Center for Systems Science and Engineering (JHU CSSE). Counts include confirmed and probable where reported.
- *Deaths*. We use the daily deaths per country reported by the JHU CSSE. Counts include confirmed and probably where reported.
- *Mobility*. We use the daily routing requests per country reported by Apple (driving; walking; transit).
- *Stringency Index.* We use the Oxford COVID-19 Government Response Tracker to measure the which records the strictness of "lockdown style" policies that primarily restrict people's behavior
- *ECB Policy Dummy. Fed Policy Dummy. Fiscal Policy Dummy.* Daily fiscal and monetary policy announcements. These were collected for individual countries, for the European Central Bank, and for the Federal Reserve. These columns capture whether or not an action or proposal was made by a given nation/institution on a specific date in the sample, but do not control for the size or number of policies on any given day. A row is coded as "1" if the date corresponded with the announcement of at least one key policy. With the exception of the Federal Reserve (whose major announcements related to reductions in the interest rate along with fiscal spending), we restricted our analysis of key fiscal policies to those which provided "millions" or "billions" of local currency units in spending. The extended list of sources used to aggregate this data can be found in the online appendix.
- *External Debt.* We use the total external and private sector debt stock as a share of GDP as reported by the World Bank. The data is yearly.
- *Debt owed to China.* We use the estimated total external debt stock owed to China in current USD as a share of the debtor GDP as reported by Horn et al. (2019). The data is

[5] Facing visible strain in dollar funding markets during the Covid-19 pandemic, the FED lowered the rate on the swap lines it had with five other central banks, and opened new ones in nine other currencies: On 19 March 2020, the FED created new swap line arrangements with nine other countries: Australia, Brazil, Mexico, Denmark, Korea, Norway, New Zealand, Singapore, and Sweden. Amongst these, as of 31 March 2020, the central banks of Sweden, Norway, Denmark and Singapore were the only banks to have completed a dollar swap line operation. Thus, no emerging market country has accessed a swap line.

reported yearly up to 2018 so that we used the most recent yearly values for cross-country variance.

- *Oil price income effect.* This is a compound variable that is calculated according to the following formula: Daily Oil price level * [(Oil share of exports * Export share of GDP) – (Oil share of imports * Import share of GDP)]. The daily oil price data is for Brent as reported by Eikon Refinitiv. The data for export and import shares of GDP are from the World Bank. The data for oil import shares are reported by the International trade Center.
- *International reserves.* International reserves held by countries and measured in current USD as reported by the IMF. Data is monthly.
- *Sovereign Wealth Fund Volume.* Sovereign wealth fund volume in current USD per country as reported by PWC. Data is yearly.
- *Rapid Financing Instrument*. Approved rapid financing instrument from the IMF as share of recipient country's GDP.

4.2.2 Specification

We first estimate a panel model examining the relationship between COVID residual (see (2)), defined as the difference between the realized values of daily log CDS spread change and the model-implied values of the dynamic factor model (1), and a set of COVID-related variables from three different realms: pandemic, economic, and policy measures. The second stage model specification is

$$\text{(3)} \qquad \Delta cr_{it} = \vartheta_i + \lambda_t + \theta X_{i,t}^{COVID} + \gamma X_{i,t}^{economy} + \eta X_{i,t}^{policy} + \epsilon_{i,t}$$

$$March\ 1, 2020\ \leq t\ \leq March\ 31, 2020$$

Pandemic-specific variables are: mortality outcomes, in which we include daily new mortality rate (per 1,000,000 population), daily new mortality growth rate, total mortality rate (per 1,000,000 population), and total mortality growth rate, the daily mobility measure in terms of driving (reported by Apple), and the daily growth rates of policy stringency indices (constructed by OxCGRT). Lower mobility levels or stricter government non-pharmaceutical interventions may signal greater economic contraction, which may increase the debt financing burden and thus impact debt pricing during the COVID-19 pandemic.

Economic variables are the oil price income effect, RFI announcements[6], Sovereign wealth fund buffers, external debt ratios and ratios of debt owed to China.

Policy variables, in which we include dummy variables indicating the date of country-specific key fiscal policy announcements, the date of European Central Bank's key policy

[6] Rapid Financing Instrument. Approved rapid financing instrument from the IMF as share of recipient country's GDP. Because no RFI was announced/approved in March 2020, this variable will not show up in the panel regression.

announcements, and the date of the FED's monetary policy announcements.[7,8] ϑ_i and λ_t represent country and time fixed effects, respectively.

Results are reported in Table 5. Daily new mortality rates and new mortality growth rates are positively associated with COVID residuals across all 5 specifications, although not statistically significantly so. Specifically, countries that saw higher new mortality rates or new mortality growth rates were likely to see wider divergence in realized CDS spread dynamics from model-implied values. The total mortality rates and the total mortality growth rates are negatively related to the COVID residuals and the growth rates become statistically significant when adding the economic and policy variables. While the mortality and mortality growth rates together only explain a small share of the variation in COVID residuals (1.24%), adding the other COVID-specific variables (mobility index and growth of policy stringency index) increases this share to 5.3%. However, the really big jump happens when we also include policy and economic variables so that we reach an R-squared of roughly 19.2%. In specifications 2 and 5 we also see that the SI growth does not explain the CDS residual very much; the mobility coefficients are statistically significant across specifications whereas the SI growth coefficients are not and leaving out the mobility coefficient lets the R-squared fall from 19.18% in specification 4 to 6.4% in specification 5. The interpretation is that mobility—as an ad-hoc measure of daily economic activity—has a much more pronounced effect on CDS residuals than the strictness of containment policies and implies that debt pricing during the COVID-19 pandemic may have been impacted significantly by country-specific economic activity outcomes. Taken together, these two results indicate that both country-specific factors as well as global/regional factors play a role in the pricing of debt in emerging markets, at least for the period of March 2020. Interestingly, all three policy measures, i.e. FED, ECB, and country-specific fiscal policies have statistically significant associations with COVID residuals. Specifically, the interaction of the fiscal policy dummy with the external debt level is positive, indicating that countries that increased their debt burdens through stimuli or countries that already have relatively high debt burdens were likely to see larger discrepancy in CDS spread dynamics. More (hidden) debt owed to China is also positively associated with CDS residuals, albeit not statistically significantly so across all specifications. However, the interaction of debt owed to China with the fiscal policy dummy is again negatively correlated with CDS spreads and statistically significantly so, similar to the interaction of (unhidden) external debt with the fiscal policy dummy. This seems to indicate a somewhat indifferent view of investors about sustainability of announced stimuli, which can probably be partially explained through the fact that many financial market participants are not aware of the debt that countries owe to China. Lastly, the

[7] In order to capture key policy announcements, we aggregated a set of variables from numerous datasets for a set of key fiscal, monetary, and miscellaneous policies, across individual countries, the European Central Bank, and the Federal Reserve. These variables captured whether or not an action or proposal was made by a given nation/institution on a specific date in the sample. Thus, we did not control for the size or number of policies on any given day, and only if the date corresponded with the announcement of at least one key policy. With the exception of the Federal Reserve (whose major announcements related to reductions in the interest rate along with fiscal spending), we restricted our analysis of key fiscal policies to those which provided "millions" or "billions" of local currency units in spending.

[8] The primary data sources used to construct these policy announcement variables are listed here and in our online references: Yale COVID-19 Financial Response Tracker; Harvard Global Policy Tracker; Bruegel COVID-19 National Dataset; IMF Policy Responses to COVID-19; and the St. Louis Federal Reserve.

oil income effect is highly statistically significant in specifications 3 and 4 which indicates that oil exporters experience a relative compression of COVID residuals over oil importers. A finding worth pointing out is the F statistic of the first specification. Since the statistic is not significant, we cannot reject the null that the group of COVID variables are jointly insignificant. This means that the COVID residuals are not driven by COVID-specific risks but rather by traditional drivers of sovereign debt pricing such as fiscal space, oil income effects, and global factors such as US and European monetary policy as specification 4 features jointly significant variables.

