Push and _pull_ determinants of the country risk premium for emerging economies: an econometric appraisal

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Área 1 - Economia

Resumo: Este artigo objetiva identificar os principais determinantes dos prêmios de risco-país de uma amostra de economias emergentes: África do Sul, Brasil, Chile, Colômbia, Indonésia, México, Rússia e Turquia, usando CDS 5 Anos e EMBI+ como indicadores. As estimativas econométricas basearam-se principalmente em modelos GMM-DIFF estático e dinâmico. Modelos autorregressivos de séries temporais também foram utilizados e contrastados com os resultados obtidos via dados em painel. O período de análise é, dependendo do país, de 2003 a 2019 (séries temporais) e de 2008 a 2019 (dados em painel). Foram utilizadas variáveis tanto do tipo *push* (exógenas) quando do tipo *pull* (específicas dos países), com dados mensais e trimestrais, para verificar os principais determinantes dos prêmios de risco-país das economias emergentes da amostra. Os resultados empíricos demonstraram que alguns fatores *push* têm efeitos estatisticamente significantes naquela determinação, tanto nos modelos de séries temporais quanto de dados em painel. Isso indica que os ciclos financeiros globais/internacionais têm importante papel na determinação dos prêmios de risco-país emergentes. No entanto, essas economias podem mitigar as influências globais através de algumas políticas internas. De acordo com os resultados obtidos, a principal variável do tipo *pull* foi a taxa de crescimento do estoque de reservas internacionais, o que destaca a importância de sólidas contas externas para as economias emergentes.

Palavras-chave: *CDS 5 Anos. EMBI+. Prêmio de risco-país. Economias emergentes. Fatores push and pull*

Abstract: This article aims to identify the main determinants of the country risk premiums for a sample of emerging economies, namely: Brazil, Chile, Colombia, Indonesia, Mexico, Russia, South Africa, and Turkey, using CDS 5 Years and EMBI+ as indicators. Econometric estimations relied on GMM-DIFF static and dynamic panel models. Individual autoregressive time series models were also used and contrasted with the panel data results. The period of the analysis is, depending on the country, from 2003 to 2019 (time series models) and from 2008 to 2019 (panel data models). We use both *push* (exogenous) and *pull* (country-specifics) variables, with monthly and quarterly data, to verify the main drivers of the country risk premium. Our empirical results demonstrate that some *push* factors have statistically significant effects on that determination, both for time series and panel data models. It indicates that the international or global financial cycles play an important role in the emerging country risk premiums. However, those economies may mitigate global influences through some country-specific tools. In our models, the main statistically significant *pull* variable was the international reserves stock growth rate, which highlights the importance of sound external accounts for the emerging countries.

Keywords: *CDS 5 Years. EMBI+. Country risk premium. Emerging economies. Push and pull factors.*

JEL Codes: F02, F62, G15.

1 Introduction

Country risk premiums measures are important elements in the evaluation of emerging economies' external sustainability. These economies usually are more exposed to external shocks and international capital flows reversals. Common metrics used as proxies for the country risk premiums are credit rating, the one classified by Standard & Poor’s, Moody’s, and Fitch agencies, financial vulnerability and currency indicators, external debt, default probability, and indexes such as Credit Default Swap (CDS) [1] and EMBI+ (Emerging Markets Bond Index Plus). [2]

EMBI+ is part of a family of indexes whose methodology was developed by the J.P. Morgan Chase bank in the 1990s. This index calculates the spread between the daily return of sovereign emerging bonds and U.S. risk-free bonds with the same maturity and characteristics. The bonds have to meet other requirements to be part of the index calculation (J.P. Morgan, 2018; 2021).

CDS is a security contract against assets credit risk which is negotiated bilaterally between the seller, usually a bank, and the purchaser. In this sense, the purchaser aims to become protected against credit risks from the reference entity, i. e. the entity that issues the asset. Currently, CDS is the main credit derivative in global terms (PIMCO, 2017).

The objective of this paper is to understand what were the main determinants of the country risk premiums using CDS 5 Years and EMBI+ as indicators. We use time series and panel data methods, and specifications suggested in the empirical literature, for a sample of emerging economies in the period from 2003 to 2019, depending on the country (time series models), and from 2008 to 2019 (panel data models). The panel data econometric strategy use variables that have presented better statistical significance in the time series models. The variables (regressors) will be both *push* (exogenous, external) and *pull* (country-specifics). We hypothesize that some external variables play important roles as determinants of the emerging country risk premium, while country-specific variables can mitigate those exogenous effects.

The countries’ sample is based on data availability, for monthly and quarterly frequency. We follow the suggestion of the Brazilian Central Bank (2020) that have classified two groups of emerging countries as low and high-risk. We then selected for our econometric proposes Chile, Indonesia, and Russia (low-risk countries, according to that methodology) and Brazil, Colombia, Mexico, South Africa, and Turkey (high-risk countries).

The paper is organized as follows: beyond this introduction, the next section presents a literature review with empirical works about country risk premiums determinants. Section 3 presents the data, methodology, and results of our econometric specifications. Section 4 analyses those models' results and the final section concludes the paper.

