THE EVOLUTION OF EMERGING MARKET (EM) SOVEREIGN CDS SPREADS DURING COVID-19

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Abstract: The COVID-19 is expected to hit emerging markets particularly hard, as many containment measures have been found to be less effective in the context of emerging markets. This study examines emerging market sovereign CDS spreadsduring the pandemic and assesses the relative importance of global factors, sovereign fundamentals, COVID-19 mortality, and policy responses. The analysis suggests that while emerging market sovereign CDS spreads can be explained by regional and global risk factors prior to COVID-19, they were determined by fiscal space, commodity revenues, and mobility dynamics during the pandemic, but not directly by changes in country-specific of the pandemic mortality rates. This case study compares the importance of dominant market factors relative to COVID-19 dynamics and policy responses to explain the daily evolution of emerging markets (EM) sovereign CDS spreads in the first half of 2020.

Topic: Computing &Applications, economics & financial systems.

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1 INTRODUCTION

The COVID pandemic triggered an economic crisis with vicious violence. Regional and national closures led to disruptions in global value, chain stores and home orders squeezed consumer demand and, as a result, business and personal incomes, and oil prices plummeted. In fact, this price drop occurred as the U.S. and Europe experienced their first waves of COVID, while many emerging countries were in the early stages of their infection curves. As a result, for some of the world's emerging and developing countries, the effects of the pandemic manifested themselves first in foreign trade and only then in domestic health issues. In particular, commodity-dependent emerging markets are going through a particularly difficult first half of 2020. They wer

first hit by a "wave" of oil and other commodities and then with the wave of COVID infections.In this article, we contribute to the discussion of the relative importance of global factors. Specifically, we compare the importance of dominant market factors in relation to the dynamics of COVID-19 and policy responses to

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explain the evolution of emerging market sovereign CDS spreads in the first half of 2020. In doing so, we unravel the effects of the global economic and financial turbulence due to the effects of lower oil prices on emerging markets. The analysis focuses on daily emerging market sovereign CDS spreads, comparing the impact of dominant market factors with the COVID-19 dynamics, the ECB and FED policies and countries' fiscal policies regarding sovereign spreads and fiscal adjustments to collapsing demand. We adopt a multistage econometric approach, drawing on a dataset from an international panel of MEs. In the first step, we estimate a multifactor model for CDS changes spanning several years before the emergence of COVID-19. Specifically, we use the model from January 2014 to June 2019, the "pre-COVID". In the second step, we use the estimated coefficients from the first step to extrapolate the model's implicit changes in CDS spreads from July 2019 to June 2020. This 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 step, we also explain the implicit model and the actual CDS changes by COVID-related factors.

In other words, we examine the residuals and explain them by a panel analysis that uses COVID-related factors in three different areas: epidemiological, economic and political factors.

2 RECENT LITERATURE

Our paper contributes to the literature that attempts to understand the relative importance of global and country-specific factors. We do not attempt to provide a general overview of the previous scholarship and instead refer readers to Augustin (2014) for a recent listing of related studies. Intuitively, one might expect that the pricing of sovereign risk would be determined by country-specific factors, but there is evidence that some of the variation in sovereign CDS spreads is determined by global variables and unrelated to the country-specific context.

This is particularly true for high trading frequencies, although, as we shall see, this is not the case for all periods. Ultimately, it is an empirical question whether global factors, country-specific factors, or both are together responsible for the dynamics of CDS spread. To get an overview, we review the main academic findings from three different camps: the "pro-global", the "pro-local", and the agnostic camp and focus specifically on exchanges dealing with CDS spread markets. This puts our results into perspective and demonstrates the practical use of our method.

2.1 Local risk factors

Using data from 2003 to 2012, Ertugrul& Ozturk (2014) study the relationship between CDS spreads and financial market indicators for bonds, equities, and market currencies for selected EU countries. Their results suggest that CDS spreads have a cointegrating relationship with other financial market indicators for the entire sample.

Another conclusion that deserves special attention is that in the long run, the CDS spread is negatively related to the uncertainties in the CDS market. They argue that this negative relationship indicates low liquidity under high uncertainty, which drives down CDS prices. The variation over time in the effects of each variable on the CDS spread is consistent with the results obtained from the cointegration analyses.