4.2.3 Examination of residuals, March 2020

Next, we use a modified specification to compare the explanatory power of the factor model predictions and COVID-related variables. We do so by treating realized log changes in CDS spreads as the outcome variable, while augmenting the panel regression with the model-implied values from (1) on the right-hand side along with COVID-related variables as in (3).

$$(4) \qquad \Delta cds_{i,t} = \vartheta_i + \lambda_t + \Gamma \widehat{\Delta cds}_{i,t} + \theta X_{i,t}^{COVID} + \gamma X_{i,t}^{economy} + \eta X_{i,t}^{policy} + \epsilon_{i,t}$$

$$March\ 1, 2020 \ \leq t \ \leq March\ 31, 2020$$

where $\quad \widehat{\Delta cds}_{i,t} = \hat{\alpha}_i + \hat{\phi}_i \Delta cds_{i,t-1} + \hat{\beta}_{i1} \Delta GCDS_t + \hat{\beta}_{i2} \Delta RCDS_{i',j,t}$

are the model-implied values of the daily CDS spread changes generated from the factor model (1). Fixed effects are again denoted ϑ_i and λ_t, representing country and time fixed effects, respectively.

Essentially, in (4) we take apart the two components that make up the COVID residual. This way, it becomes obvious that the regression in (3) with the COVID residual as an outcome variable is equivalent to the restricted regression shown in (4) when $\Gamma = 1$. (4) relaxes this implicit assumption of (3) and lends to a richer analysis.

Results are reported in Table 6. First, after including COVID-related variables, the coefficient of model-implied values remains statistically significant and keeps its positive sign, implying that model-implied values still trace realized CDS spread changes during the COVID-19 pandemic, giving merit to our model selection in the first stage. Second, new daily mortalities and the growth rate of new mortalities are both positively associated with spread changes across all model specifications, although not statistically significantly so, consistent with the time-series evolution of the COVID residuals shown in the previous section (Figure 11).

Third, country-specific announcements of fiscal responses to the pandemic appear insignificant, both statistically and in its economic magnitude, indicating that neither the presence of such announcements nor the existence of higher external debt burdens significantly increased the perceived risk. This result is interesting: it would indicate that during COVID even governments with higher external debt levels or governments which announced large and potentially unsustainable stimuli were able to get away with it for now. This indicates a form of “COVID-dominance”; governments seem to get a free pass at engaging in stimulus spending as investors do not currently care that much about debt sustainability. Lastly, the oil income effect is again negative and statistically significantly in specifications 3 & 4. Interestingly, it loses its significance and drops in magnitude when we do not control for mobility. This may indicate multicollinearity between the two regressors (oil income effect and mobility) which would confirm that mobility is a decent ad-hoc measure of economic activity.

5 Conclusion

We study the role that country-specific and global variables have in determining sovereign CDS spreads of emerging markets during the COVID pandemic. We use a two-stage econometric approach. In the first stage, a heterogenous factor model is used to “train” a model that predicts daily log changes in CDS spreads as a function of previous changes and regional and global CDS dynamics. The method is useful in handling various data issues that are especially relevant in emerging markets such as data unavailability and differences in data frequencies. The model makes relatively accurate predictions in sample (Jan 2014-June 2019) as well as out of sample (July 2019-December 2019). In 2020, the predictions loose accuracy and the residuals increase. Since COVID is a global pandemic and CDS spreads of countries around the world were affected, we take the increase in residuals as a sign that country-specific variables particularly drive CDS spreads in times of crisis. The residuals are particularly large at peak COVID in March 2020, which supports several papers in the existing literature that emphasize the time-varying nature of the relationship between sovereign CDS spreads and explanatory variables.

In the second stage, regressions of residuals on fundamental factors suggest that COVID mortalities and infections are not as important in explaining CDS spreads as are variables capturing fiscal space, economic activity, actions by the FED and the ECB, and the change in oil prices. There are two possible interpretations for the relative insignificance of COVID mortalities and infections for CDS spread changes. On the one hand, it could be that international investors deem COVID mortality and infection data as noisy and unreliable and do not pay too much attention to them when making their investment decisions. On the other hand, it could be that international investors are aware that COVID is a pandemic that may ultimately hit all countries to more or less the same degree in terms of its health repercussions and hence do not pay as much focus on infections and mortalities and instead focus more on the performance and the stability of the economy. An interesting empirical corollary is the finding that while external debt/GDP levels across emerging countries are not statistically significant in explaining the COVID residuals, the (hidden) debt to China is statistically significant.

Appendix

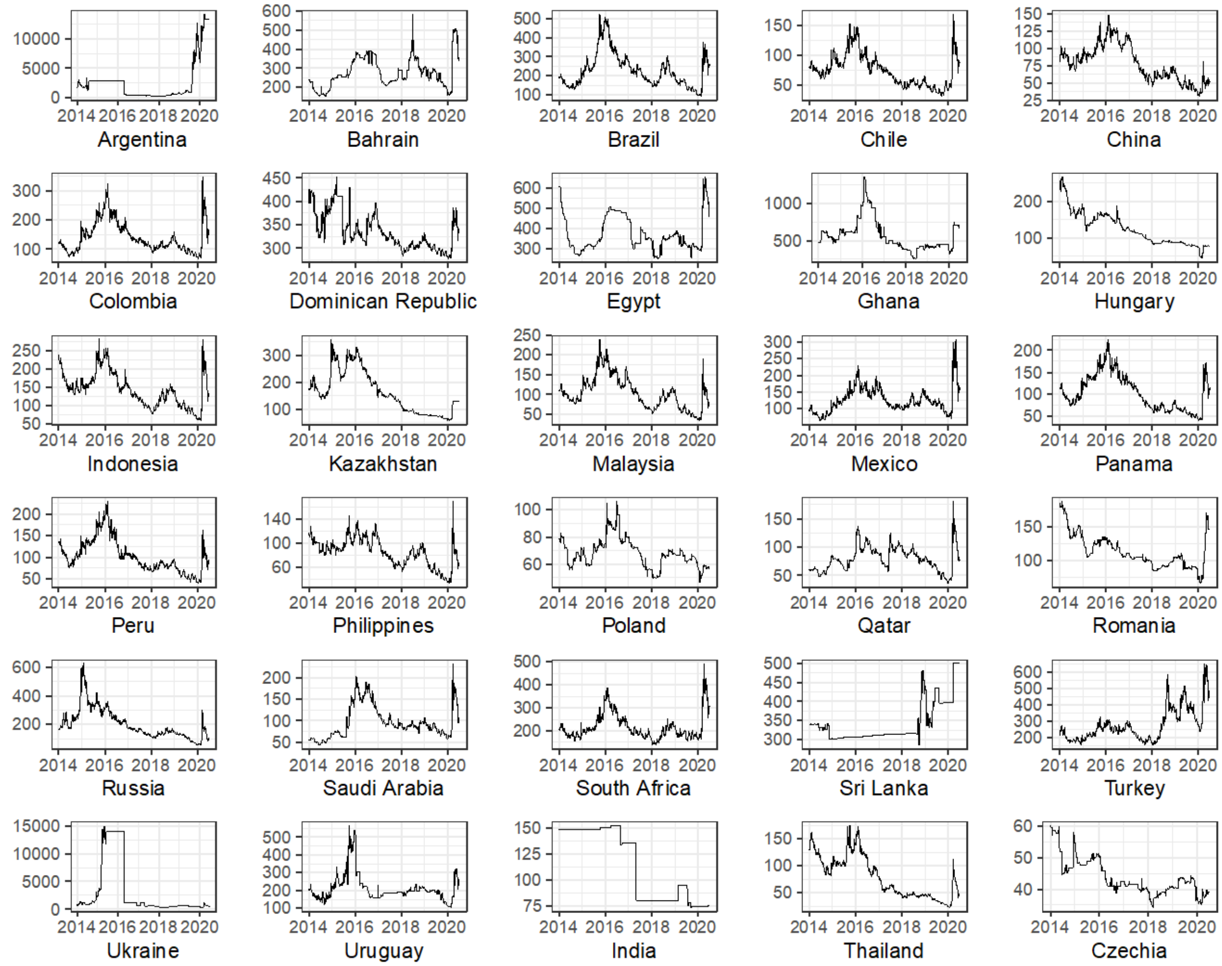

Figure 1: 5-year CDS spreads of emerging market countries (full sample), January 2014 - June 2020. Data source: Eikon Refinitiv.