2 Literature review

In the last twenty years, there has been a relevant empirical production in Economics about the determinants of the emerging economies' country risk premiums. However, the *theoretical* aspects have not been well developed yet and there is no theoretical paradigm to follow. For this reason, we start by analyzing some central results of the empirical literature, usually through time series and panel data applications. In general, the empirical literature uses the concepts of the international capital flows, the so-called *push* and *pull* debate that influences capital inflows/outflows and emerging economies’ country risk premium. We believe that there is a critical (inverse) relationship between international capital flows to/from emerging economies and their country risk premium.

Calvo *et al.* (1993) were pioneers in analyzing the main drivers of capital inflows and capital outflows to/from emerging countries. Based on that work, Chuhan *et al.* (1993), for the first time in the literature, used the terms *push/pull* to denominate the factors that have important roles in the

[1] CDS indexes are available on different maturities. In this paper we use CDS 5 Years.
[2] CDS and EMBI+ are mensured by basis points, i. e. one basis point is equivalent to 0,01%. The higher the index, the higher the country risk premium.

determination of the country risk premiums in emerging economies. In short, *push* factors are related to external/global events such as those related to monetary policy and economic growth in the most powerful economies of the world, risk aversion by international investors, international oil prices, and so on. The *pull* factors are also known as *country-specific* factors and are related to variables such as domestic economic growth, international reserves stock, industrial production, monetary and fiscal pace, external debt, and so on.

Given the expected inverse relationship between capital flows and country risk premiums, we believe that the *push/pull* approach can also be adapted to analyze country risk premiums. Although simple, Koepke (2018) defends that this distinction is a useful approach in the economic literature and Hannan (2018) believes that the factors *push/pull* will continue to have an important role in the literature about capital flows.

Aronovich (1999), in the article named *Country risk premium: theoretical determinants and empirical evidence for Latin American countries*, conceptualized the country risk spread of emerging economies as

> [...] the compensation required by a foreign investor for assuming the risk of default implicit in a bond issued by a government i, which matures in n years and yields R_{in}, when compared to the alternative return of purchasing a default risk-free bond of the same maturity (R_{fn}). Default risk-free bonds denote domestic debt bills and notes issued by developed countries' governments. Thus, $S_{in} = R_{in} - R_{fn}$ (*Ibidem*, 1999, p. 466).

According to the author, that spread is useful because it describes the economic agents' perceptions of the financial market about the long-term fundamentals of the economy. His empirical work analyzed Argentina, Brazil, and Mexico from June 1997 to September 1998. The author has found that positive variations in the default probability of the economies have raised the external borrowing costs. Furthermore, the author has argued that the country risk spreads of the three countries, in that period, were superelastic concerning the long-term interest rate of The United States (U.S.) (*Ibidem*, 1999).

García-Herrero and Ortíz (2005) assessed if the global risk aversion (GRA, proxy to the yield of USA corporative bonds with high relative risk) and some of its determinants such as short and long-term interest rates and economic growth in the USA were responsible to impact the sovereign spreads in a sample of nine Latin American countries (Argentina, Brazil, Colombia, Chile, Ecuador, Mexico, Panama, Peru, and Venezuela) from May 1994 to October 2003. The authors have used as proxies for the sovereign spreads the EMBI Global (Chile) and EMBI+ (other countries) and have found that there was a positive significant relationship between GRA and Latin American sovereign spreads. In contrast, U.S. economic growth and long-term interest rate (10-Year Treasury Bond Rate) have presented negative significant effects. However, when the econometric application was tested with the short-term U.S. interest rate – Federal Fund Rate – the effect was immediate: when that interest rate has raised, the Latin America sovereign spread has raised also.

Andrade e Teles (2006) developed a *beta country risk model* to assess the Brazilian country risk premium from January 1991 to December 2002. The authors found that the stock of international reserves was relevant just when Brazil had a fixed exchange rate; when it floated, the coefficient associated with the variable lost significance. Furthermore, fiscal variables (public debt and public sector primary net lending/borrowing) and the international oil price were not significant in the author's beta model.

Baldacci et al. (2008) analyzed empirically the main determinants of the country risk premium EMBI through a data panel with 30 emerging countries from 1997 to 2007. To the authors, fiscal and political factors were relevant in the model: fiscal consolidation has contributed to limiting the emerging spreads; however, the authors found that the composition of the public expenditure matters: public investment, for example, presented a negative impact on the spreads while the fiscal position was sustainable and the fiscal deficit does not become worse. On the other hand, political risks such as violence, expropriation and instability have operated to increase the country risk premiums of those countries.

Rocha and Moreira (2010) developed a panel data approach with 23 emerging countries in the period from 1998 to 2007. The authors aimed to assess the external (exogenous) and domestic determinants of the external vulnerability of those countries. As proxies for the global aversion to the risk, the authors have used the VIX Index and the J.P. Morgan Domestic High Yield Spreads (HY). The main finds of the paper were that those exogenous factors are relevant and produce different impacts on each economy: macroeconomic fundamentals are *multipliers* of those impacts.

