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Modelling CDS Volatility at Different Tenures: An Application for Latin-American Countries

By: Fredy Gamboa-Estrada
José Vicente Romero

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Modelling CDS Volatility at Different Tenures: An Application for Latin-American Countries*

FREDY GAMBOA-ESTRADA+ JOSÉ VICENTE ROMERO ++

Abstract

Assessing the dynamics of risk premium measures and its relationship with macroeconomic fundamentals is important for both macroeconomic policymakers and market practitioners. This paper analyzes the main determinants of CDS in Latin-America at different tenures, focusing on their volatility. Using a component GARCH model, we decompose volatility between permanent and transitory components. We find that the permanent component of CDS volatility in all tenors was higher and more persistent in the global financial crisis than during the recent COVID-19 shock.

JEL Classification: C22, C58, G01, G15.

Keywords: Credit default swaps (CDS), CDS in Latin-American countries, sovereign risk, volatility, crisis, component GARCH models.

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+ Researcher, Monetary and International Investment Division, Banco de la República. E-mail: fgamboes@banrep.gov.co. Correspondent author at Carrera 7 #14-78, Bogotá, Colombia, Tel.+57 1 3430756.

++ Junior Researcher, Macroeconomic Modelling Department, Banco de la República. E-mail: jromerch@banrep.gov.co.

MODELLING CDS VOLATILITY AT DIFFERENT TENURES: AN APPLICATION FOR SOME LATIN-AMERICAN COUNTRIES

Modelación de la Volatilidad de los CDS a Diferentes Plazos: Una Aplicación para Países Latinoamericanos

FREDY GAMBOA-ESTRADA   JOSÉ VICENTE ROMERO

Resumen

Evaluar la dinámica de las medidas de prima de riesgo y su relación con los fundamentales macroeconómicos es importante tanto para quienes implementan las políticas macroeconómicas como para los participantes del mercado. En este documento se analizan los principales determinantes de los CDS para economías de Latinoamérica a diferentes plazos, enfocándose en su volatilidad. Empleando un modelo GARCH por componentes, se realiza una descomposición de la volatilidad de los CDS a diferentes plazos entre un componente permanente y transitorio. En los resultados se encuentra que el componente permanente de la volatilidad de los CDS en todos los plazos fue mayor y más persistente durante la crisis financiera global que durante el episodio más reciente relacionado con el choque del COVID-19.

Clasificación JEL: C22, C58, G01, G15.

Palabras clave: Credit default swaps (CDS), CDS de países en Latinoamérica, riesgo soberano, volatilidad, crisis, modelos GARCH por componentes.

1 Introduction

Sovereign credit default swaps (CDS) are derivatives that provide insurance against the credit risk of the default on government debt. Studying the dynamics of CDS is important for macroeconomic policymakers and market practitioners as high and volatile sovereign risk premiums could have negative effects on the economy. In this context, modelling the level of sovereign CDS spreads provide an indication of sovereign credit risk while modelling their volatility gives a measure of uncertainty about the economic conditions of a country and the response of an economy to specific international shocks such as the global financial crisis of 2008 and 2009 and the recent COVID 19 pandemic. Therefore, high levels of country risk volatility could be associated with episodes in which an economy could be more susceptible to default on its debt.

Our paper enlarges the literature on analyzing the determinants of CDS and its contribution is twofold. On one hand, this is the first analysis we are aware of that documents the determinants of CDS at different tenures in Latin America, including the recent period of the Covid-19 pandemic, using an empirical approach that allows to differentiate between local and global risk factors. On the other, we decompose CDS volatility between permanent and transitory components. This approach permits us to examine CDS volatility persistence. We show that permanent sovereign risk premium volatility during the Global Financial Crisis was higher than during the COVID-19 shock. In addition, we find that different stress episodes seem to affect the term structure of the CDS volatility curve.

This article consists of five sections including this introduction. The second section briefly reviews the literature on CDS determinants. The third section describes the data and stylized facts about the performance of CDS in Brazil, Chile, Colombia, Mexico, and Peru. Section four presents the econometric approach and the main results. The last section summarizes the main findings and discusses policy implications.

2 Literature Review

The literature on CDS has focused on analyzing its main determinants in advanced and emerging economies. Nevertheless, the literature on the determinants of CDS at different tenures and the pattern of its volatility is scarce. The most influential research we are aware of are Belke & Gokus (2011), Aizenman & Jinjarak (2013), Gündüz & Kaya (2013), Calice, Mio, Štěrba, & Vašíček (2015), Bouri, de Boyrie & Pavlova (2017), Sabkha, de Peretti, & Mallek (2020).

Belke & Gokus (2011) analyze the volatility patterns of CDS spreads, bond yield spreads and stock prices of four large US financial institutions between 2006 and 2009. Using a multivariate GARCH model, they evidence that volatility, especially that of CDS spreads is significantly higher in times of crisis.

Aizenman & Jinjarak (2013) develop a model for CDS spreads of sixty countries including advanced and emerging economies over 2005-2010. Using dynamic panel estimates they find that fiscal space and other macroeconomic factors such as trade openness, the TED spread, external debt, and inflation play an important role in the pattern of CDS at 5-year tenure. The authors provide the robustness checks using CDS at 3- and 10-year tenure. The results support the important effects of fiscal measures on sovereign spreads.

Gündüz & Kaya (2013) test the long memory behavior of sovereign CDS spread changes and their volatilities in 10 eurozone countries during the financial crisis. Although, CDS spread changes did not show any persistence behavior during the crisis, their volatilities had a long memory process.

Calice, Mio, Štěrba, & Vašíček (2015) investigate the behavior of the CDS term premium for five European countries defined as the difference between CDS spreads at 5 and 10 years. They decompose the premium into a permanent (nonstationary) and a transitory (stationary) component and estimate their determinants in each of the volatility regimes estimated. The transitory component is linked to long-term fundamental factors such as government debt, fiscal stance, and macroeconomic performance, while the permanent component is determined by shocks to financial market variables. Moreover, the response of the CDS term premium to shocks in these variables is stronger during periods of high volatility.

Bouri, de Boyrie & Pavlova (2017) analyze the volatility transmission from commodities to CDS spreads volatility. Using an autoregressive GJR-GARCH model, the authors find a significant volatility spillover from commodities to CDS spreads for 17 emerging economies and 6 frontier economies over June 2010-July 2016.

Sabkha, de Peretti, & Mallek (2020) describes the pattern of sovereign CDS volatility in a sample of 38 countries from 2006 to 2017. Using both linear and non-linear GARCH models, they find evidence of nonlinearities and asymmetric leverage effects in these markets. Results show evidence of volatility clustering and long-memory behavior.

3 Data Description and Stylized Facts

In this section, we describe the data and analyze the main stylized facts about the performance of CDS in Brazil, Chile, Colombia, Mexico, and Peru. Figure 1 displays the dynamics of CDS at different tenures in LATAM between January 2005 and December 2020. It is evident the co-movement between CDS at different tenures in each country and the co-movement of CDS between countries. The level of CDS increased during three episodes: i) the global financial crisis; ii) the drop in commodity prices between mid-2014 and early 2016; and iii) the recent global crisis caused by the COVID-19 pandemic. The effects of the financial crisis of 2008 and 2009 were stronger on CDS in LATAM than during the other two episodes.

Moreover, the shock in commodity prices and the recent COVID-19 pandemic affected more sovereign risk in Brazil, Chile, and Colombia.