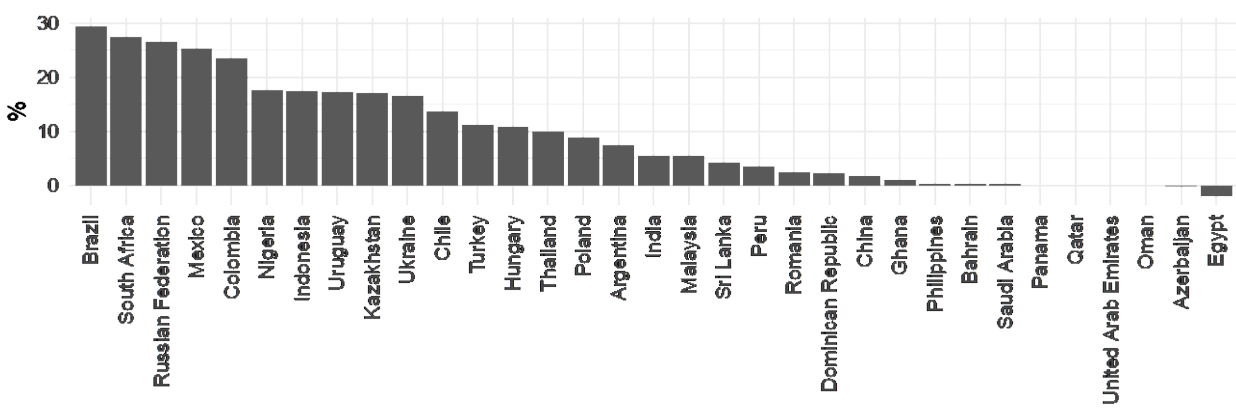

Figure 2: Changes in exchange rates of emerging market countries against the US Dollar between January and March 2020 (full sample). Positive values indicate a weakening of the currency. Data source: Eikon Refinitiv.

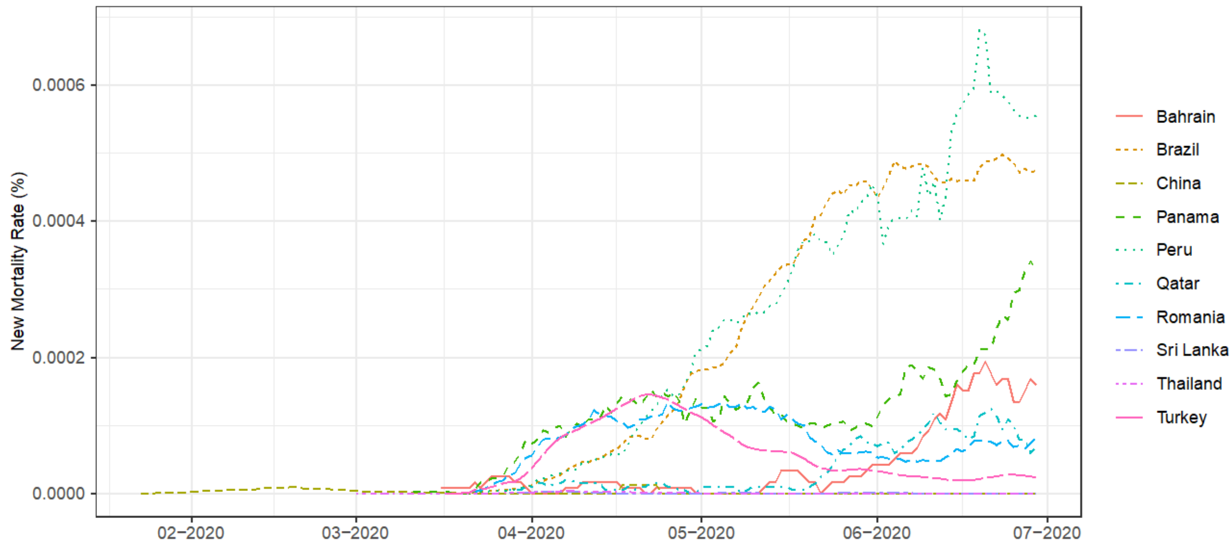

Figure 3: COVID-19 mortality rate curves for the top 5 and bottom 5 emerging market countries as per the end of April 2020 (out of the full sample). New mortality rate as 7-day rolling averages. Data source: JHU CSSE.

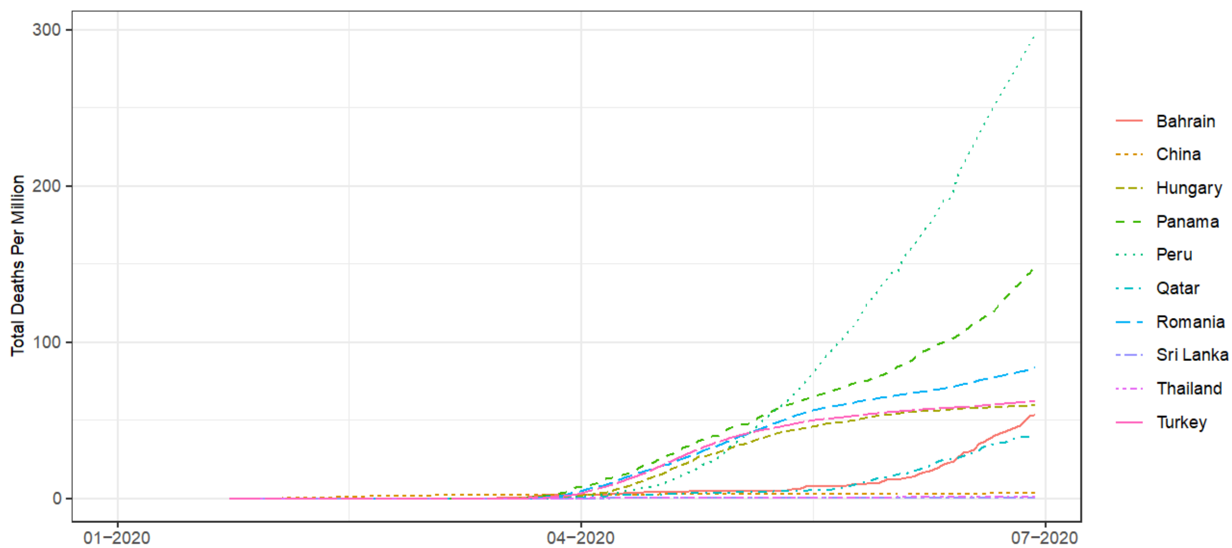

Figure 4 COVID-19 deaths per million residents for the top 5 and bottom 5 emerging market countries as per the end of April 2020 (out of the full sample). Data source: JHU CSSE.