> The results support policies towards financial liberalization, public debt management, consistent economic growth, development of the domestic financial market and improvements in governance indicators, especially the rule of law and regulatory quality (*Ibidem*, 2010, p. 181).

Aidar and Braga (2020), through a principal component analysis, have shown that the financial cycles in peripheric economies are subordinated to the global financial cycles. In a model with 10 emerging countries from January 1999 to January 2019, the authors aimed to present the main drivers of the country risk premiums (EMBI+ and CDS) for that sample of countries. The debate of the paper was centered on the *push/pull* approach. The authors have argued that *push* factors such as VIX Index and the U.S. 5-Year T-Note Interest Rate (with a positive sign), and international oil price (with a negative sign) have played a more relevant role as determinants of the country risk premiums, compared to some *pull* factors.

Finally, International Monetary Fund (IMF) developed a non-balanced panel data analysis in its Global Financial Stability Report in October 2019. The researchers of the institution have studied 71 countries intending to explain the main determinants of the EMBI Global Index (proxy to the country risk premium) from 1996 to 2019. The model had exogenous variables (US BBB corporate spread, proxy to the global risk appetite, and external real GDP growth (one year forward forecasts)). It also considered the following country-specific variables: domestic real GDP growth and domestic CPI inflation (one year forward forecasts), current account, external debt, net issuance of foreign currency government debt, and foreign currency reserves, all as percent of GDP. Domestic credit rating has interacted with the variable associated with the global risk appetite.

In the results, the model has shown that domestic fundamentals are important in explaining the sovereign spreads of those economies. For example, higher real GDP growth, lower inflation, higher stock of international reserves and lower external debt reduce sovereign spreads. Furthermore, countries with better credit ratings were less susceptible to external instabilities:

> Lower-rated issuers are more sensitive to global risk appetite. A 100 basis point increase in the US BBB corporate bond spread could widen spreads of B-rated EM bonds by more than 200 basis points, compared to only 50 basis points for A-rated EM issuers (IMF, 2019, p.14).

Based on this literature review, in the next section we present the methodology and data of our empirical analysis.

3 Methodology and data

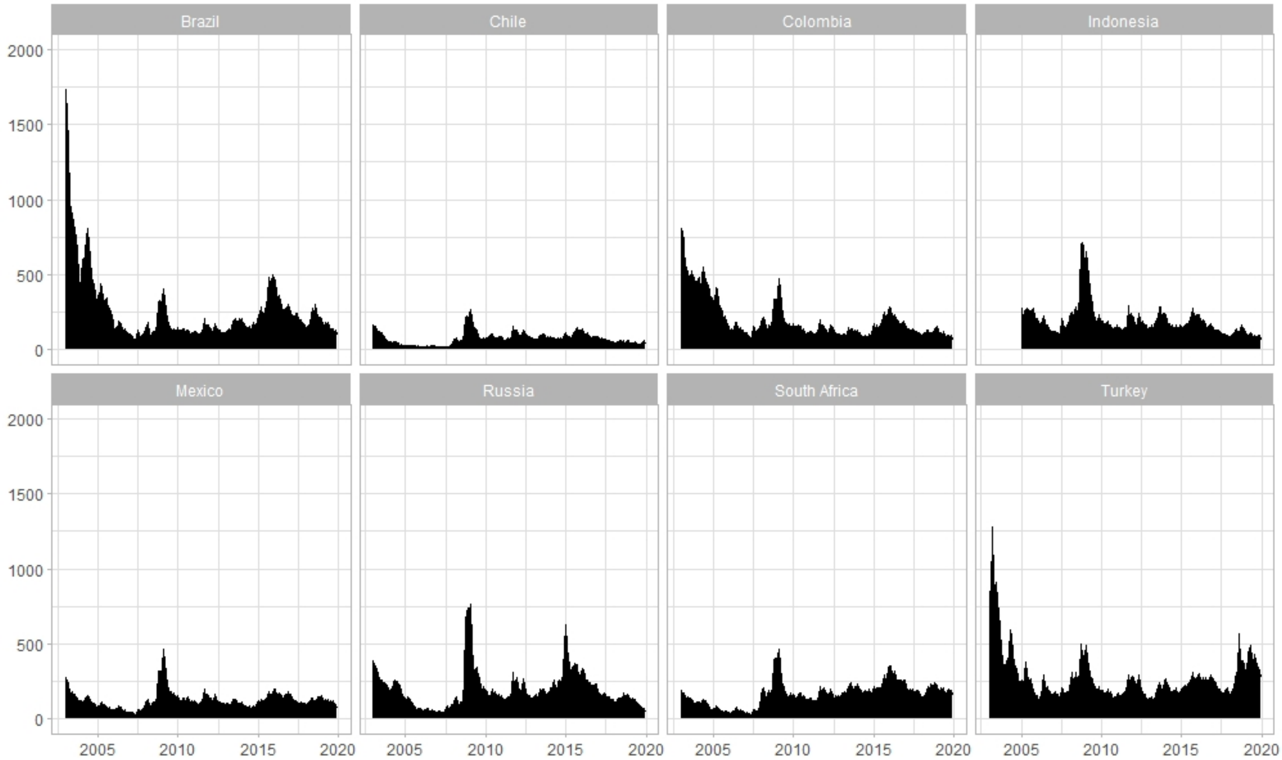
This paper developed time series and panel data econometric approaches to verify the main determinants of the country risk premiums EMBI+ and CDS 5 years for a sample of emerging economies. At first, we ran time series models to select the main variables – both *push* and *pull* – that in the period 2003-2019, depending on the country, were more important in that determination. The models proposed were the following:

$$LN\_CDS\_5Y_t = \beta_0 + \beta_1 LN\_CDS\_5Y_{t-1} + \beta_2 W_t + \beta_3 X_t + u_t, u_t \sim N(0,1) \quad (1)$$

$$LN\_EMBI_t = \beta_0 + \beta_1 LN\_EMBI_{t-1} + \beta_2 W_t + \beta_3 X_t + u_t, u_t \sim N(0,1) \quad (2)$$

where $t = 1, \ldots, T$; the number of observations depending on the country and the model, if it has monthly or quarterly data. [3] In this sense, for each one of the eight countries of the sample, we have four models: two using monthly data and two using quarterly data. It totalizes 32 models. Also, all the models have the dependent variables with one lag as regressors, because of the format of their correlograms (autoregressive processes of order one) (Bueno, 2015, p. 47). Figures 1 and 2 show the path of CDS 5 Years and EMBI+ indexes (in basis points) for the countries of our sample. [4]

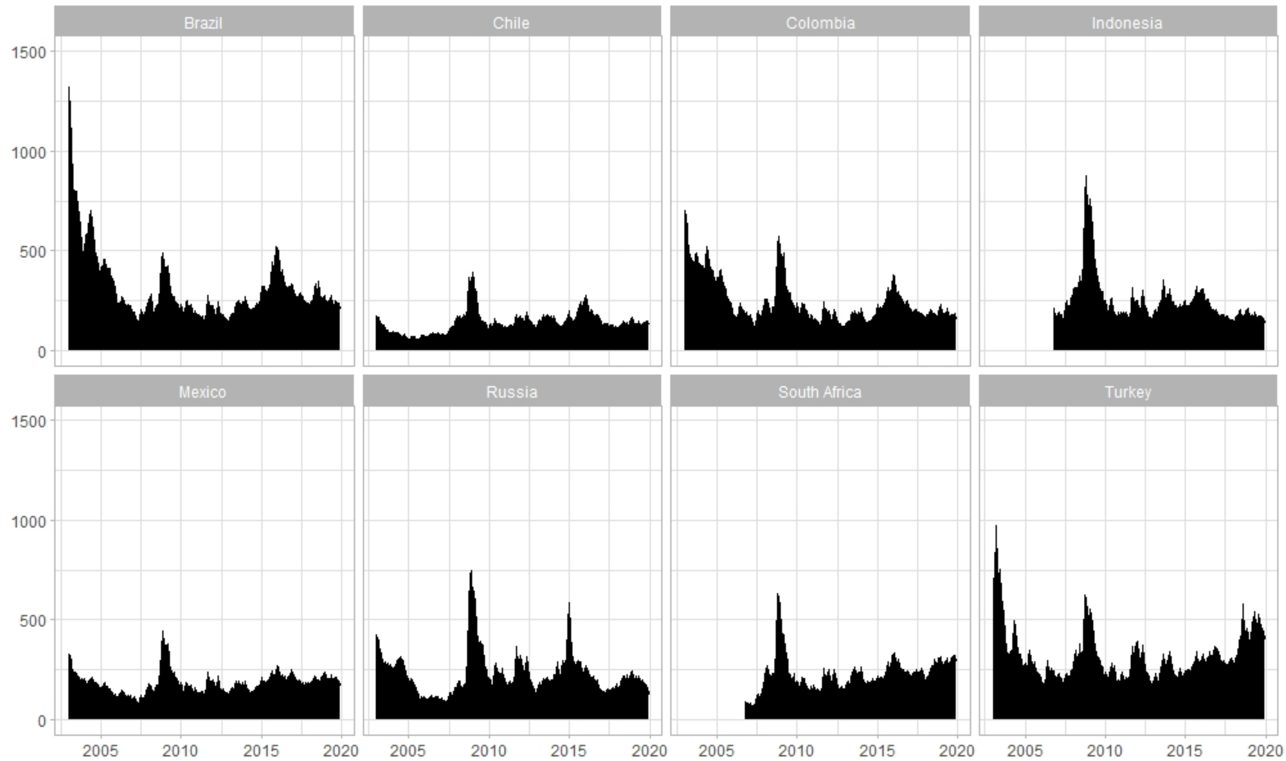
Figure 1 – CDS 5 Years country risk premium.



Source: J.P. Morgan.

Figure 2 – EMBI+ country risk premium.