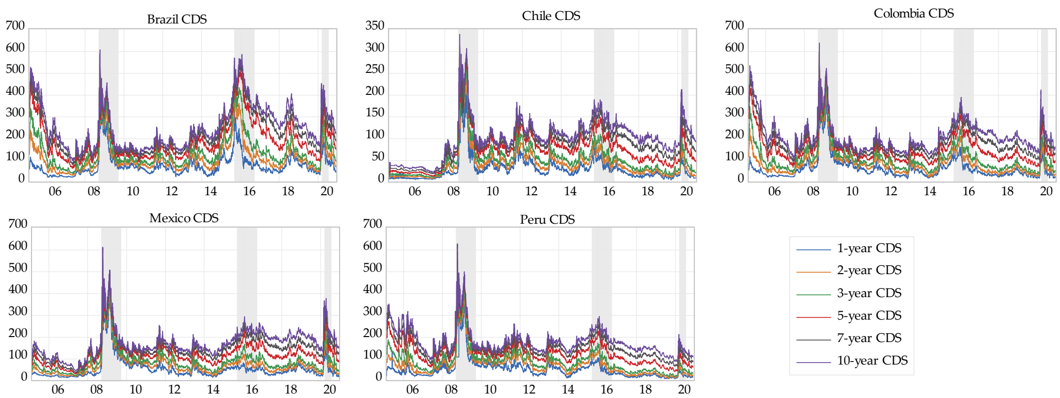

FIGURE 1. CDS DYNAMICS AT DIFFERENT TENURES

Source: Bloomberg and authors' calculations.

Table 1 shows ordinary Pearson correlations between daily changes of 5-year CDS in LATAM. We observe that all the correlations are positive and significantly different from zero. CDS in Colombia, Mexico, and Peru are highly correlated with CDS in Brazil, while CDS in Colombia are highly correlated with CDS in Mexico.

TABLE 1. CDS CORRELATIONS

Correlation between daily changes of Latin-American 5Y Credit Default Swaps

Correlation [t-statistic]	Brazil	Chile	Colombia	Mexico	Peru
Brazil	1.00				

Chile	0.65***	1.00			
	[55.96]	-----			
Colombia	0.88***	0.71***	1.00		
	[116.4]	[63.89]	-----		
Mexico	0.86***	0.73***	0.91***	1.00	
	[109.56]	[67.98]	[137.12]	-----	
Peru	0.82***	0.65***	0.88***	0.85***	1.00
	[90.46]	[54.65]	[116.42]	[103.65]	-----

Source: Authors' calculations.

4 Modeling CDS

A credit default swap (CDS) is a contract between two parties in which one party purchases protection from another party against losses from the default of a borrower for a defined period. Thus, the valuation of a CDS is determined by estimating the present value of the payment leg, which is the series of payments made from the protection buyer to the protection seller, and the present value of the protection leg, which is the payment from the protection seller to the protection buyer in event of default. If the present value of the payment leg is greater than the present value of the protection leg, the protection buyer pays an upfront premium to the seller. If the present value of the protection leg is greater than the present value of the payment leg, the seller pays an upfront premium to the buyer (CFA Institute, 2021). Thus, an important determinant of the value of the expected payments is the hazard rate, the probability of default given that default has not already occurred. This hazard rate depends on variables that determine the ability to pay. In the case of Latin American sovereign CDS, these variables are related to commodity prices, regional financial conditions, and variables related to the global financial cycle which directly affect their economic performance and creditworthiness.

a. Econometric Approach

GARCH models generally are used to model time series that evidence long periods of high volatility. Some authors (see Gündüz & Kaya, 2013) find different degrees of persistence between CDS spreads and their volatility. For instance, CDS spreads levels could not be persistent during stress episodes but highly persistent in their volatility. In this paper, we use a Component GARCH model to decompose CDS volatility into a short-run and a long-run component. Therefore, a Component GARCH model allows us to capture transitory deviations of the conditional volatility around a trend that is time-varying, and it permits us to explore the speed at which long-run mean reversion of CDS´s conditional variance occurs (see Engle and Lee, 1999 and Bollerslev, 2008).

Our approach consists in estimating the following model for the mean of each country:

$$\Delta CDS_t^{i,k} = \gamma_1 \Delta CI_t^i + \gamma_2 \Delta EM_{CDS}{}_t^i + \gamma_3 \Delta GF_t + \gamma_5 Debt_{Dummy} + \epsilon_t^{i,k} \quad (1)$$

Where $\Delta CDS_t^{i,k}$ represents the daily change in the risk premium for country i at tenor k, ΔCI_t^i is a commodity price index specific to each country[1], $\Delta EM_{CDS}{}_t^i$ is a country specific CDS index constructed using information of LATAM CDS at the same tenor (excluding country i), ΔGF_t is the change of a variable related to the global financial cycle. In our estimations we use both the Bloomberg financial conditions index for the U.S.[2] and the VIX[3] index. $Debt_{Dummy}$ is a dummy variable

[1] For Brazil we use a broad soft-commodity index, for Chile and Peru we use an industrial metal price index, and for Colombia and Mexico we use an oil price index. We also run monthly models using the IMF commodity terms of trade obtaining similar qualitative results.

[2] The Bloomberg U.S. Financial Conditions Index tracks the overall level of financial stress in the U.S. money, bond, VIX and equity markets to help assess the availability and cost of credit. A positive value indicates accommodative financial conditions, while a negative value indicates tighter financial conditions relative to pre-crisis norms. The index is normalized with mean zero and variance equal to 1.

[3] The VIX Index is a calculation designed to produce a measure of constant, 30-day expected volatility of the U.S. stock market, derived from real-time, mid-quote prices of S&P 500 Index call and put options. On a global

that represents changes in the mean of the gross government debt level for each country. $\epsilon_t^{i,k}$ stands for the CDS residuals for country i and tenor k. The main series used in our analysis are shown in Appendix A.

To model the conditional variance, we use a component GARCH model which allows mean reversion to a varying level m_t. This characteristic lets to distinguish between the permanent and transitory components of volatility at different CDS tenors. Thus, the conditional variance is modeled as:

$$\sigma_t^{2,i,k} - m_t^{i,k} = \alpha\left(\epsilon_{t-1}^{2,i,k} - m_{t-1}^{i,k}\right) + \beta\left(\sigma_{t-1}^{2,i,k} - m_{t-1}^{i,k}\right)$$

$$m_t^{i,k} = \omega + \rho\left(m_{t-1}^{i,k} - \omega\right) + \phi\left(\epsilon_{t-1}^{2,i,k} - \sigma_{t-1}^{2,i,k}\right) \quad (2)$$

Here $\sigma_t^{2,i,k}$ is the CDS volatility for country i at tenure k, while $m_t^{i,k}$ is the time varying long-run volatility. The first equation in (2) describes the transitory component $\sigma_t^{2,i,k} - m_t^{i,k}$, which converges to zero with powers $(\alpha + \beta)$. The second equation describes the long run component $m_t^{i,k}$, which converges to ω with powers of ρ[4]. Given that CDS changes can exhibit fat tails, the estimation assumed a t-distribution.

b. Estimation Results

In our estimations we find several interesting features regarding CDS dynamics. First, the regional CDS is an important driver to explain CDS in Latin America as this variable may summarize the external financial conditions faced by countries in the region. Second, factors related to the global financial cycle have an important role in CDS dynamics. As we mentioned before, in our exercises we use both the US financial conditions index and the VIX separately to control for the global financial cycle (See appendix B for detailed results). Given the construction of this variables the expected sign for changes in the US financial conditions index is negative (i.e., an improvement in US financial conditions reduces Latin-American CDS) while the expected sign for the VIX index is positive (i.e. an increase in financial markets risk aversion increases Latin-American CDS). In general, changes in the VIX index and in the U.S. financial conditions have an impact in all tenors of the CDS curve for our selected Latin-American countries. In Chile, only the 3-year tenor seems to be unaffected by our global financial cycle selected variables. Third, relevant commodity price gains reduce CDS in all countries and for most of the tenures. As a summary, Table 2 presents the results of the

basis, it is one of the most recognized measures of volatility associated with the global financial cycle and with international investors' risk appetite.