Covering the so-called "taper-tantrum" episode of 2013 and other EM episodes (2017) assess the importance of the use of money in debt management. Economic fundamentals in the transmission of international shocks to financial markets in general in the various emerging market economies. Cross-country regressions lead them to the following results: 1) Emerging economies with relatively better economic fundamentals experienced less deterioration in financial markets during the 2013 market meltdown episode. 2) Differentiation between emerging financial markets Markets were established relatively early and persisted throughout this episode. 3) During the temper tantrum, while holding neither macroeconomic variables nor country ratings significantly explain the spread of CDS changes. Second, measures of U.S. bond, equity, and CDX High Yield yields are the main drivers of CDS spread changes. Finally, their analysis suggests that CDS spreads are more strongly influenced by international spill overs in times of market stress than in normal times, which leaves some room for country-specific factors.

2.3 Global and local risk factors

While the scholarships of the "pro-global" and "pro-local" camps generally recognize each other, they do so more or less casually. However, based on the intuition that financial asset prices are determined by country-specific fundamentals, Remolona et al. (2008) decompose monthly data on risk appetite in emerging markets at 5 years. CDSs are spread 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 relates to country-specific risk measures and the global risk aversion/risk appetite measure. Fundamental variables include inflation, industrial production, consensus forecasts of GDP growth, and currency reserves. Indicators of global risk aversion are as follows: Tsatsaronis&Karamptatos (2003) the 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 main determinant of sovereign risk, whereas country-specific fundamentals and market liquidity are more important for risk. The two components therefore behave differently.

3 Emerging Markets And COVID-19

In contrast to previous crises, the response of emerging markets to the impact of COVID-19 has been decisive:With the exception of Saudi Arabia, all member states put in place fiscal and non-fiscal stimulus packages. While the stimulus packages in emerging market economies may seem impressive at first glance, Alberola et al. (2020) point out that they are not that large compared to advanced economies. In fact, fiscal measures in advanced economies reached 8.3 percent of GDP, 6.6 percentage points (pp) more than following the GFC, while in emerging markets they amounted to only 2 percent of GDP, even less than in the emerging markets of the last financial crisis. The contrast is most striking for credit guarantees: 6.6 percent of GDP in advanced economies and only 0.4 percent in emerging markets. The gap is narrower for financing facilities: 4 percent of GDP in advanced economies compared with 1.3 percent in emerging markets. The difference in fiscal stimulus between advanced and emerging markets may indicate a lack of space for the latter. But it is likely that fiscal constraints account for only part of the difference; another possible reason for the reduction in the fiscal stimulus packages is the lack of space in the advanced and emerging markets. could be the difference in the prevalence of the pandemic: COVID-19 affected advanced economies earlier and more strongly than emerging markets, with the exception of some Asian emerging markets.

Contrary to budgetary constraints, emerging markets 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 greater leeway to reduce policy rates than their advanced counterparts. At the beginning of 2020, policy rates in emerging markets averaged 4.9%.

(Excluding Argentina), while the average policy rate for advanced economies was 0.4 percent.

Since then, member states have cut policy rates by about 114 basis points (excluding Argentina), compared with 40 basis points for advanced economies. However, rate cuts alone are not a panacea for emerging markets. Especially for oil-exporting countries (except for Mexico, which largely covers oil revenues), rate cuts had to go hand in hand with foreign exchange interventions.

4. ANALYSIS OF COVID'S DOMINANCE

In this section, our main objective is to examine whether and to what extent COVID-related developments and the associated policy responses of countries, central banks, and the IMF have influenced the pricing of sovereign risk in emerging markets. In this context, we ask whether and to what extent the dominant factors and dynamics related to COVID have influenced sovereign risk pricing by the pandemic. We propose a two-step econometric analysis that takes advantage of a daily data set of cross-national panels.

In the first step, we estimate a dynamic heterogeneous multi-factor model for changes in 5-year CDS spreads over the period from January 1, 2014 to June 30, 2019. Then, using the estimated parameters of the model, we apply a synthetic control-type procedure to extrapolate the model - implicit change in CDS spreads - given by the realized values of the factors - from July 1, 2019 to June 30, 2020.

This approach allows us to calculate the "COVID residual", i.e. the difference between the realized CDS adjustment to the variation implied by the model at both the individual country level and the aggregate ME level, during the pandemic period.

In a second step, focusing specifically on the 2020 pandemic period, we examine whether daily deaths due to COVIDs, announced policy responses, or other country fundamentals contribute to explaining the variation in the COVID residual.