[3] See table 2 on appendices.
[4] End of period monthly data.



Source: J.P. Morgan.

We assume, as already accepted in the economic literature (Rezende, 2009; Lavoie, 2013; Serrano and Pimentel, 2017), that a country issuer of its own currency cannot face a *default* on its public debt. In this sense, we do not consider internal fiscal variables as relevant for the external solvency indicators. However, the possibility of a country with a fiscal expansion or monetizing its public debt may be assessed by international investors as a risk for the domestic inflation rate. This possible increase in the inflation rate, although not necessarily represents a cost for the investor, usually has adverse macroeconomic consequences, mainly in emerging economies, which can cause capital outflows. Also, we do not use external debt variables because of data unavailability for the frequency we needed. We believe that the variable associated with the international reserves stock fulfills well that external issue.

In this sense, and mainly based on IMF (2019) and Aidar and Braga (2020) econometric approaches, we have selected the following variables for our specifications [5]: W_t is a *push* matrix with the following variables: U.S. GDP growth rate, U.S. industrial production growth rate, U.S. interest rate (Market Yield On U.S. Treasury Securities at 5-Year Constant Maturity), international oil price (Brent crude), and VIX Index – an index usually used to measure the global aversion risk; X_t is a *pull* matrix with the following variables: GDP growth rate, industrial production and manufacturing industrial production growth rates, international reserves stock growth rate, inflation rate, and current account net balance. u_t is the error term.

We also expect that the coefficients associated with the dependent variables with one lag, inflation rate, U.S. interest rate, and VIX Index have positive significant effects on the dependent variables; on the other hand, we expect that the coefficients associated with the variables U.S. GDP and U.S. industrial production, industrial and manufacturing industrial production growth rates, international reserves stock, current account balance, GDP growth rate, and international oil price have negative significant effects on those dependent variables. [6]

[5] See table 1 on appendices for more details about the variables we have used on the models.
[6] We also have tested a dummy variable in the period from September 2008 to June 2009 (monthly data) and from 2008.Q3 to 2009.Q2 (quarterly data) regarding to the global financial crisis. But that dummy variable was not significant in almost

We ran the Generalized Method Of Moments (GMM) for each one of the models of our time series econometric specifications. We did it because GMM deals better with endogeneity problems, i.e., $\text{cov}(u_t, x_t) \neq 0$. According to Wooldridge (2001, p. 50-51), endogeneity occurs because of omitted variables, measurement errors, or simultaneity. In our approach, we consider all of the *pull* variables as endogenous and then we instrumentalized them; also, we consider all of the *push* variables as exogenous. A good instrument z_t has to be valid in two cases: $\text{cov}(u_t, z_t) = 0$ e $\text{cov}(x_t, z_t) \neq 0$. Johnston and DiNardo (1996, section 5.5) present some considerations about the choice of correct instruments. In this paper, we have used lags of the variables as instruments. The J-statistic will be used as a test of overidentifying restrictions, i.e. when the number of instruments is greater than the number of regressors of the true model (Hansen, 1982). It also presents a test for the validity of the instruments. [7]

Table 1 summarizes the results of the models. In bold we highlight the main variables that have presented expected signs on at least 50% of the specifications. In this sense, we have two *push* variables: VIX Index and international oil price, and two *pull* variables: international reserves stock growth rate and inflation rate. Moreover, the dependent variables with one lag also have presented expected effects in all specifications we have tested, demonstrating the *inertial* character of the processes.

Table 1 – Summary of time series results.* [8]

VARIABLES	Expected coefficient signal	Total of specifications	Sign of the coefficient as expected		Sign of the coefficient different from the expected		Not significant	
			Quantity	%	Quantity	%	Quantity	%
LN_CDS_5Y(-1)	+	**16**	**16**	**100,0**	**0**	**0,0**	**0**	**0,0**
LN_EMBI(-1)	+	**16**	**16**	**100,0**	**0**	**0,0**	**0**	**0,0**
GDP_DOM_YOY	-	16	2	12,5	5	31,3	9	56,3
IND_PROD_MANUF_YOY	-	6	2	33,3	2	33,3	2	33,3
IND_PROD_YOY	-	10	1	10,0	1	10,0	8	80,0
RT12_LN_INT_RES	**-**	**16**	**8**	**50,0**	**2**	**12,5**	**6**	**37,5**
RT4_LN_INT_RES	-	16	6	37,5	2	12,5	8	50,0
GDP_US_YOY	-	16	4	25,0	3	18,8	9	56,3
IND_PROD_US_YOY	-	16	4	25,0	4	25,0	8	50,0
LN_VIX	+	**32**	**32**	**100,0**	**0**	**0,0**	**0**	**0,0**
CA	-	16	4	25,0	1	6,3	11	68,8
LN_OIL	**-**	**32**	**24**	**75,0**	**1**	**3,1**	**7**	**21,9**
INF_YOY	+	**32**	**23**	**71,9**	**0**	**0,0**	**9**	**28,1**
LN_INTEREST_5Y_US	+	32	9	28,1	10	31,3	13	40,6

*Prob. < 0,10.