[4] Combining the transitory and permanent components is possible to show that the component model is a nonlinear restricted GARCH (2,2) model.

component GARCH model for 5-year CDS using the US financial conditions index. Detailed results for each country and for all tenures are presented in Appendix B.

TABLE 2. COMPONENT GARCH REGRESSIONS FOR 5-YEAR CDS IN LATAM

	Brazil		Chile		Colombia		Mexico		Peru	
D(Commodity Index)	-0.18	**	-2.31	**	-0.05	***	-0.05	***	-0.07	***
	[0.08]		[1.16]		[0.01]		[0.01]		[0.01]	
D(LATAM_EX_5)	1.22	***	0.39	***	1.06	***	0.89	***	0.81	***
	[0.01]		[0.00]		[0.01]		[0.01]		[0.01]	
D(USFCON)	-3.35	***	-0.37	**	-1.31	***	-1.64	***	-1.44	***
	[0.44]		[0.16]		[0.18]		[0.19]		[0.21]	
Debt Dummies										
Variance Equation										
α	16.31	***	168.42		385.33	***	268.63	***	99.00	
	[1.25]		[144.13]		[86.96]		[345.77]		[1468]	
β	0.97	***	1.00	***	1.00	***	1.00	***	1.00	***
	[0.05]		[0.00]		[0.00]		[0.00]		[0.00]	
ω	0.04		0.08	***	0.11	***	0.10	***	0.08	***
	[0.20]		[0.01]		[0.01]		[0.01]		[0.01]	
ρ	0.04		0.15	***	0.20	***	0.15	***	0.15	***
	[0.20]		[0.02]		[0.03]		[0.02]		[0.02]	
ϕ	0.90	***	0.54	***	0.43	***	0.63	***	0.72	***
	[0.08]		[0.08]		[0.08]		[0.06]		[0.05]	
Adjusted R-Squared	0.79		0.52		0.87		0.83		0.76	
Durbin-Watson stat	1.86		2.27		2.84		1.99		1.95	
ARCH Test (lag 7) F-stat	0.22		0.32		0.01		1.65		0.06	
ARCH Test p-value	0.64		0.57		0.94		0.20		0.80	
Observations	4132		4132		4132		4132		4132	

Source: Authors' calculations. Note: Commodity index is included in logs.

More importantly, from the estimation of the component GARCH model we can obtain the conditional volatility and distinct between the transitory and the permanent component. For all countries and tenures our results show that not only CDS but also CDS volatility increased in stressed episodes such as the Global Financial Crisis (GFC), the commodity price shock in 2014-2016, and the COVID-19 shock. Nonetheless, we found an important level of heterogeneity across countries. Also, the GFC had the largest impact on CDS volatility across all countries according to our estimates while the COVID-19 reaction of CDS volatility was lower. Finally, the persistence of CDS volatility was higher during the GFC shock. To illustrate the dynamics of CDS volatility we present both the time series and the behavior of a CDS permanent volatility curve for selected periods during the GFC and the COVID-19 shock.

Figure 2 and Figure 3 show the results for Brazil. As shown in Figure 2, it is clear the increase in volatility during stress periods for all tenors. Figure 3 shows the term structure of our computed permanent conditional standard deviation during selected stress episodes such as the GFC and the COVID-19 health prices. During the GFC, the short-end CDS volatility increased more than the mid and the long end of the curve, reducing the slope of the CDS volatility curve. During the COVID-19 health crisis CDS volatility for Brazil displayed a parallel shift, although with an increase in the slope of the curve.

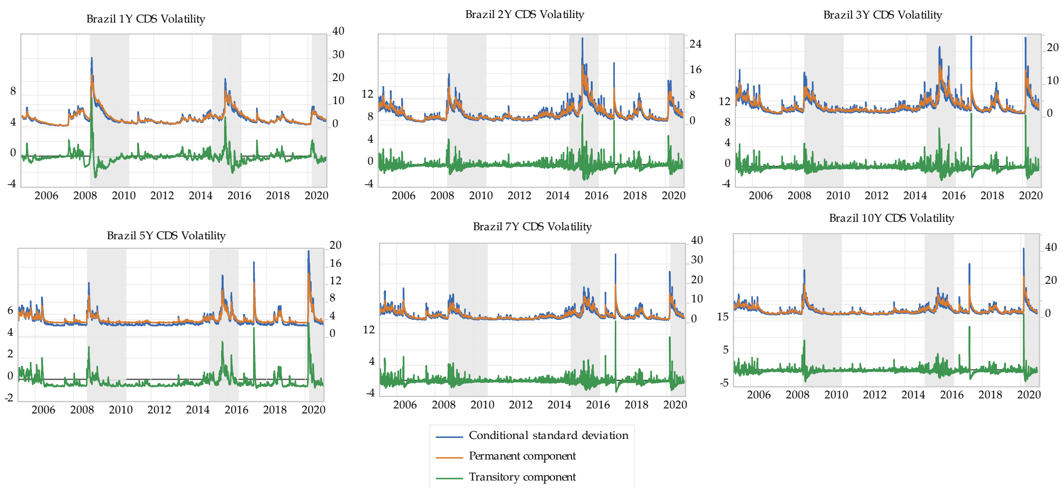

FIGURE 2. CDS CONDITIONAL STANDARD DEVIATION FOR BRAZIL AT DIFFERENT TENURES

Source: Authors' calculations. Notes: The shaded areas correspond to the global financial crisis, the commodity price decline of 2014-2016 and the Covid-19 health crisis. The left- and right-hand scales are in CDS basis points.

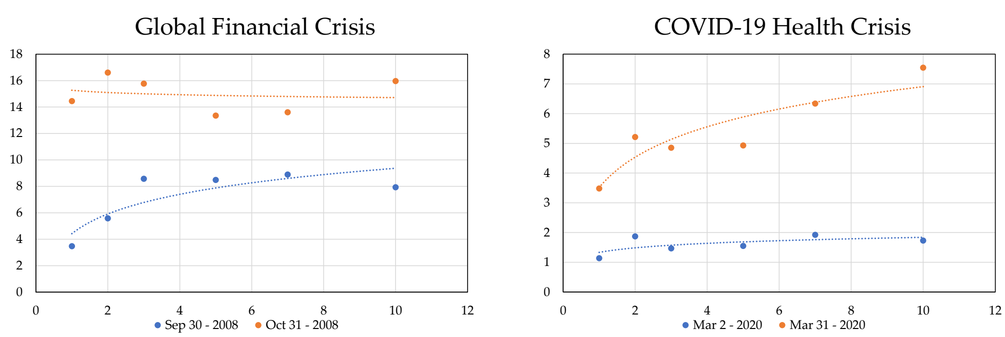

FIGURE 3. CDS CONDITIONAL STANDARD DEVIATION TERM STRUCTURE FOR BRAZIL (PERMANENT COMPONENT)

Source: Authors' calculations. Notes: The curve is computed using a logarithmic function. The left-hand scale is in CDS basis points.

In the case of Chile, CDS volatility displayed a significant spike during the GFC. Other stress episodes had lower increases in the volatility of the country risk premium as shown in Figure 4. In Figure 5, the permanent component of CDS volatility curve shows that in both the GFC and the COVID-19, there was a parallel shift, with the increase in the last episode being more modest and with a slight increase in the slope.