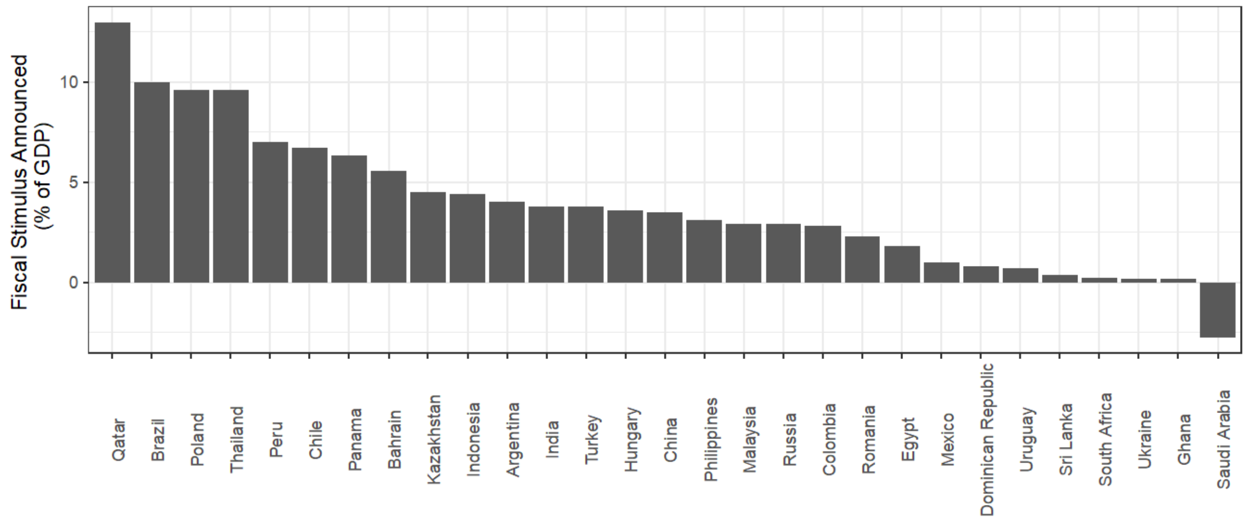

Figure 5: Announced 2020 COVID-related fiscal stimulus of emerging market countries (full sample). COVID-19 fiscal stimulus data taken from the IMF COVID policy tracker.

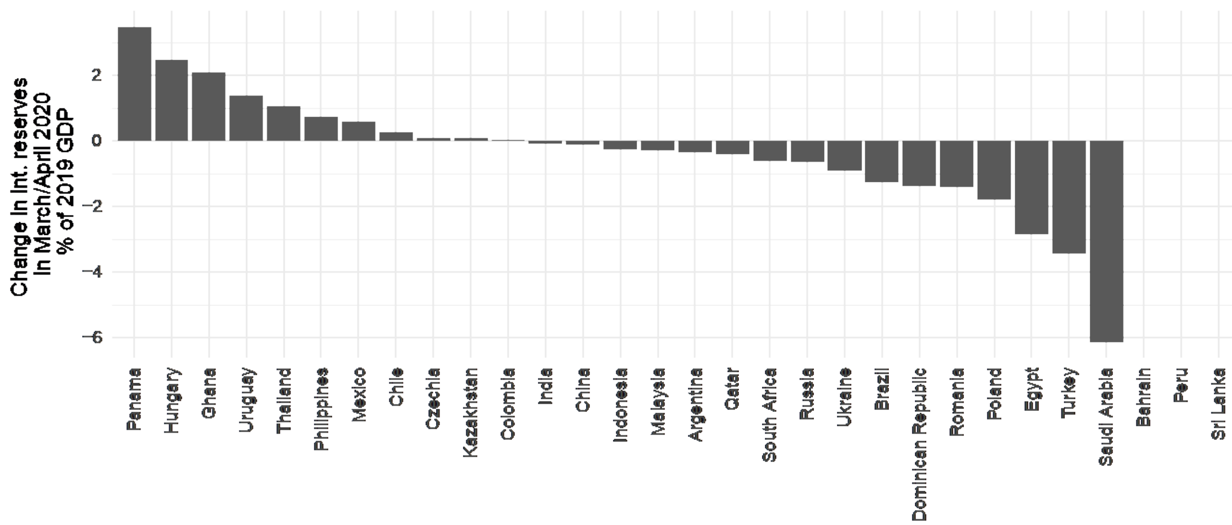

Figure 6: Change in international reserve holdings by emerging market economies between the end of February 2020 and the end of April 2020 as a share of 2019 GDP (full sample). Data source: IMF.

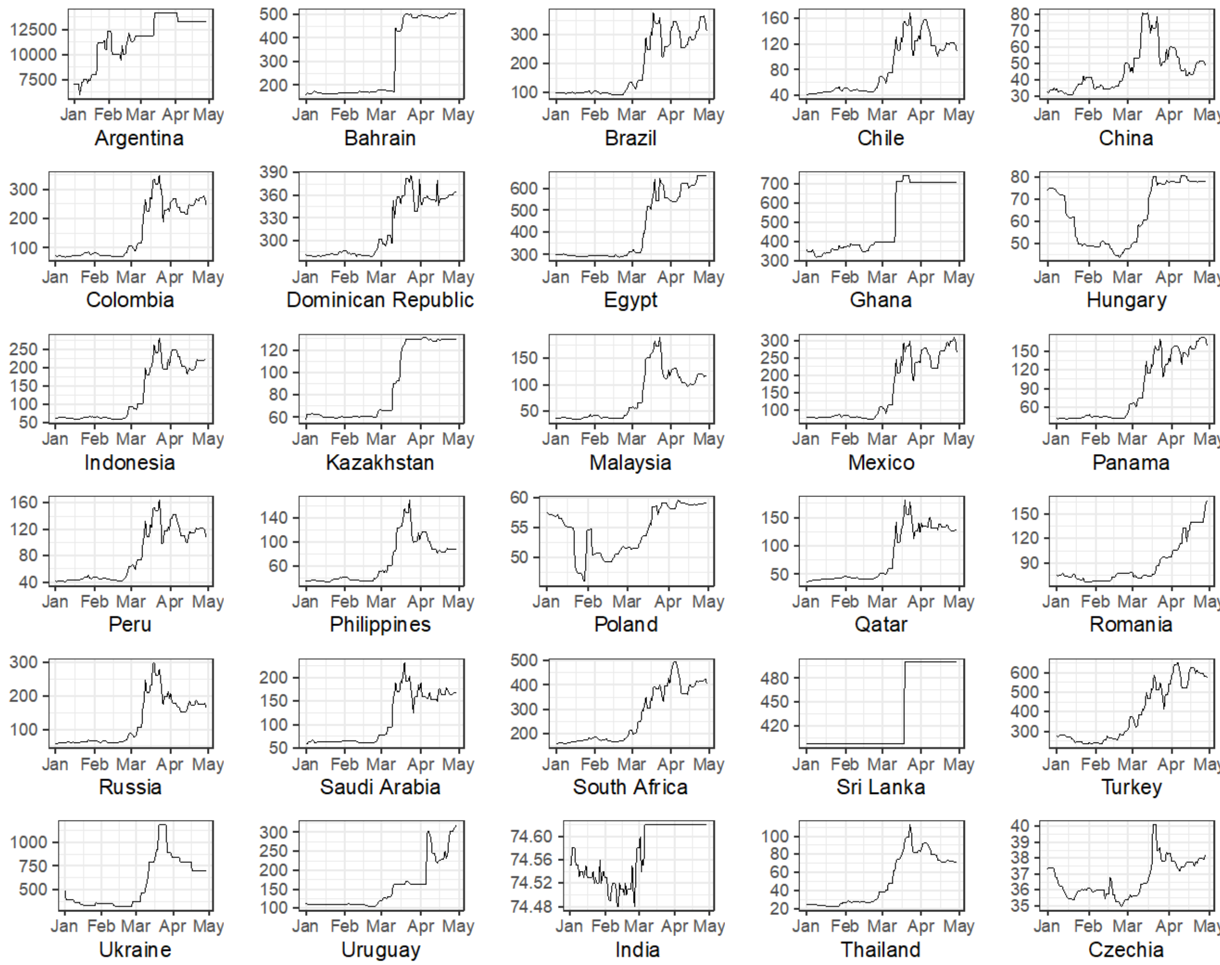

Figure 7: Development of sovereign 5-year CDS spreads of emerging market economies from January 2020 to April 2020 (full sample). Data source: Eikon Refinitiv.