We then specify a balanced panel data model with those variables that have presented better adequacy to the expected signs. We ran a GMM-DIFF, as proposed by Arellano and Bond (1991), for the period from 2008 to 2019 with monthly and quarterly data. Again, such as in the time series models, the GMM method was chosen because it deals better with the endogeneity problem (Roodman, 2009). More common models like fixed effects, which use ordinary least squared, present some difficulties to deal with that problem and it is not recommended for dynamic panel data.

Other problems arise because we have a small sample of countries. According to Arellano (2002) and Roodman (2009), many instruments may cause problems to the GMM estimation, including the J test of overidentifying. In this sense, we have limited the instruments to seven and we have used the same strategy of the time series models: variables lags as instruments. Because of that, we had just four (static specifications) or five (dynamic specifications) explanatory variables in the

all the specifications we have tested. We believe this happened because the effects of the crisis were already present in other variables, like VIX Index and GDP growth rates.

[7] All the econometric tests and the instrument lists are available with the authors upon request.

[8] Quarterly model for Russia took the growth rate from previous period for the dependent variable CDS 5 Years and for the regressors VIX Index, current account balance, international oil price, and the autoregressive variable. We did it to solve unit root problem.

models which are those that have presented better adequacy to the expected effects in the time series models. We also transformed all the variables in growth rates concerning the previous period, month or quarter, to solve the unit root problem.

Dynamic specification:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 RT1\_LN\_INT\_RES_{it} + \beta_3 INF\_QOQ_{it} + \beta_4 RT1\_LN\_VIXit + \beta_5 RT1\_LN\_OIL_{it} + \mu_i + u_{it} \quad (3)$$

Static specification:

$$Y_{it} = \beta_0 + \beta_1 RT1\_LN\_INT\_RES_{it} + \beta_2 INF\_QOQ_{it} + \beta_3 RT1\_LN\_VIX_{it} + \beta_4 RT1\_LN\_OIL_{it} + \mu_i + u_{it} \quad (4)$$

where Y_{it} represents both dependent variables, the growth rate of the indexes CDS 5 Years and EMBI+; Y_{it-1} represents the autoregressive variables. The regressors are the growth rate of the international reserves stock and the inflation rate (*pull* variables). The growth rate of the VIX Index and the growth rate of the international oil price are the *push* variables. $i = 1, \ldots, 8$ (eight countries) and $t = 1, \ldots, T$ (1.152 observations for monthly models, from January 2008 to December 2019, and 384 observations for quarterly models, from 2008.Q1 to 2019.Q4). All the variables were transformed by their natural logarithm, except inflation. μ_i represents country specifics effects and u_{it} is the error term.

Worth mentioning that the GMM-DIFF method, taking the first difference of the variables, rules out those variables that are time-invariant (Baltagi, 2005). In our models, there are no estimations for intercept terms and country specifics effects then.

Tables 2 and 3 summarize the GMM-DIFF results and, in the next section, we present some considerations about the results we have found.

Table 2 – Panel data results for the dependent variable CDS 5 Years.

MODELS	Monthly		Quarterly	
	Dynamic	**Static**	**Dynamic**	**Static**
RT1_LN_CDS_5Y(-1)	-0.0667		0.1296	
	(0.0583)		(0.1059)	
RT1_LN_INT_RES	-4.3108***	-4.7381***	-9.5894***	-8.5432***
	(0.8263)	(0.5883)	(1.5191)	(1.2165)
INF_QOQ	0.4056	0.3220	1.3536	1.3997

	(0.3225)	(0.3218)	(1.1205)	(1.0846)
RT1_LN_VIX	0.1488***	0.1555***	0.2101***	0.1900***
	(0.0135)	(0.0149)	(0.0384)	(0.0303)
RT1_LN_OIL	-0.1477***	-0.1269***	-0.4141***	-0.4110***
	(0.0349)	(0.0315)	(0.0601)	(0.0550)
Number of observations	1.152	1.152	384	384
Jarque Bera Test	109.4634	122.9289	32.6177	36.3554
Prob. Jarque Bera Test	0.0000	0.0000	0.0000	0.0000
AR (1) - m-Statistic	-2.7727	-2.7339	-3.0919	-2.6513
Prob. AR (1)	0.0056	0.0063	0.0020	0.0080
AR (2) - m-Statistic	0.3759	1.3575	-6.9103	-1.1055
Prob. AR (2)	0.7070	0.1746	0.0000	0.2689
J-Statistic	0.2365	0.1384	2.2476	2.3000
Prob. J-Statistic	0.6267	0.7099	0.3250	0.3166
Instrument rank	6	5	7	6

Significance: (***) 0.01; (**) 0.05; (*) 0.10.
Coef. Covariance method: White period.

Table 3 – Panel data results for the dependent variable EMBI+.