We are taking several steps to get as close as possible to a causal interpretation of our results.

First, we control for a series of alternative explanatory variables that could skew our results.

Second, we use several specifications and our results remain robust to increase the fixed-effect specification. This shows that these results are not influenced by factors that are time in our sample, such as the advantage enjoyed by some countries in being democratic/non-democratic, having a specific currency, etc.

4.1 Stage 1 Estimate, January 2014 - June 2019 (Table 1) First, we estimate and evaluate a heterogeneous multi-factor model. Our empirical analysis uses daily data for 30 emerging market sovereigns over a period of

6.5 years, from January 10, 2014 to June 30, 2020. We selected 30 MEs based on their undesirability and the availability of data for the dependent variable where undesirability is defined by the representation of a country in the benchmark index for ME sovereigns, the J.P. Morgan Emerging Markets Bond Index.

We chose this specific period because it begins after the structural break in the temper tantrum and to have sufficient data to calibrate and test the model under normal and COVID-times conditions.

4.1.1 Data

We use the following data:

- Sovereign Credit Default Swap (CDS spread). We use 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

First, we estimate a dynamic factor model on the data from the pre-COVID period of the following form:

(1) $\Delta cds_{i,t} = \alpha_i + \phi_i \Delta cds_{i,t-1} + \beta_{i1} \Delta GCDS_t + \beta_{i2} \Delta GCDS_{í,j,t} + \varepsilon_{i,t}$

January 1.2014 $\leq$ t $<$ July 1.2019

And $\Delta CDS_{i,t} = In\,(CDS_{i,t})/(CDS_{i,t-1})$

Our result variable is the daily variation of the logarithm of the dispersion of CDS in the country i. On the right, we include the lagged dependent variable and two factors. A global factor, ΔGDCSt and a regional EM factor ΔRDCSi', j, t. The global factor is constructed as the GDP-weighted cross-sectional average of the daily changes in log CDS over a reference group of 20 advanced economies; the United States, Japan, and 18-euro area member states. It therefore captures the common component of fluctuations in sovereign risk at the global level. The regional factor is constructed slightly differently. The regional factor is constructed slightly differently. It is the GDP-weighted cross-sectional average of the daily variations in the logarithm of CDSs relative to the reference sovereigns of a country in its region. In other words, the 30 emerging markets were first classified into seven reference groups based on their geographical proximity and dependence on oil exports.

We estimate the model over the pre-COVID period from January 1, 2014 to June 30, 2019.

Instead of estimating the model to the end of 2019, we choose this window because it extends from July to December 2019 to validate the out-of-sample accuracy of our model before the COVID shock in 2020. Finally, the COVID residual is defined as follows:

(2) $\Delta cr_{i,t} = \Delta cds_{it} - [\ddot{\alpha}_i + \phi_i \Delta cds_{i,t-1} + \beta_{i1} \Delta GCDS_t + \beta_{i2} \Delta GCDS_{í,j,t}]$

By merely comparing the realized change in log CDS to the expected value of the model, considering the actual realization of the factors and the lagged change in log CDS.

4.1.3 Exposure to global and regional risks and fiscal fundamentals in emerging markets.

Regional and global betas are positively, but not significantly, associated with the size of COVID-related fiscal stimulus in emerging markets. This leaves room for two interpretations: On the one hand, since the coefficients are not statistically significant, it cannot be excluded that systematically riskier countries (higher regional betas) issued less stimulus/GDP due to considerations of lack of fiscal space. On the other hand, if Saudi Arabia, which is an outlier, were removed from the sample, the coefficients would become potentially significant. This, in turn, could mean that although countries with high betas would generally find it difficult to engage in deficit spending, the seriousness of the situation, coupled with a low interest rate environment, could mean that countries that would otherwise be perceived as risky could engage in economic stimulus.

4.2 Second estimation phase, January - June 2020

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

- January-February 2020 (start of COVID)
- March 2020 (peak COVID)
- April-June 2020 (end of COVID)

4.2.1 Data

- Infections. We use daily infections by country reported by the Johns Hopkins University Center for Systems Science and Engineering (JHU CSSE). Figures include confirmed and probable when reported.