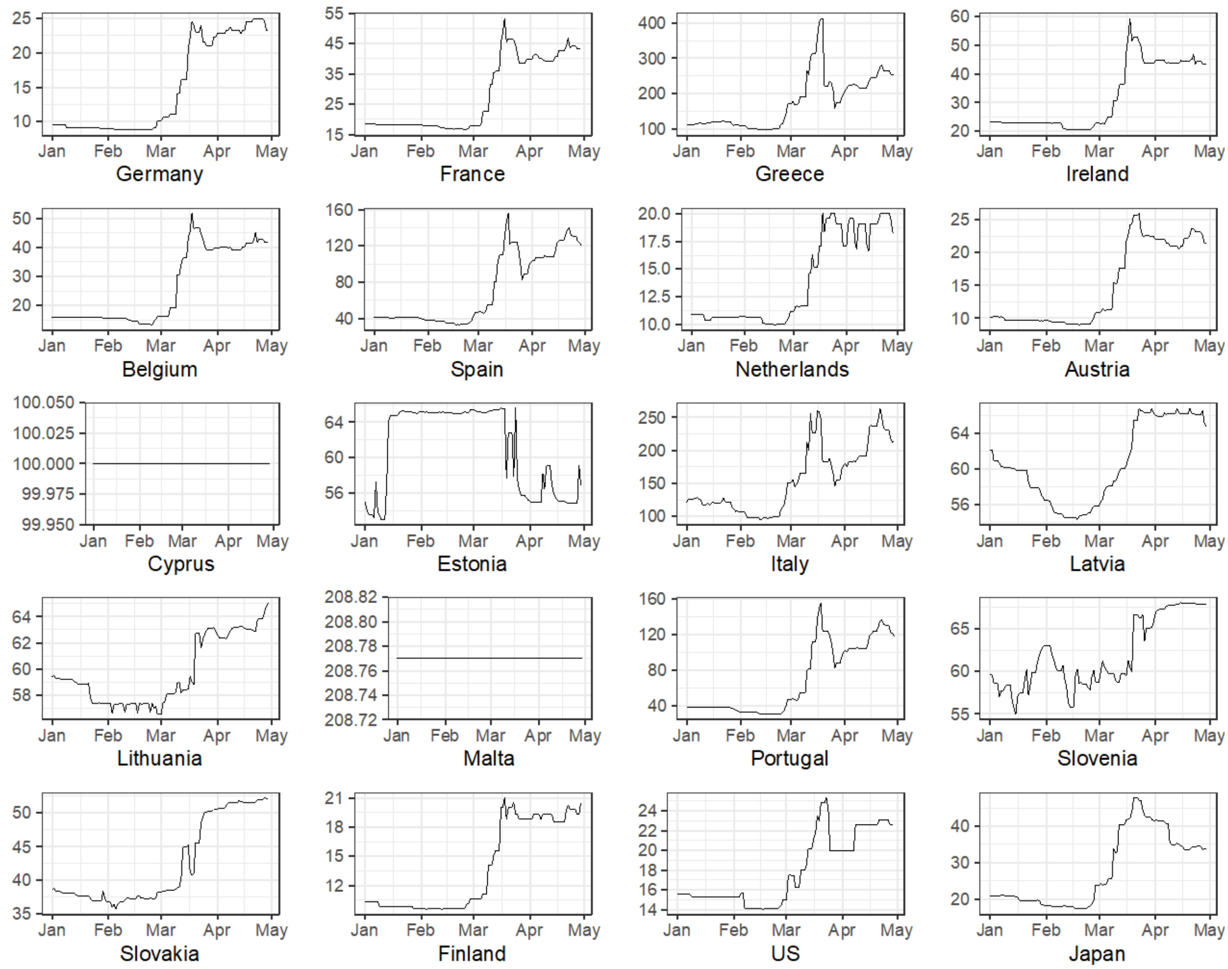

Figure 8: Development of sovereign 5-year CDS spreads of advanced economies from January 2020 to April 2020. Data source: Eikon Refinitiv.

Argentina, Bahrain, Brazil, Chile, China, Colombia, Czechia, Dominican Republic, Egypt, Ghana, Hungary, India, Indonesia, Kazakhstan, Malaysia, Mexico, Panama, Peru, Philippines, Poland, Qatar, Romania, Russia, Saudi Arabia, South Africa, Sri Lanka, Thailand, Turkey, Ukraine, Uruguay

Table 1: List of the 30 emerging markets which constitute our "full" sample. This sample is used to train the model in the first stage. The 30 countries were selected based on the criterion of investibility (as defined by the inclusion in the JP Morgan Chase EMBI index) and data availability.

Eurozone (33.3%), 2019 GDP in Million USD: 13,264,737	Japan (12.8%), 2019 GDP in million USD: 5,081,770	US (53.9%), 2019 GDP in million USD: 21,427,700
Germany, France Greece, Ireland, Belgium, Spain, Netherlands, Austria, Cyprus, Estonia, Italy, Latvia, Lithuania, Malta, Portugal, Slovenia, Slovakia, Finland;		

Table 2: Weights of countries in the global factor are in brakes. The weights are constructed by dividing the country's 2019 GDP by all 20 countries' combined 2019 GDP. Luxemburg is not included in the Eurozone as no CDS data was available for it.

Africa	**CentralAsia**	**EastAsia**	**Europe**	**LATAM**	**MiddleEast**	**SouthAsia**
Egypt	Kazakhstan	China	Czechia	Argentina	Bahrain	Sri Lanka
Ghana	Russia	Indonesia	Hungary	Brazil	Qatar	India
South Africa		Malaysia	Poland	Chile	Saudi Arabia	
		Philippines	Romania	Colombia		
		Thailand	Turkey	Dominican Republic		
			Ukraine	Mexico		
				Panama		
				Peru		
				Uruguay		

Table 3: Classification of large sample into geographic groups. These groups are used to calculate the regional factors in the first-stage regression. Example for China: Indonesia's weight is [Indonesia GDP / (GDP of Indonesia, Malaysia, Philippines, Thailand]. Malaysia's weight is [Malaysia GDP / (GDP of Indonesia, Malaysia, Philippines, Thailand].