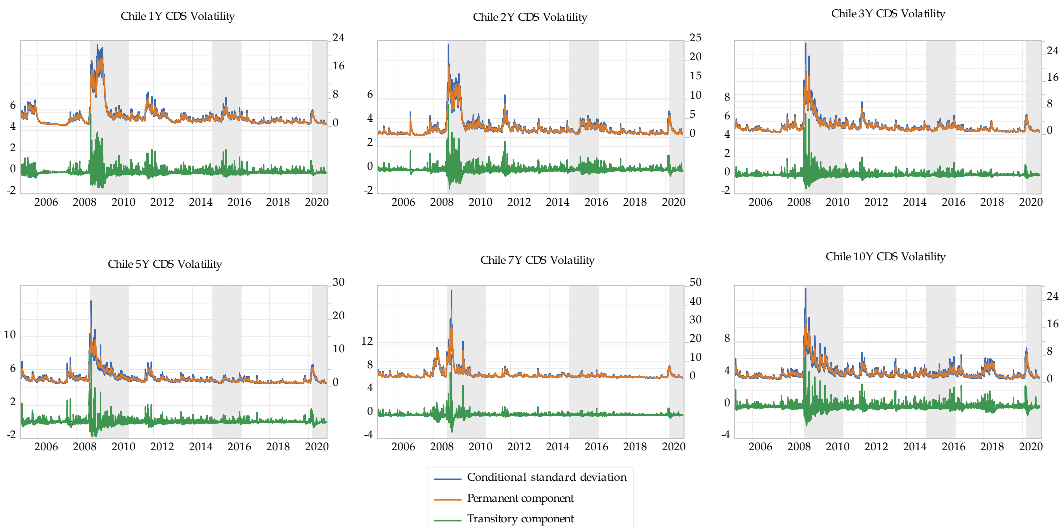

FIGURE 4. CDS CONDITIONAL STANDARD DEVIATION FOR CHILE AT DIFFERENT TENURES

Source: Authors' calculations. Notes: The shaded areas correspond to the global financial crisis, the commodity price decline of 2015-2016 and the Covid-19 health crisis. The left- and right-hand scales are in CDS basis points.

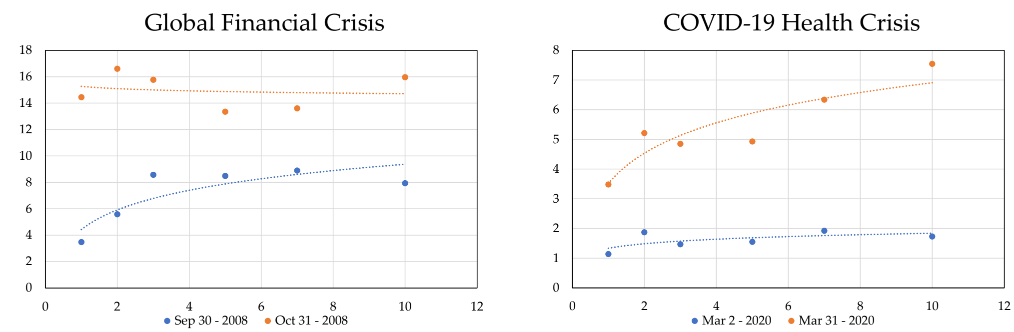

FIGURE 5. CDS CONDITIONAL STANDARD DEVIATION TERM STRUCTURE FOR CHILE (PERMANENT COMPONENT)

Source: Authors' calculations. Notes: The curve is computed using a logarithmic function. The left-hand scale is in CDS basis points.

For Colombia, we find that the GFC seems to be the episode with a higher increase in CDS volatility, except for 5-year and 7-year CDS (Figure 6). When we explore the dynamics of the permanent volatility at different tenors (Figure 7), we found than in the GFC the CDS volatility curve was inverted, with short-end volatility being more affected. During the COVID-19 episode we saw a parallel shift, with the 5-year CDS volatility displaying the higher increase.

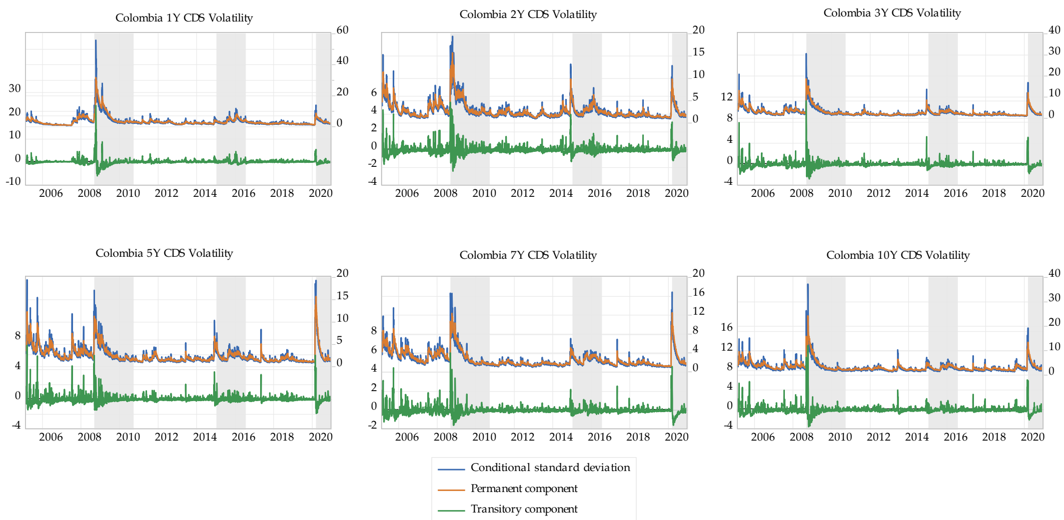

FIGURE 6. CDS CONDITIONAL STANDARD DEVIATION FOR COLOMBIA AT DIFFERENT TENURES

Source: Authors' calculations. Notes: The shaded areas correspond to the global financial crisis, the commodity price decline of 2015-2016 and the Covid-19 health crisis. The left- and right-hand scales are in CDS basis points.

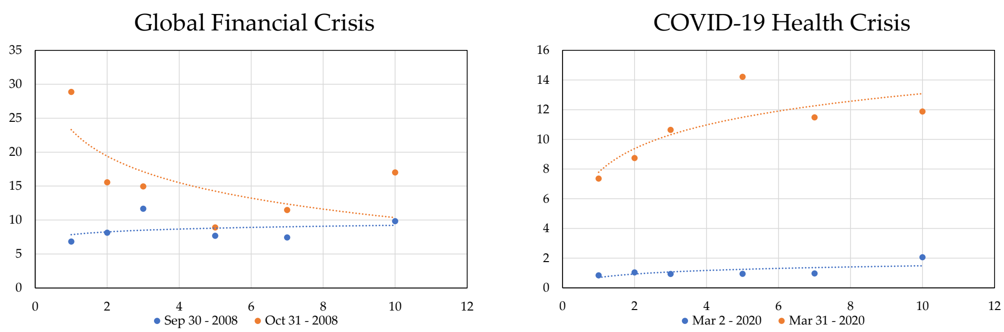

FIGURE 7. CDS CONDITIONAL STANDARD DEVIATION TERM STRUCTURE FOR COLOMBIA (PERMANENT COMPONENT)

Source: Authors' calculations. Notes: The curve is computed using a logarithmic function. The left-hand scale is in CDS basis points. The left-hand scale is in CDS basis points.

For Mexico, the GFC was also the episode were CDS volatility was affected the most (Figure 8). In this episode, we also observed that short-end volatility increased more than the long-end (Figure 9).