MODELS	**Monthly**		**Quarterly**	
	Dynamic	**Static**	**Dynamic**	**Static**
RT1_LN_EMBI(-1)	0.1708***		0.2112***	
	(0.0571)		(0.0764)	
RT1_LN_INT_RES	-2.4281***	-1.8646***	-2.8984*	-1.9107
	(0.5328)	(0.3308)	('-1.8839)	(1.2826)
INF_QOQ	0.6839	0.7785	0.7505	0.7850
	(0.4814)	(0.5181)	(0.8894)	(0.7760)
RT1_LN_VIX	0.1306***	0.1160***	0.1984***	0.1701***
	(0.0089)	(0.0083)	(0.0218)	(0.0143)
RT1_LN_OIL	-0.0989**	-0.1462***	-0.2462***	-0.2540***
	(0.0393)	(0.0397)	(0.0419)	(0.0430)
Number of Observations	1.152	1.152	384	384
Jarque Bera Test	25.3680	38.7822	10.0059	32.0611
Prob. Jarque Bera Test	0.0000	0.0000	0.0067	0.0000
AR (1) - m-Statistic	-2.7395	-2.7791	-3.0526	-2.7641
Prob. AR (1)	0.0062	0.0055	0.0023	0.0057
AR (2) - m-Statistic	2.2029	-1.2039	0.0588	-0.5688
Prob. AR (2)	0.0276	0.2286	0.9531	0.5695
J-Statistic	0.0962	0.5759	3.9341	4.0806
Prob. J-Statistic	0.7564	0.4479	0.1399	0.1300
Instrument rank	6	5	7	6

Significance: (***) 0.01; (**) 0.05; (*) 0.10.
Coef. Covariance method: White period.

It is important to highlight that two of the eight models had problems with the AR(2) Arellano-Bond Serial Correlation Test: the dynamic quarterly model for dependent variable CDS 5 Years and the dynamic monthly model for dependent variable EMBI+ have rejected the null hypothesis of the test (p-value < 0,10).

> Arellano and Bond (1991) propose a test for the hypothesis that there is no second-order serial correlation for the disturbances of the first-differenced equation. This test is important because the consistency of the GMM estimator relies upon the fact that $E[\Delta v_{it} \Delta v_{it-2}] = 0$ (Baltagi, 2005, p. 141).

4 Empirical analysis

Our econometric approaches, both time series and panel data, have tested some *push* and *pull* variables to analyze the main determinants of the country risk premiums for a sample of emerging economies. At first, we have computed all the results from the time series models. For a matter of space, in the previous section, we have not exhibited the individual models for each one of the eight countries, nor the coefficients that the GMM estimator has estimated. The most important information about those estimated models were summarized in table 1.

In that table, we have the degree of adequacy of each one of the independent variables concerning the coefficient sign we have expected. *Push* and *pull* variables such as GDP growth rate, industrial production growth rate, U.S. GDP growth rate, and current account have demonstrated poor suitability (in all models those variables were tested, more than 50% had insignificant coefficients). Other variables such as manufacturing industrial production, U.S. industrial production, and U.S. interest rate have demonstrated mixed results according to the signs of the coefficients we have expected.

However, econometric models developed by Nogués and Grandes (2001), Afonso (2003), and FMI (2019) have found that economic growth is an important factor that improves country risk premiums of emerging economies. Furthermore, econometric estimations by Aronovich (1999), Arora and Cerisola (2001), Nogués and Grandes (2001), González-Rozada and Yeyati (2008), Dailami (2008), Aidar and Braga (2020), and Hartelius *et al.* (2008) have found evidence that a rise in the U.S. interest rate can cause increases in the emerging country risk premiums. For Aronovich (1999), emerging economies' spreads are *superelastic* to the long-term U.S. interest rate. Dailami (2008) finds that the relation between U.S. monetary policy and emerging country risk is positive, but the countries that have moderate debt levels are in general less impacted by The U.S. interest rate movements. Aidar and Braga (2020, p. 99) have argued: "*The empirical exercise suggests that an increase in the interest rate associated with the 5-Year T-Note coincides with a higher perception of risk captured by the first principal component*".