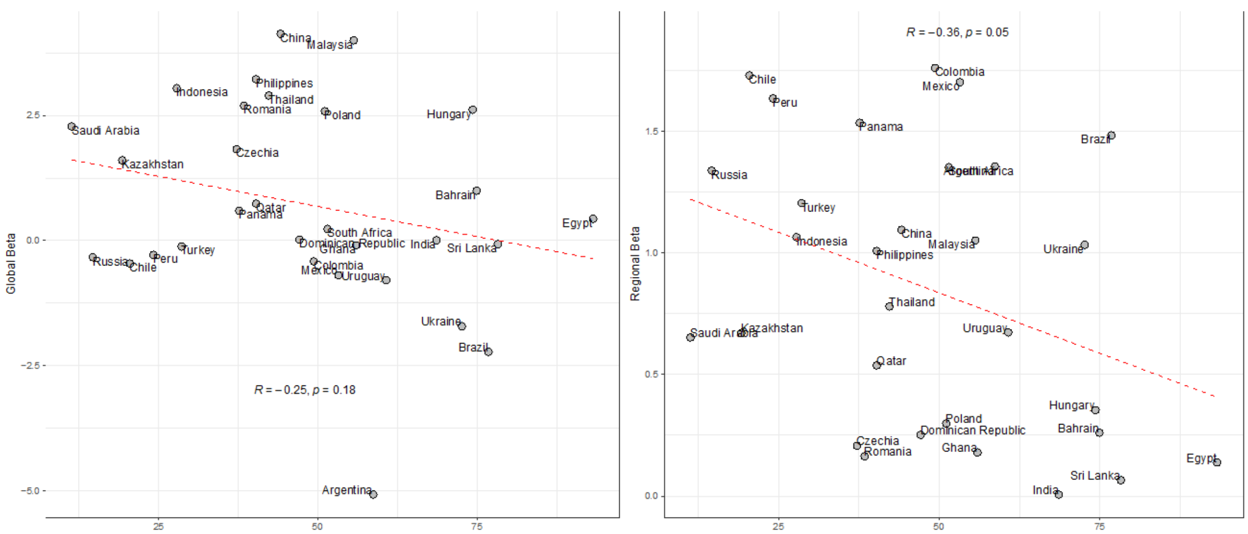

Figure 9: Left side shows scatterplot of global betas vs public debt/GDP (full sample). Right side shows regional betas vs public debt/GDP for the (full sample). Debt/GDP ratios are 5-year averages over the period 2014-2018. The betas are estimated over the period 2014 to June 2019. Data source for debt measures: IMF.

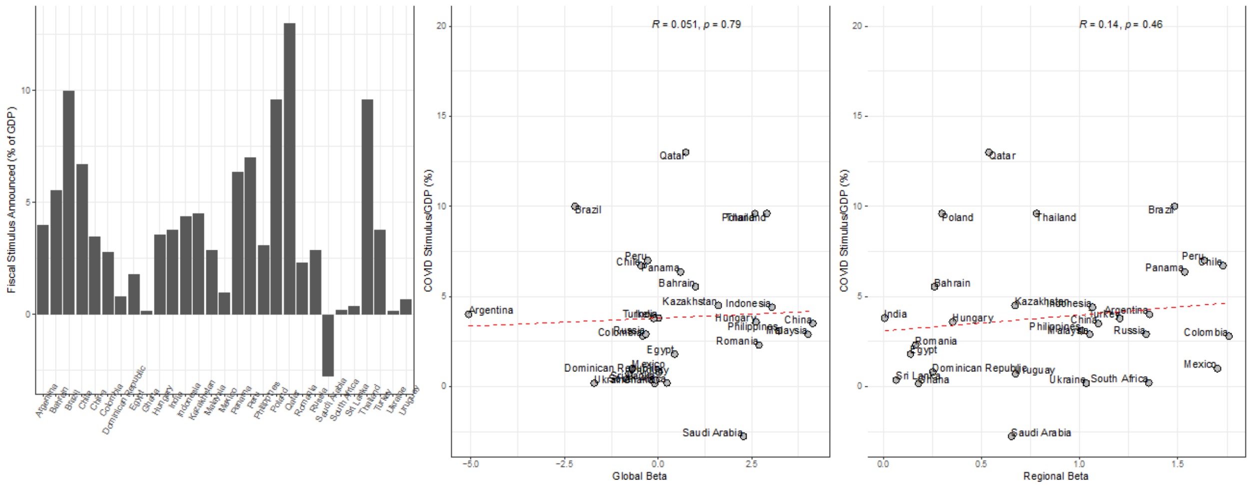

Figure 10: Announced 2020 COVID-related fiscal stimulus versus global and regional betas. The betas are estimated over the period 2014 to June 2019 (full sample). Data on fiscal stimulus is from the IMF COVID response policy tracker.

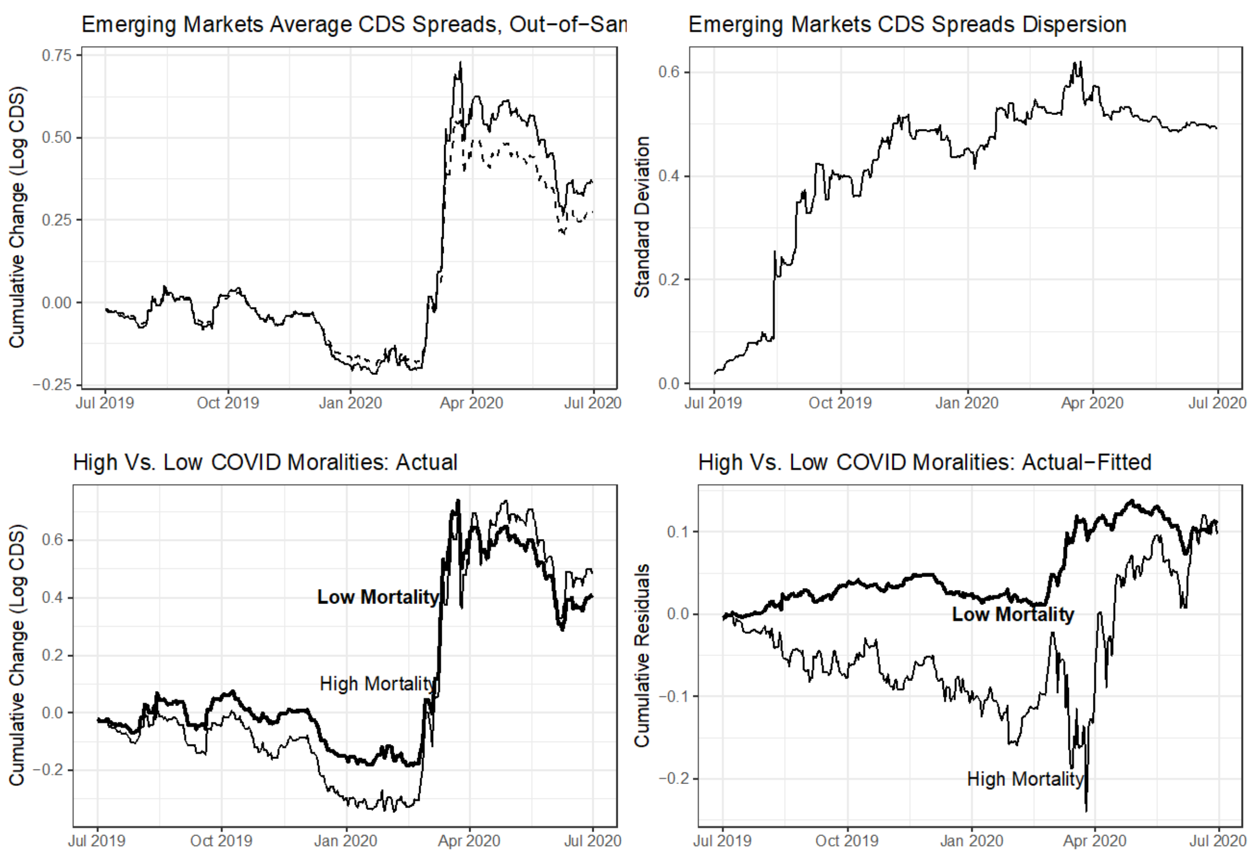

Figure 11: Emerging market spread development, July 2019- June 2020 (reduced sample).