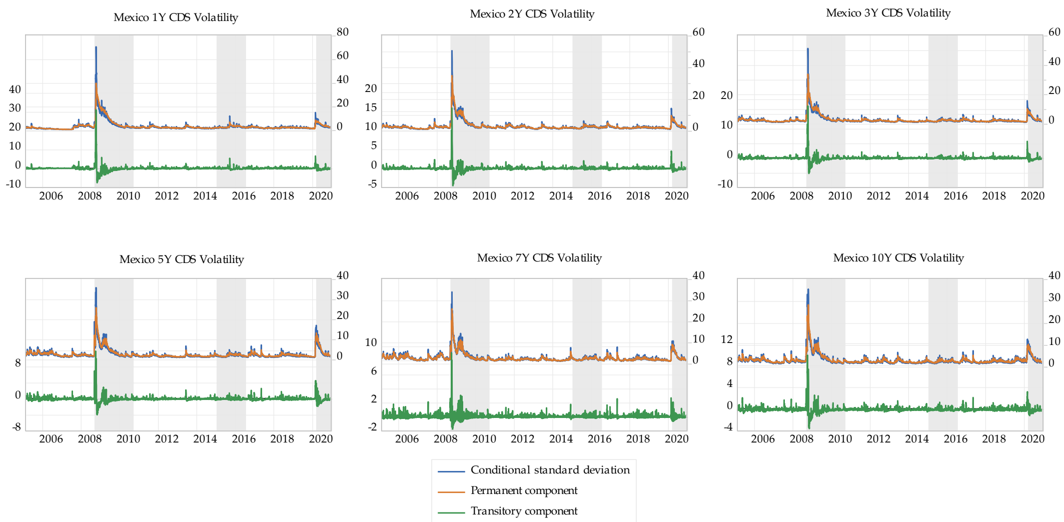

FIGURE 8. CDS CONDITIONAL STANDARD DEVIATION FOR MEXICO AT DIFFERENT TENURES

Source: Authors' calculations. Notes: The shaded areas correspond to the global financial crisis, the commodity price decline of 2015-2016 and the Covid-19 health crisis. The left- and right-hand scales are in CDS basis points.

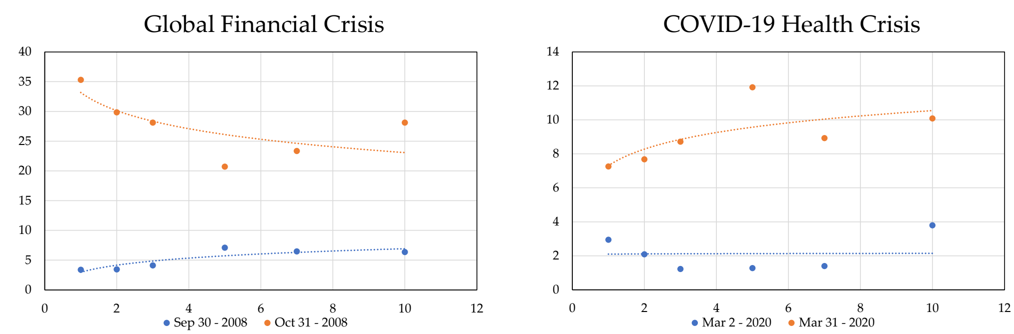

FIGURE 9. CDS CONDITIONAL STANDARD DEVIATION TERM STRUCTURE FOR MEXICO (PERMANENT COMPONENT)

Source: Authors' calculations. Notes: The curve is computed using a logarithmic function. The left-hand scale is in CDS basis points.

Finally, we observe in Figures 10 and 11 that in the case of Peru, the permanent component of CDS volatility was more affected in the short end of the volatility curve but in a lesser magnitude than in other countries during the COVID-19 crisis. CDS volatility increased in all tenors during the GFC and displayed a modest parallel shift.

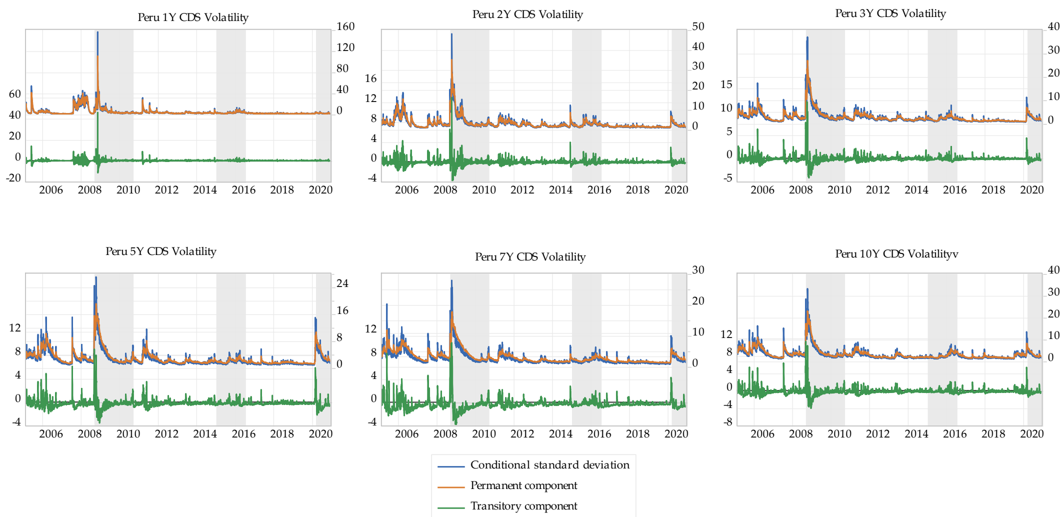

FIGURE 10. CDS CONDITIONAL STANDARD DEVIATION FOR PERU AT DIFFERENT TENURES

Source: Authors' calculations. Notes: The shaded areas correspond to the global financial crisis, the commodity price decline of 2015-2016 and the Covid-19 health crisis. The left- and right-hand scales are in CDS basis points.

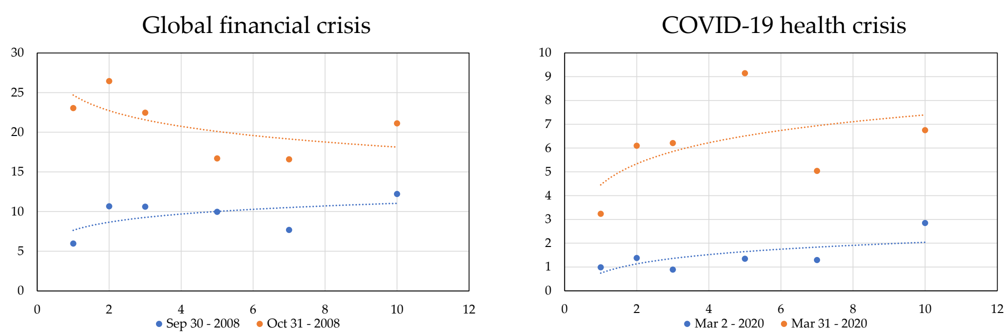

FIGURE 11. CDS CONDITIONAL STANDARD DEVIATION TERM STRUCTURE FOR PERU (PERMANENT COMPONENT)

Source: Authors' calculations. Notes: The curve is computed using a logarithmic function. The left-hand scale is in CDS basis points.