- Deaths. We use the daily deaths by country reported by JHU CSSE. Figures include confirmed and probable where it was reported.
- Mobility. We use daily routing requests by country reported by Apple (driving; walking; public transit).
- Index of stringency. We use the Oxford COVID-19 Government Response Tracker as a measure that records the stringency of "lock-in style" policies that primarily restrict people's behavior.- Daily fiscal and monetary policy announcements. This information was collected for individual countries, for the Central Bank, and for the Federal Reserve. These columns indicate whether an action or proposal was made by a given nation/institution on a specific date in the but do not control the size or number of fonts on a given day. A line is coded "1" if the date corresponds to the announcement of at least one political key. Except for the Federal Reserve (whose major announcements were related to interest rate cuts and budget spending), we have restricted our analysis of key fiscal policies to those that provided "millions" or "billions" of local currency spending units.

The extended list of sources used to aggregate these data can be found in the online appendix.

- External debt. We use the total stock of external and private sector debt as a percentage of GDP as reported by the World Bank. The data are annual.
- Debt owed to China. We use the estimate of the total stock of external debt owed to China in current US dollars as a proportion of the debtor's GDP as reported by Horn et al (2019).

4.2.2 Specification

We first estimate a panel model examining the relationship between the COVID residual, defined as the difference between the realized values of the daily variation in the spread of CDS and the implied values of the dynamic factor model (1), and a set of COVID-related variables from three different domains: pandemic, economy and policy measures. The second step of the model specification is as follows:

$$(3)\quad \Delta cr_{it} = \vartheta_i + \Lambda_t + \Theta X_{it}^{COVID} + yX_{i,t}^{economy} + \eta X_{i,t}^{policy} + \varepsilon_{i,t}$$

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

Economic variables include the effect of oil prices on revenues, RFI announcements, sovereign fund reserves, external debt ratios, and debt to China ratios.

It is interesting to note that all three policy measures, i.e., the FED, the ECB, and country-specific fiscal policies, have statistically significant associations with COVID residuals. Specifically, the interaction of fiscal policy with the level of external debt is positive, indicating that countries that have increased their debt burdens through stimulus measures or countries that already have relatively high debt burdens were likely to see a larger gap in the dynamics of CDS spread. More (hidden) debt Debt to China is also positively associated with CDS residuals, although not statistically significantly so, in all specifications. However, the interaction of debt to China with the fiscal policy dummy is again negatively correlated with CDS spreads and statistically significantly, as is the interaction of (non-hidden) external debt with the fiscal policy dummy. This suggests some investor indifference to the sustainability of the announced stimuli, which can probably be explained in part by the fact that many

Financial market players are not aware of the debt that countries owe to China. Finally, the effect of oil revenues is highly statistically significant in specifications 3 and 4, indicating that oil exporters experience a relative compression of COVID residues compared to oil importers. A noteworthy finding is the F-statistic in the first specification. Since this statistic is not significant, we cannot reject the fact that the group of COVID variables is jointly insignificant. This means that the COVID residuals are not due to COVID-specific risks but rather to traditional drivers of sovereign debt pricing, such as the margin of fiscal manoeuvring, the effects of oil revenues and global factors such as the and European monetary policy,

because Specification 4 contains jointly significant variables.

4.2.3 Residue Review, March 2020

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

(4) $\Delta cds_{i,t} = \vartheta_i + \lambda_t + \Gamma \Delta cds_{i,t} + \Theta X_{it}^{COVID} + y X_{i,t}^{economy} + ɲ X_{i,t}^{policy} + \varepsilon_{i,t}$

With

$\Delta cds_{it} = \ddot{\alpha}_i + \phi_i \Delta cds_{i,t-1} + \beta_{i1} \Delta GCDS_t + \beta_{i2} \Delta GCDS_{i,j,t}$

These are the implied values of the daily changes in the CDS spread generated by the factor model

(1). The fixed effects are again designated by ϑi and λt, representing the fixed effects by country and period respectively.

Essentially, in (4), we separate the two components that make up the COVID residual. In this way, it becomes clear that the regression in (3) with the COVID residual as an outcome variable is equivalent to the restricted regression in (4) when $\Gamma = 1$. (4) relaxes this assumption implicit in (3) and allows for a richer analysis.

5. **Results**(Shown in Table 3)

First, after including the COVID-related variables, the coefficient of the model's implied values remain statistically significant and keep their positive sign, implying that the model's implied values still track the changes in CDS spread achieved during the COVID-19 pandemic, giving merit to our model selection in the first instance.