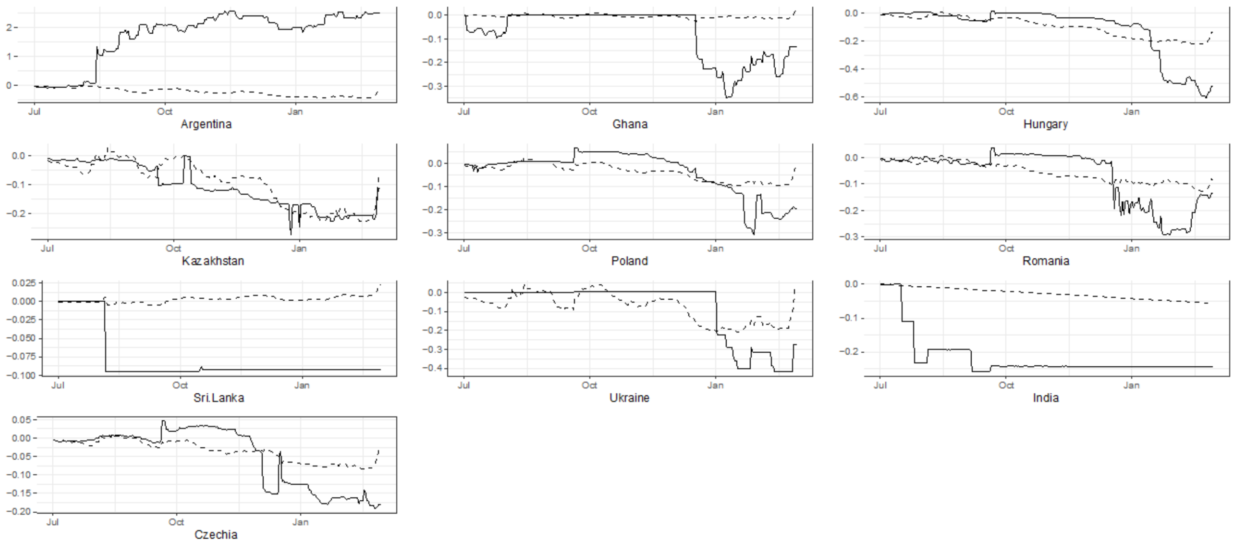

Figure 12: Actual vs fitted values before COVID (July 2019 to January 2020). These are the ten countries for which the correlation coefficient between actual vs fitted values are below 0.25. That is, the model does not do a very good job at predicting the actual values. Therefore, these countries are removed from the full sample and won't be used for the second-stage regressions.

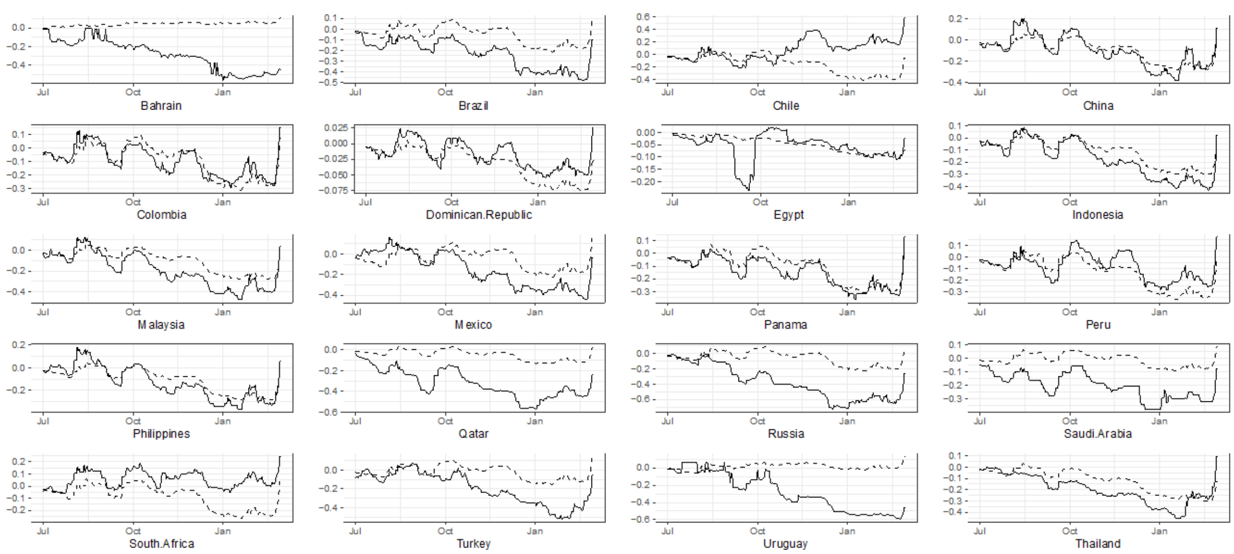

Figure 13: Actual vs fitted values before COVOID (July 2019 to January 2020). These are the 20 countries that constitute the "reduced sample" that is used to run the second-stage regression.

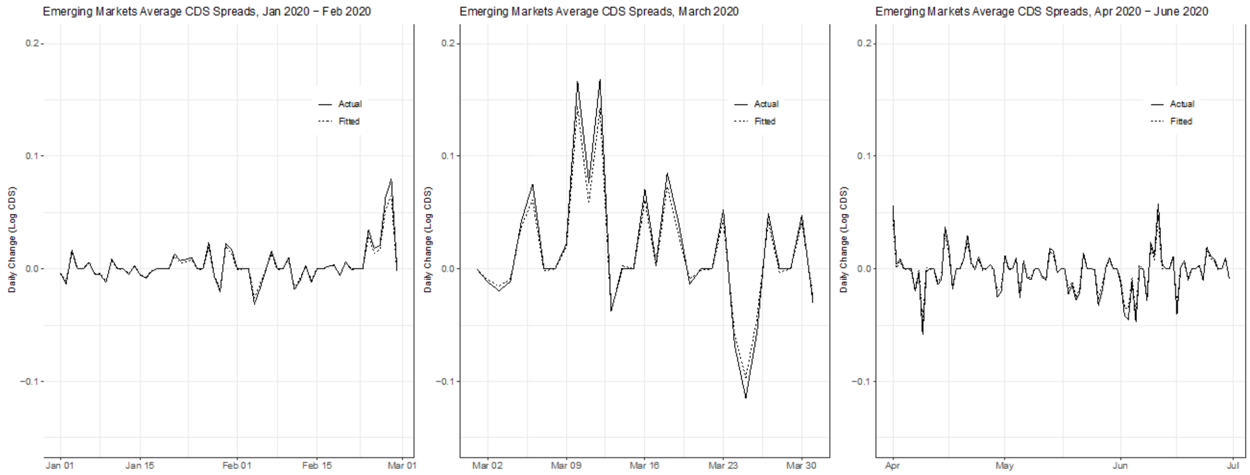

Figure 14: Emerging Market average COVID residual (reduced sample).

10 countries to drop from full sample	20 countries ro remain in reduced sample
Argentina, Ghana, Hungary, Kazakhstan, Poland, Romania, Sri Lanka, Ukraine, India, Czechia	Bahrain, Brazil, Chile, China, Colombia, Dominican Republic, Egypt, Indonesia, Malaysia, Mexico, Panama, Peru, Philippines, Qatar, Russia, Saudi Arabia, South Africa, Turkey, Uruguay, Thailand

Table 4: List of 20 emerging markets that constitute our reduced sample that we use to run the second stage regressions. The 20 countries were obtained after deleting 10 countries from the full sample based on low correlation coefficients between actual vs fitted values over the pre COVID period July 2019 to February 2020.