5 Conclusions

This paper presents a first effort to try to model the sovereign risk premium, measured by the CDS, at different tenors. Using a component GARCH model for Brazil, Chile, Colombia, Mexico, and Peru we find that the changes of CDS can be explained by a similar set of fundamentals that capture international financial conditions, regional dynamics, and macroeconomic fundamentals that could be related to the creditors ability to pay. It is important to highlight the importance of the regional CDS index for each tenor as an explicative variable in all our estimated models. Regarding volatility, we find that the conditional standard deviation could be decomposed into a permanent and transitory component. Also, we find that in stress episodes, the CDS volatility permanent component tend to be persistent. The increase in permanent volatility is clear in episodes such as the GFC and the COVID-19 health crisis, although there is some heterogeneity regarding the magnitude of the changes across countries (some countries with higher increases in volatility than others) and across stress episodes (GFC displayed a higher change in CDS permanent volatility and in most cases an inversion of the volatility curve). In these respect, further areas of research could incorporate how the nature of the shock and different policy responses could affect CDS volatility. Also, it is important to understand if factors such as the level of debt are important drivers of the pattern of CDS volatility in LATAM economies. Finally, it could be desirable to increase the sample to a higher number of emerging and advances economies to disentangle the differences across these markets.

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Appendix A: Selected series

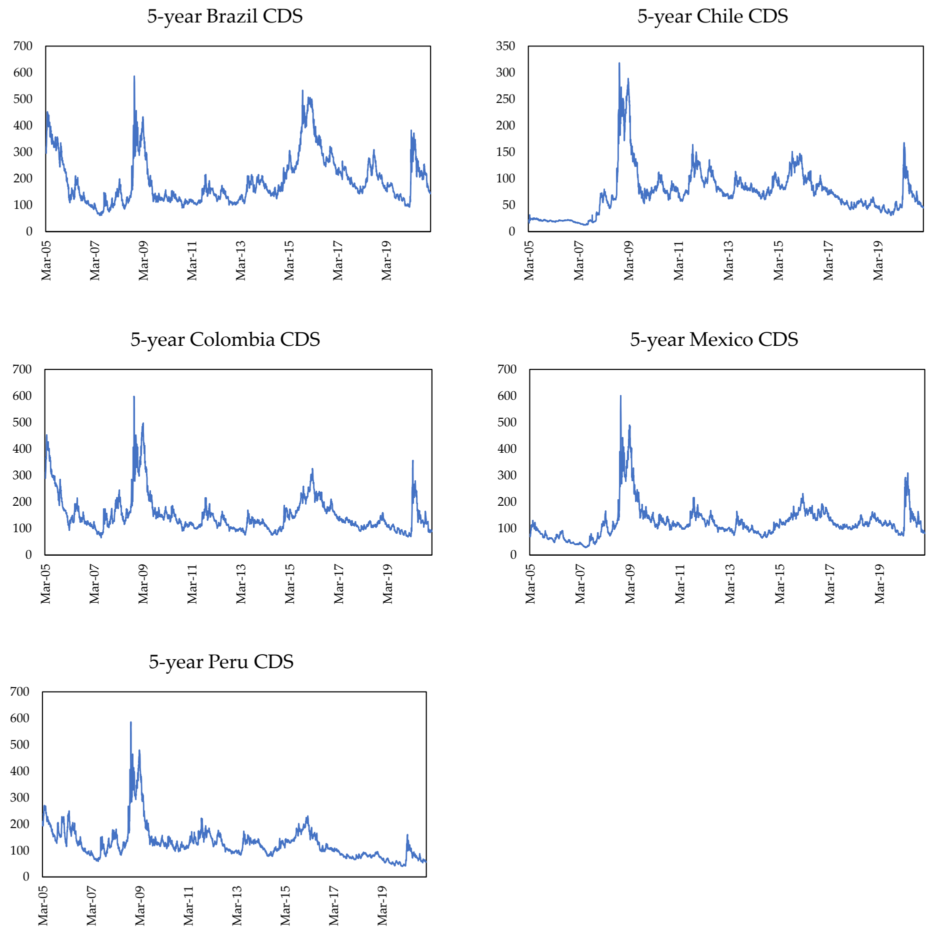

FIGURE A1. 5-YEAR CDS IN SELECTED LATAM COUNTRIES

Source: Bloomberg.

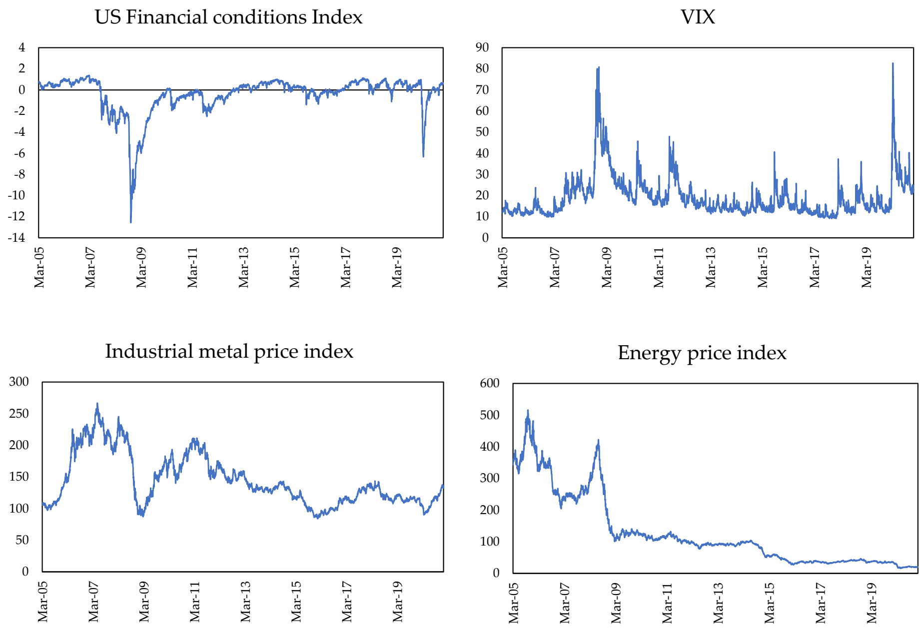

FIGURE A2. 5-SOME CONTROLS USED IN THE MODELS

Source: Bloomberg.

Appendix B: Detailed country results at each tenor

TABLE 1B. CDS MODEL FOR DIFFERENT TENURES: BRAZIL

Brazil	1Y		2Y		3Y		5Y		7Y		10Y	
Dlog(Commodity Index)	-0.27 ***	-0.05 *	-0.08 ***	-0.06 **	-0.08 ***	-0.20 ***	-0.18 **	-0.03	-0.05 **	-0.05 *	-0.06	-0.05
	[0.04]	[0.02]	[0.03]	[0.03]	[0.03]	[0.07]	[0.08]	[0.03]	[0.03]	[0.03]	[0.03]	[0.04]
D(LATAM_EX)	1.04 ***	0.72 ***	1.03 ***	1.02 ***	1.09 ***	1.20 ***	1.22 ***	1.11 ***	1.11 ***	1.11 ***	1.12 ***	1.12 ***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
D(USFCON)	-6.32 ***		-3.04 ***		-3.00 ***		-3.35 ***		-2.84 **		-3.16 ***	
	[0.31]		[0.21]		[0.22]		[0.44]		[0.26]		[0.29]	
D(VIX)		0.27 ***		0.27 ***		0.30 ***		0.24 ***		0.22 ***		0.22 ***
		[0.02]		[0.02]		[0.03]		[0.02]		[0.02]		[0.02]
Debt Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Variance Equation												
α	22.61	437.86 **	213.63 ***	436.98 ***	370.37 ***	14.34 ***	16.31 ***	822.40 ***	559.48 ***	913.05 ***	583.29 ***	610.09 ***
	[864.68]	[182.75]	[64.52]	[132.82]	[97.37]	[1.13]	[1.25]	[185.86]	[132.43]	[216.36]	[142.9]	[150.39]
β	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	0.97 ***	0.97 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.16]	[0.05]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
ω	0.04 ***	0.08 ***	0.08 ***	0.09 ***	0.09 ***	0.04	0.04	0.11 ***	0.09 ***	0.09 ***	0.09 ***	0.09 ***
	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[1.14]	[0.20]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
ρ	0.04 ***	0.14 ***	0.16 ***	0.17 ***	0.18 ***	0.04	0.04	0.19 ***	0.21 ***	0.21 ***	0.17 ***	0.17 ***
	[0.01]	[0.02]	[0.02]	[0.02]	[0.02]	[1.13]	[0.20]	[0.02]	[0.03]	[0.02]	[0.02]	[0.02]
ϕ	0.91 ***	0.69 ***	0.61 ***	0.59 ***	0.62 ***	0.91	0.90 ***	0.58 ***	0.54 ***	0.53 ***	0.65 ***	0.65 ***
	[0.01]	[0.042]	[0.06]	[0.057]	[0.05]	[0.29]	[0.08]	[0.05]	[0.06]	[0.06]	[0.05]	[0.06]
Adjusted R-Squared	0.54	0.48	0.72	0.72	0.76	0.77	0.79	0.78	0.77	0.78	0.74	0.74
Durbin-Watson stat	2.17	1.96	1.86	1.84	1.75	1.78	1.86	1.84	1.77	1.77	1.96	1.95
Log Likelihood	-10140.1	-9756.7	-9635.3	-9618.7	-9543.7	-10084.5	-10153.3	-9368.0	-9784.2	-9773.8	-10152.4	-10147.9
ARCH Test (lag 14) F-stat	1.55	0.31	2.10	0.24	0.18	0.16	0.22	0.01	0.05	0.01	0.04	0.02
ARCH Test p-value	0.09	0.99	0.15	0.99	0.67	0.99	0.64	0.92	0.83	0.90	0.85	0.89
Observations	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132