Second, both the daily new mortality and the growth rate of new mortality are positively and significantly correlated with the daily changes in CDS spread over the specification set. Consistent with the evolution of the time series of COVID residuals shown in the previous section (Figure 1), countries that had higher levels of new daily mortality rates or higher new mortality growth rates were likely to experience a more severe daily spread of CDS changes.

Third, announcements of country-specific budget measures to address the pandemic appear significantly associated with daily CDS changes. Countries that announced fiscal responses and thus increased debt burdens were more likely to experience daily variations in CDS spreads.

It is important to note that our results show that factors specific to COVID explain most of the variation in CDS spread dynamics during the COVID-19 pandemic period. In particular, mortality results, including new daily mortality dynamics, explain about 6% of the variation, with COVID-specific policy announcements adding another 3%. In contrast, dynamic factor model predictions explain only about 2% of the variation over this period, implying that the explanatory power of COVID-specific factors is almost five times greater than that of regional and global factors that did a good job for 18 times the normal range.

The high-frequency regression parameter of the country panel may lead to low overall explanatory power even after controlling for COVID-specific factors in addition to regional and global factors, but comparison of the explanatory power before and after the inclusion of COVID-specific factors suggests that in the model specification, COVID

In Figure 2, we present the overall (average) dynamics of CDS spread for the euro zone countries during the pandemic by plotting the overall realized and implied values of the model. Surprisingly, the global values implicit in our regressions (which consider COVID-specific factors) almost perfectly follow the realized values, so that their lines coincide with each other.

We can see this by plotting the realized aggregate values, the model implied values in column [1] of Table 3 and the model implied values in column [4] of Table 3. Surprisingly, the global values implied by the model in equation [4] - which for COVID

-specific factors, almost perfectly traces the realized values, so that their rows coincide with each other. We therefore conclude that COVID-specific factors play an important role in explaining the divergent dynamics of CDS spread during the pandemic and should not be ignored in the pricing of debt in the euro area during this period.

A potential limitation of the second-step analysis, which may contribute to the overall low R-squared values of the model, is the omission of important variables due to data limitations.

For example, credit tenure could play a key role in the eligibility of assets for purchase by the ECB, but we have no control over this. Another important issue is the interpretation of global and regional factors as reflecting fundamental proxies. If COVID19 is a global shock, then our interpretation of the global factor may not be accurate, as the variation in the global factor may incorporate both fundamental and pandemic information. This is a special case of the more general problem of identifying idiosyncratic or country-specific variations in macroeconomic and financial research, a common dilemma when exploring the extent of financial contagion (Bekaert et al., 2014).

CONCLUSION

We investigate the role that country-specific and global variables have in determining emerging market sovereign CDS during the pandemic Crisis. We use a two-stage econometric model approach. First, a heterogeneous factor model is used to "form" a model that predicts daily changes in CDS spreads based on previous changes and overall CDS dynamics. The method is useful for addressing various data issues that are particularly relevant in emerging markets, such as data unavailability and differences in data frequency.

The model makes relatively accurate forecasts both in-sample (January 2014-June 2019) and out-of-sample (July 2019-December 2019). In 2020, forecasts lose precision and residuals increase. Given that COVID is a global pandemic and that the spread of CDS in countries around the world has been affected, we consider the increase in residuals as a sign that country-specific variables, in particular drive CDS spreads in times of crisis. The residuals are particularly important at the peak of COVID in March 2020, which supports several papers in the literature that focus on the variation over time nature of the relationship between sovereign CDS spreads and the explanatory variables. Second, regressions of residuals on fundamentals suggest that COVID mortality and infections are not as important as the variables to explain CDS spreads the capture of fiscal space, economic activity, FED and ECB actions, and oil price changes. There are two possible interpretations of the relative insignificance of COVID mortality and infections for changes in CDS spread. On the one hand, international investors may view COVID mortality and infection data as noisy and unreliable and not pay too much attention to them when making their investment decisions. On the other hand, international investors may be aware that COVID is a pandemic that may ultimately affect all countries to roughly the same degree in terms of health impacts and therefore focus less on infections and mortality and more on economic performance and stability.

An interesting empirical corollary is the finding that while the external debt and GDP levels of emerging countries are not statistically significant in explaining the COVID residuals, the (hidden) debt to China is statistically significant.