	Dependent variable:				
	CDS spread COVID Residual				
	(1)	(2)	(3)	(4)	(5)
New Mortality Rate	0.0285	0.0420	0.1606	0.1685	0.1388
	(0.0391)	(0.0448)	(0.1874)	(0.1789)	(0.1704)
New Mortality Rate Growth	0.0027	0.0028	0.0050	0.0052	0.0020
	(0.0051)	(0.0051)	(0.0045)	(0.0046)	(0.0055)
Total Mortality Rate	−0.0071	−0.0101	−0.0385	−0.0420	−0.0307
	(0.0092)	(0.0103)	(0.0512)	(0.0495)	(0.0394)
Total Mortality Rate Growth	−0.0278	−0.0272	-0.0514^{**}	-0.0525^{**}	-0.0407^{*}
	(0.0202)	(0.0220)	(0.0240)	(0.0226)	(0.0245)
Mobility		0.0012^{**}	0.0031^{***}	0.0031^{***}	
		(0.0005)	(0.0006)	(0.0006)	
SI Growth		−0.0063	−0.0075		−0.0063
		(0.0220)	(0.0259)		(0.0224)
ECB Policy Dummy			-0.1459^{***}	-0.1478^{***}	-0.0882^{**}
			(0.0285)	(0.0296)	(0.0388)
Fed Policy Dummy			-0.0486^{*}	-0.0488^{*}	−0.0183
			(0.0277)	(0.0277)	(0.0261)
Ext. Debt/GDP			−0.0003	−0.0005	−0.0018
			(0.0025)	(0.0024)	(0.0018)
Ext. Debt/GDP x Fiscal Policy Dummy			0.0009^{*}	0.0009^{*}	0.0006
			(0.0005)	(0.0005)	(0.0006)
Debt owed to China/GDP			0.0709^{*}	0.0683^{*}	0.0077
			(0.0378)	(0.0369)	(0.0403)
Debt owed to China/GDP x Fiscal Policy Dummy			-0.0185^{*}	-0.0188^{*}	−0.0103
			(0.0111)	(0.0112)	(0.0117)
Oil income effect			-0.0904^{***}	-0.0869^{**}	−0.0175
			(0.0332)	(0.0337)	(0.0302)
International Reserves/GDP			−0.3162	−0.3117	−0.1521
			(0.2000)	(0.1971)	(0.2914)
Sovereign Wealth Fund volume/GDP			−0.9802	−0.8499	0.5109
			(1.3513)	(1.3448)	(1.1034)
Fixed effects?	Y	Y	Y	Y	Y
Observations	173	171	153	153	153
R^2	0.0124	0.0533	0.1925	0.1918	0.0647
F Statistic	0.3781	1.1070	1.4777	1.5933^{*}	0.4644
Note:	*,**,*** correspond to 10%, 5% and 1% significance, respectively. HAC robust standard errors, clustered by country. Time and Country FEs.				

Table 5: Sovereign spread COVID residual, reduced sample, March 2020 pandemic period.

	Dependent variable:				
	Daily CDS Spread Change				
	(1)	(2)	(3)	(4)	(5)
Fitted Daily CDS Spread Change	0.5684**	0.6485**	0.9171***	0.9107***	0.6049*
	(0.2698)	(0.2620)	(0.3276)	(0.3309)	(0.3461)
New Mortality Rate		0.0298	0.1624	0.1695	0.1499
		(0.0419)	(0.1862)	(0.1774)	(0.1623)
New Mortality Rate Growth		0.0020	0.0047	0.0048	0.0010
		(0.0052)	(0.0048)	(0.0049)	(0.0057)
Total Mortality Rate		−0.0069	−0.0383	−0.0415	−0.0310
		(0.0098)	(0.0504)	(0.0486)	(0.0367)
Total Mortality Rate Growth		−0.0267	−0.0509**	−0.0518**	−0.0393*
		(0.0196)	(0.0234)	(0.0218)	(0.0234)
Mobility			0.0030***	0.0030***	
			(0.0008)	(0.0008)	
SI Growth			−0.0067		−0.0029
			(0.0258)		(0.0249)
ECB Policy Dummy			−0.1444***	−0.1460***	−0.0884**
			(0.0282)	(0.0289)	(0.0359)
Fed Policy Dummy			−0.0484*	−0.0485*	−0.0211
			(0.0275)	(0.0274)	(0.0287)
Ext. Debt/GDP			−0.0003	−0.0005	−0.0019
			(0.0025)	(0.0024)	(0.0016)
Ext. Debt/GDP x Fiscal Policy Dummy			0.0008	0.0009	0.0004
			(0.0006)	(0.0006)	(0.0006)
Debt owed to China/GDP			0.0692*	0.0667*	0.0076
			(0.0400)	(0.0390)	(0.0391)
Debt owed to China/GDP x Fiscal Policy Dummy			−0.0179	−0.0182	−0.0086
			(0.0123)	(0.0124)	(0.0120)
Oil income effect			−0.0887**	−0.0854**	−0.0182
			(0.0360)	(0.0364)	(0.0292)
International Reserves/GDP			−0.3180	−0.3141	−0.1813
			(0.1987)	(0.1955)	(0.2874)
Sovereign Wealth Fund volume/GDP			−0.9351	−0.8154	0.5380
			(1.3855)	(1.3749)	(1.0528)
Fixed effects?	Y	Y	Y	Y	Y
Observations	620	173	153	153	153
R^2	0.0399	0.0687	0.2116	0.2111	0.1054
F Statistic	23.6398***	1.7567	1.5436	1.6591*	0.7303

Note: *,**,*** correspond to 10%, 5% and 1% significance, respectively.
HAC robust standard errors, clustered by country. Time and Country FEs.

Table 6 Panel Analysis on Daily CDS spread change, reduced sample, March 2020 pandemic period.

Bibliography

Ahmed, S., Coulibaly, B., & Zlate, A. (2017). International financial spillovers to emerging market economies: How important are economic fundamentals?. *Journal of International Money and Finance*, *76*, 133-152.

Alberola-Ila, E., Arslan, Y., Cheng, G., & Moessner, R. (2020). *The fiscal response to the Covid-19 crisis in advanced and emerging market economies* (No. 23). Bank for International Settlements.

Ertugrul, H. M., & Ozturk, H. (2013). The drivers of credit default swap prices: Evidence from selected emerging market countries. *Emerging Markets Finance and Trade*, *49*(sup5), 228-249.

Fender, I., Hayo, B., & Neuenkirch, M. (2012). Daily pricing of emerging market sovereign CDS before and during the global financial crisis. *Journal of Banking & Finance*, *36*(10), 2786-2794.

Forbes, K J and F E Warnock (2012), "Capital Flow Waves: Surges, Stops, Flight, and Retrenchment", *Journal of International Economics* 88: 235-251.

Heller, P. (2005), *Understanding Fiscal Space.* IMF Policy Discussion Paper 05/4. International Monetary Fund, Washington, DC.

Horn, Sebastian, Carmen M. Reinhart, and Christoph Trebesch. 2019. "China's Overseas Lending." NBER Working Paper No. 26050. The data is yearly. (HRT China Debt Stock Database update April2020.xlsx)

Ismailescu, I., & Kazemi, H. (2010). The reaction of emerging market credit default swap spreads to sovereign credit rating changes. *Journal of Banking & Finance*, *34*(12), 2861-2873.

Jinjarak, Yothin, et al. Accounting for Global COVID-19 Diffusion Patterns, January-April 2020. No. w27185. National Bureau of Economic Research, 2020.

Jinjarak, Yothin, et al. 2020. Pandemic Shocks and Fiscal-Monetary Policies in the Eurozone: COVID-19 Dominance During January - June 2020. NBER Working Paper No. 27451.

Kocsis, Z., & Monostori, Z. (2016). The role of country-specific fundamentals in sovereign CDS spreads: Eastern European experiences. *Emerging Markets Review*, *27*, 140-168.

Panjwani, Ahyan, Ross, Chase. A Long Way to Go for Emerging Markets. Retrieved form: https://som.yale.edu/blog/long-way-to-go-for-emerging-markets. (2020)

Remolona, E. M., Scatigna, M., & Wu, E. (2008). The dynamic pricing of sovereign risk in emerging markets: Fundamentals and risk aversion. *The Journal of Fixed Income*, *17*(4), 57-71.

Rey, Hélène, "Dilemma not Trilemma: The global financial cycle and monetary policy independence." Federal Reserve Bank of Kansas City working paper (2013).

Tarashev, N., Tsatsaronis, K., & Karampatos, D. (2003). Investors' attitude towards risk: what can we learn from options. *BIS Quarterly Review*, *6*, 57-65.