Source: Author's calculations.

TABLE 2B. CDS MODEL FOR DIFFERENT TENURES: CHILE

Chile

	1Y		2Y		3Y		5Y		7Y		10Y	
Dlog(Commodity Index)	-0.57	-0.41	-1.22	-1.18	-1.42	-1.36	-2.31 **	-14.34 ***	-3.90 ***	-3.90 ***	-3.19 **	-3.02 **
	[0.90]	[0.92]	[0.91]	[0.90]	[1.05]	[1.05]	[1.16]	[2.81]	[1.18]	[1.17]	[1.41]	[1.40]
D(LATAM_EX)	0.22 ***	0.22 ***	0.18 ***	0.18 ***	0.31 ***	0.37 ***	0.39 ***	0.37 ***	0.35 ***	0.35 ***	0.26 ***	0.24 ***
	[0.00]	[0.00]	[0.01]	[0.01]	[0.05]	[0.04]	[0.00]	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]
D(USFCON)	-0.33 ***		-0.28 **		-0.14		-0.37 **		-0.58 **		-1.14 **	
	[0.07]		[0.13]		[0.16]		[0.16]		[0.18]		[0.21]	
D(VIX)		0.04 ***		0.02 **		0.02		-0.07 ***		0.05 ***		0.11 ***
		[0.01]		[0.01]		[0.31]		[0.02]		[0.01]		[0.02]
Debt Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Variance Equation												
α	109.16 ***	115.21 ***	187.83 ***	245.32 ***	217.29	451.47 *	168.42	7.11 ***	235.43	705.60	523.85	628.88 ***
	[41.89]	[17.06]	[52.01]	[67.48]	[207.96]	[272.37]	[144.13]	[0.19]	[1327]	[453.28]	[414.22]	[147.97]
β	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	0.50 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.18]	[0.00]	[0.00]	[0.00]	[0.00]
ω	0.09 ***	0.08 ***	0.11 ***	0.11 ***	0.11 ***	0.11 ***	0.08 ***	0.04	0.14 ***	0.14 ***	0.11 ***	0.11 ***
	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.04]	[0.01]	[0.01]	[0.01]	[0.01]
ρ	0.12 ***	0.12 ***	0.11 ***	0.11 ***	0.14 ***	0.14 ***	0.15 ***	0.04	0.11 ***	0.11 ***	0.18 ***	0.17 ***
	[0.01]	[0.01]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.04]	[0.03]	[0.03]	[0.03]	[0.02]
ϕ	0.35 ***	0.35 ***	0.47 ***	0.47 ***	0.02	0.02	0.54 ***	0.02	0.46 ***	0.46 ***	0.45 ***	0.45 ***
	[0.05]	[0.06]	[0.11]	[0.11]	[0.12]	[0.12]	[0.08]	[0.29]	[0.14]	[0.15]	[0.09]	0.06
Adjusted R-Squared	0.09	0.09	0.23	0.23	0.31	0.31	0.52	0.53	0.34	0.35	0.44	0.43
Durbin-Watson stat	2.55	2.55	2.30	2.30	2.26	2.26	2.27	2.25	2.32	2.32	2.25	2.22
Log Likelihood	-8373.0	-9746.8	-7605.1	-7604.5	-7597.3	-7596.8	-7599.8	-9058.3	-7815.2	-7811.9	-8606.1	-8601.7
ARCH Test (lag 14) F-stat	0.11	0.12	0.01	0.01	0.02	0.03	0.32	31.15	0.78	0.72	0.04	0.16
ARCH Test p-value	0.75	0.72	0.90	0.90	0.88	0.86	0.57	0.00	0.38	0.40	0.84	0.69
Observations	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132

Source: Author's calculations.

TABLE 3B. CDS MODEL FOR DIFFERENT TENURES: COLOMBIA

Colombia

	1Y		2Y		3Y		5Y		7Y		10Y	
Dlog(Commodity Index)	-0.02	-0.03 *	-0.04 **	-0.04 ***	-0.04 **	-0.04 *	-0.05 ***	-0.05 ***	-0.06 ***	-0.06 ***	-0.06 ***	-0.06 ***
	[0.02]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.01]	[0.02]	[0.02]
D(LATAM_EX)	0.74 ***	0.74 ***	0.98 ***	0.99 ***	1.03 ***	1.03 ***	1.06 ***	1.06 ***	1.04 ***	1.04 ***	1.02 ***	1.03 ***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]		[0.01]	[0.01]
D(USFCON)	-2.06 ***		-2.17 ***		-1.50 ***		-1.31 ***		-1.52 ***		-2.39 ***	
	[0.18]		[0.22]		[0.20]		[0.18]		[0.22]		[0.26]	
D(VIX)		0.12 ***		0.11 ***		0.08 ***		0.06 ***		0.07 ***		0.10 ***
		[0.01]		[0.01]		[0.01]		[0.01]		[0.01]		[0.02]
Debt Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Variance Equation												
α	145.49 **	185.36 **	235.32	283.65 ***	235.46 ***	60.33	385.33 ***	253.84 ***	25.30	27.87	74.00	93.88
	[63.94]	[86.82]	[734.17]	[68.35]	[58.63]	[564.81]	[86.96]	[57.39]	[88.16]	[107.85]	[455.51]	[746.48]
β	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	0.99 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]
ω	0.07 ***	0.07 ***	0.11 ***	0.11 ***	0.09 ***	0.09 ***	0.11 ***	0.11 ***	0.07 ***	0.08 ***	0.08 ***	0.08 ***
	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
ρ	0.19 ***	0.19 ***	0.17 ***	0.17 ***	0.17 ***	0.17 ***	0.20 ***	0.20 ***	0.12 ***	0.13 ***	0.17 ***	0.17 ***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]	[0.02]	[0.02]	[0.02]	[0.03]	[0.02]
ϕ	0.62 ***	0.61 ***	0.55 ***	0.55 ***	0.63 ***	0.63 ***	0.43 ***	0.44 ***	0.68 ***	0.67 ***	0.65 ***	0.63 ***
	[0.04]	[0.04]	[0.07]	[0.07]	[0.06]	[0.05]	[0.08]	[0.08]	[0.06]	0.06	[0.06]	[0.06]
Adjusted R-Squared	0.53	0.53	0.80	0.80	0.82	0.82	0.87	0.87	0.86	0.85	0.81	0.81
Durbin-Watson stat	2.28	2.28	2.20	2.20	2.05	2.05	2.84	1.87	1.82	1.82	2.13	2.13
Log Likelihood	-8887.6	-8898.2	-8712.4	-8726.6	-8307.3	-8314.9	-8128.0	-8135.9	-8513.1	-8523.0	-9172.2	-9189.0
ARCH Test (lag 14) F-stat	0.06	0.04	0.00	0.09	2.83	2.56	0.01	0.04	0.01	0.08	0.06	0.06
ARCH Test p-value	0.81	0.84	0.98	0.77	0.09	0.11	0.94	0.84	0.92	0.78	0.81	0.81
Observations	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132

Source: Author's calculations.