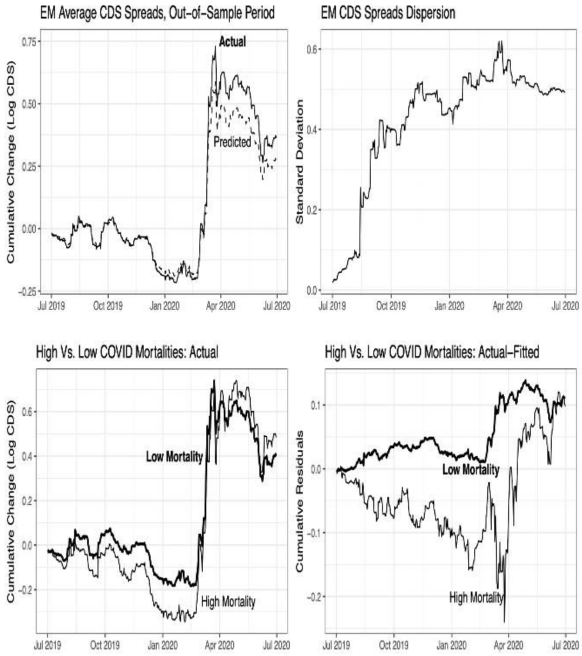
Table 1. First-phase regression results estimated for the period January 2014 to June 2019

Dependent variable $\Delta CDSit$	**Δcds_{it-1}**	**$\Delta GCDS_t$**	**$\Delta RCDS_i$**	**R-Carré**	**Out of sample R-Square: July 1st, 2019 to June 15, 2020**
Germany	-0.395***	0.322***	0.820***	0.22	0.17
France	-0.223***	0.117	1.156***	0.17	0.19
Greece	-0.019	0.083	0.395***	0.04	0.32
Ireland	-0.050**	0.179***	0.905***	0.28	0.26
Belgium	-0.368***	0.300**	0.578***	0.16	0.17
Spain	-0.337***	0.430***	1.833***	0.33	0.17

Netherlands	-0.212***	0.235***	0.566***	0.15	0.22
Austria	-0.269***	-0.097	0.955***	0.17	0.12
Cyprus	-0.125***	0.161*	0.149**	0.03	0.20
Estonia	-0.222***	-0.156***	0.167***	0.09	0.07
Italy	0.021	0.305***	1.470***	0.37	0.16
Latvia	-0.034	0.407***	0.158***	0.09	0.01
Lithuania	-0.093***	0.275***	0.189***	0.10	0.01
Portugal	-0.052**	0.407***	1.229***	0.30	0.55
Slovenia	-0.127***	0.170***	0.200***	0.09	0.01
SlovakRepublic	-0.168***	0.305***	0.173***	0.16	0.01
Finland	-0.175***	0.209***	0.459***	0.18	0.19

NB: Country-specific time series regression estimates from equation 1. Dependent is the change in the daily CDS spread. ***,**,* correspond to 1, 5, and 10 percent significance, respectively. Out-of-sample (pseudo) R-squared reports the percentage change in the real Δcdsit explained by the model's implied values over the out-of-sample estimation period, July to December 2019. Number of daily observations per country, T, equal to 1.432.

Figure 1: Emerging market sovereign CDS from July 2019 to June 2020.



Source*: Hevia, C, P A Neumeyer (2020), "A perfect storm: COVID-19 in emerging economies", VoxEU.org, 21 April.

Note: The top left panel of the figure plots the actual changes in the mean cumulative ME (log) CDS spread over the period COVID-19 (solid) compared to those implied by the factor model (dashes). First, it should be noted that the factor model does a good job of predicting changes in the CDS spread to the end of 2019. However, from 2020 onwards, the actual and predicted series start to diverge. The gap between actual and predicted only begins to narrow in March 2020, when governments and central banks around the world announced economic stimulus packages. The top right panel shows the cross-country dispersion of CDS spreads over the same period. While the dispersion increased in the second half of 2019, it increased in March 2020, highlighting the emergence of country-specific exposure. The lower panels compare the five countries with the highest mortality rates to the five countries with the lowest mortality rates in April. The lower left panel suggests that the evolution of actual CDS spreads has been similar for high mortality and low mortality countries. Nevertheless, the lower right panel indicates that the high-mortality countries initially experienced larger fluctuations in their CDS spreads, but that the gap between actual and expected values became similar to that of the low-mortality countries in July.

Table 2 Residual COVID sovereign deviations, reduced sample, pandemic period March 2020.