TABLE 4B. CDS MODEL FOR DIFFERENT TENURES: MEXICO

Mexico	1Y		2Y		3Y		5Y		7Y		10Y	
Dlog(Commodity Index)	-0.02	-0.02	-0.04 ***	-0.04 *	-0.05 ***	-0.05 *	-0.05 ***	-0.04 ***	-0.08 ***	-0.07 ***	-0.08 ***	-0.11 ***
	[0.01]	[0.01]	[0.04]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.02]	[0.02]	[0.04]
D(LATAM_EX)	0.52 ***	0.51 ***	0.76 ***	0.75 ***	0.79 ***	0.79 ***	0.89 ***	0.88 ***	0.88 ***	0.87 ***	0.86 ***	1.04 ***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
D(USFCON)	-1.11 ***		-1.65 ***		-1.57 ***		-1.64 ***		-1.74 ***		-1.32 **	
	[0.14]		[0.19]		[0.17]		[0.19]		[0.22]		[0.39]	
D(VIX)		0.11 ***		0.13 ***		0.14 ***		0.14 ***		0.15 ***		0.02 ***
		[0.01]		[0.01]		[0.01]		[0.03]		[0.01]		[0.03]
Debt Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Variance Equation												
α	174.85	216.75 *	230.11 ***	256.49 ***	31.05	22.15	268.63 ***	371.42 ***	21.94	20.45	261.05	10.55 ***
	[109.07]	[125.46]	[65.44]	[67.53]	[132.78]	[66.03]	[345.77]	[93.61]	[41.51]	[35.63]	[5646]	[0.28]
β	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	0.50 ***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.16]
ω	0.06 ***	0.06 ***	0.08 ***	0.09 ***	0.09 ***	0.08 ***	0.10 ***	0.10 ***	0.11 ***	0.11 ***	0.10 ***	0.04
	[0.00]	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.02]	[0.04]
ρ	0.17 ***	0.17 ***	0.12 ***	0.14 ***	0.14 ***	0.14 ***	0.15 ***	0.15 ***	0.15 ***	0.15 ***	0.12 ***	0.04
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]	[0.03]	[0.05]
ϕ	0.63 ***	0.64 ***	0.66 ***	0.52 ***	0.68 ***	0.69 ***	0.63 ***	0.64 ***	0.08	0.03	0.68 ***	0.02
	[0.05]	[0.05]	[0.07]	[0.10]	[0.06]	[0.05]	[0.06]	[0.06]	[0.14]	[0.14]	[0.08]	[0.34]
Adjusted R-Squared	0.43	0.43	0.71	0.72	0.76	0.76	0.83	0.83	0.82	0.82	0.79	0.81
Durbin-Watson stat	1.86	1.85	2.09	2.08	2.04	2.03	1.99	1.97	1.81	1.80	1.99	2.09
Log Likelihood	-8552.8	-8544.4	-8471.8	-8470.7	-8140.7	-8132.5	-8142.1	-8132.3	-8670.4	-8662.6	-9027.1	-10030.5
ARCH Test (lag 14) F-stat	0.11	0.01	0.02	0.00	0.01	0.08	1.65	3.42	0.30	0.17	0.81	0.83
ARCH Test p-value	0.74	0.90	0.89	0.98	0.92	0.78	0.20	0.00	0.59	0.68	0.37	0.36
Observations	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132

Source: Author's calculations.

TABLE 5B. CDS MODEL FOR DIFFERENT TENURES: PERU

Peru	1Y		2Y		3Y		5Y		7Y		10Y	
Dlog(Commodity Index)	-0.03 ***	-0.03 ***	-0.05 ***	-0.05 ***	-0.04 ***	-0.04 ***	-0.07 ***	-0.07 ***	-0.07 ***	-0.07 ***	-0.08 ***	-0.08 ***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.04]	[0.01]	[0.01]	[0.01]	[0.01]
D(LATAM_EX)	0.43 ***	0.43 ***	0.64 ***	0.65 ***	0.70 ***	0.70 ***	0.81 ***	0.81 ***	0.74 ***	0.74 ***	0.72 ***	0.72 ***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
D(USFCON)	-0.29 *		-0.59 ***		-0.48 ***		-1.44 ***		-1.31 ***		-2.23 **	
	[0.17]		[0.21]		[0.18]		[0.21]		[0.21]		[0.25]	
D(VIX)		0.02		0.04 *		0.02		0.05 ***		0.06 ***		0.12 ***
		[0.01]		[0.01]		[0.01]		[0.01]		[0.01]		[0.01]
Debt Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Variance Equation												
α	869.45 ***	798.72 **	152.83	652.52 ***	217.78 ***	429.80 ***	99.00	168.53	197.17 ***	240.57 ***	422.50 ***	725.10 ***
	[131.34]	[120.42]	[2768]	[132.99]	[56.60]	[112.45]	[1468]	[870.12]	[56.05]	[68.99]	[106.50]	[184.53]
β	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***	1.00 ***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
ω	0.20 ***	0.20 ***	0.12 ***	0.13 ***	0.09 ***	0.09 ***	0.08 ***	0.08 ***	0.06 ***	0.06 ***	0.08 ***	0.08 ***
	[0.00]	[0.01]	[0.02]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
ρ	0.20 ***	0.20 ***	0.15 ***	0.15 ***	0.16 ***	0.16 ***	0.15 ***	0.15 ***	0.14 ***	0.14 ***	0.15 ***	0.15 ***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
ϕ	0.32 ***	0.32 ***	0.57 ***	0.58 ***	0.65 ***	0.66 ***	0.72 ***	0.72 ***	0.78 ***	0.78 ***	0.68 ***	0.69 ***
	[0.08]	[0.08]	[0.08]	[0.07]	[0.05]	[0.05]	[0.05]	[0.04]	[0.03]	[0.03]	[0.05]	[0.05]
Adjusted R-Squared	0.08	0.08	0.62	0.62	0.70	0.70	0.76	0.76	0.74	0.74	0.69	0.69
Durbin-Watson stat	2.57	2.57	2.07	2.07	1.98	1.98	1.95	1.96	1.69	1.70	1.92	1.93
Log Likelihood	-9160.8	-9161.0	-8918.0	-8918.4	-8495.1	-8496.3	-8291.6	-8301.5	-8642.3	-8648.0	-9191.1	-9199.9
ARCH Test (lag 14) F-stat	0.00	0.00	0.00	0.01	0.09	0.10	0.06	0.08	0.26	0.30	0.17	0.19
ARCH Test p-value	0.98	0.98	0.95	0.92	0.76	0.75	0.80	0.78	0.61	0.58	0.68	0.67
Observations	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132	4132

Source: Author's calculations.


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