Sovereign Variances Residual COVID			
	(1)	(2)	(3)
New mortality rate	0.0096** (0.0043)	0.0102* (0.0055)	0.0108* (0.0056)
New growth in mortality rate	0.0033*** (0.0008)	0.0035*** (0.0010)	0.0033*** (0.0010)
Total mortality rate	-0.0004 (0.0006)	-0.0004 (0.0008)	-0.0004 (0.0008)
Growth in total mortality rate	-0.0456 (0.0433)	-0.0510 (0.0482)	-0.0510 (0.0492)
Mobility		0.0004 (0.0006)	0.0003 (0.0006)
SI Growth		0.0093 (0.0553)	0.0141 (0.0567)
Country-by-country budget policy announcement			0.0394* (0.0219)
Announcement on EU tax policy			-0.0065 (0.0647)
ECB policy announcement			0.0323 (0.0696)
Fed policy announcement			0.0414 (0.0747)
Fixed Effects	Y	Y	Y
Observations	156	149	149
R2	0.0416	0.0423	0.0600
F Statistic	1.2362	0.7883	0.6569

Note:
Pandemic Sample: Data as of March 2020; Residual COVID: The difference between the actual adjustment of the CDS and the change implied by the model, both at the level of individual countries and at the level of the aggregated EA (Embryonic Zebrafish) over the pandemic period. *, **, *** correspond to an importance of 10%, 5% and 1% respectively. Robust HAC standard errors, grouped by country. EFPs of time and country.

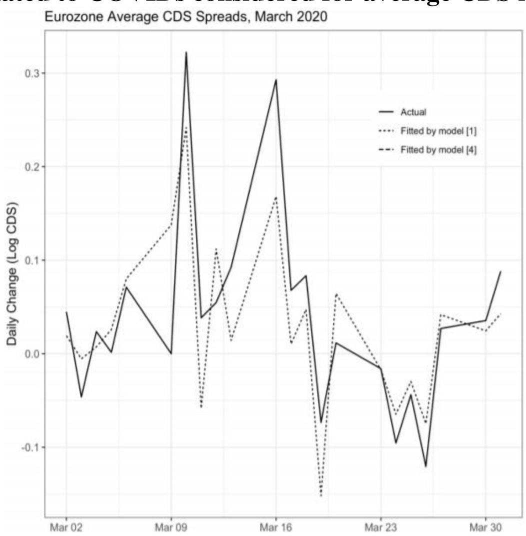
Table 3. Panel Analysis of Daily Change in CDS spreads, Pandemic Sample

Dependent variable / Daily change in CDS Gap	(1)	(2)	(3)	(4)
Daily change in CDS spreads	0.3689** (0.1797)	-0.4345** (0.1912)	-0.4707** (0.1954)	- 0.5135*** (0.1856)
New mortality rate		0.0086** (0.0034)	0.0087* (0.0047)	0.0094* (0.0050)
New growth in mortality rate		0.0038*** (0.0008)	0.0038*** (0.0011)	0.0029*** (0.0010)
Total mortality rate		-0.0005 (0.0004)	-0.0005 (0.0006)	-0.0004 (0.0006)

Growth in total mortality rate		0.0169 (0.0407)	-0.0151 (0.0478)	-0.0135 (0.0473)
Mobility			0.00002 (0.0008)	-0.0001 (0.0007)
SI growth			0.0044 (0.0464)	0.0069 (0.0407)
Country-by-country budget policy announcement				0.0475** (0.0218)
Announcement on EU tax policy				0.0138 (0.0584)
ECB policy announcement				-0.0261 (0.0678)
Fed policy announcement				-0.0509 (0.0558)
Effets fixes	Y	Y	Y	Y
Observations	374	156	149	149
R2	0.0206	0.0812	0.0866	0.1184
F Statistic	7.0406***	1.9975*	1.4351	1.2448

Note:
Pandemic Sample: Data after March 2020; COVID Residual: The difference between the actual CDS adjustment and the change implied by the model, both at the individual country level and the aggregate EA levels during the pandemic period. *, **, *** correspond to 10%, 5% and 1 respectively. Robust HAC standard errors, grouped by country. FEs by time and country.

Figure 2: Risks and factors related to COVIDs considered for average CDS in the euro zone.



*Note: Solid lines reflect average daily changes in euro zone CDS spreads. Dotted lines reflect the average expected changes in euro area CDS spreads, as specified in [1] and [4] in table 2, respectively.

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