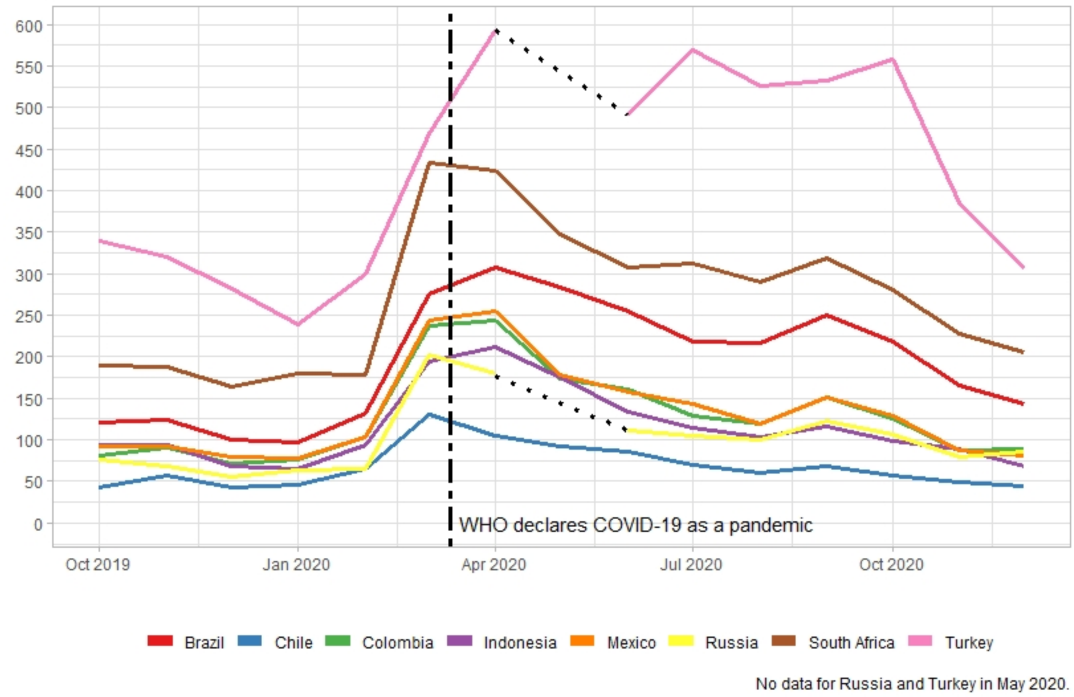
In our estimations, using the variable Market Yield On U.S. Treasury Securities at 5-Year Constant Maturity, only 28,1% of the models have demonstrated some evidence of a positive significant relationship between that interest rate and emerging country risk premiums.

In the case of the autoregressive independent variables tested in the 16 specifications, all of them had the expected positive sign. It shows the *inertial* character of the series, as their correlograms have already demonstrated. In other words, the current level of the dependent variables depends on a great measure of their previous levels.

Push variables VIX Index and international oil price coefficients estimated also had the expected signs. VIX Index has presented positive significant coefficients in all 32 models, both monthly and quarterly. The international oil price, in its turn, has presented negative significant coefficients, as expected, in 3/4 of the monthly and quarterly specifications. In this sense, those were the main *push* variables we have found through time series specifications. This situation emphasizes the relevant role played by some global factors in the emerging country risk premium pricing.

The role of international liquidity, captured in those *push* variables, implies that there is a common cause for the country risk premium dynamics, as noted by Aidar and Braga (2020). Although the 2020 data was not included in our sample, we can use the first months that followed the outburst of the COVID-19 pandemic to illustrate that common movement. Figure 3 shows that the country risk premiums, measured by the CDS 5 years, increased in all the countries of our sample.

Figure 3 – CDS country risk premiums from October 2019 to December 2020.



Source: J.P. Morgan.

On the other hand, the coefficient signs of the main *pull* variables were as expected: the inflation rate, with positive effects, and the growth rate of the international reserves stock (monthly models), with negative effects. Our results contrast with Andrade and Teles (2006) study about the Brazilian economy because the authors have argued that the international reserves stock was relevant in explaining country risk premium just for fixed exchange rate periods. However, all the countries in our sample have floating exchange rates, according to the Assessing Reserve Adequacy methodology by IMF.

In this sense, the time series models have suggested that lower inflation and a growing stock of international reserves are the main *pull* variables that can mitigate some effects of the global financial cycles on emerging country risk premiums.

GMM-DIFF panel data estimations, static and dynamic, were produced out of the time series results. In this sense, for both dependent variables CDS 5 Years and EMBI+, we have tested as independent variables: autoregressive variables (only dynamic models) and two *push* regressors (VIX Index and international oil price) and two *pull* regressors (international reserves stock growth rate and the inflation rate).

The results were similar in all eight models estimated. For the dependent variable associated with the CDS 5 Years, neither monthly nor quarterly models have demonstrated positive significant effects in the coefficient associated with the autoregressive regressors. However, for the dependent variable EMBI+, it happened, as expected. Furthermore, both dynamic and static, monthly and quarterly estimations, have demonstrated the same results: *push* variables VIX Index (positive effects) and international oil price (negative effects) have played important roles in explaining the country risk premiums in emerging economies. On the other hand, accumulating international reserves is an important economic tool to lower the country risk premium and deal with the exogenous shocks from the international economies, like those from variations in the VIX Index and international oil price. Contrary to most of the time series results, the inflation rate concerning the previous period was insignificant in all models we have tested. Worth mentioning that in all models the coefficients estimated for the international reserves variable were larger than the coefficients associated with the *push* variables. Also, those coefficients were larger for the dependent variable CDS 5 Years models, in comparison with EMBI+ models. It suggests the great relevance that accumulating international reserves has in lowering the emerging country risk premiums since it acts as a financial backing for futures market transactions and safety against capital outflows (flight to safety or flight to quality).

In this sense, besides the inertial characteristic of both variables CDS 5 Years and EMBI+, our results in this kind of GMM-DIFF estimation have demonstrated that the movements of the VIX Index, the international oil price, and the growth rate of the international reserves stock played important roles as drivers of the emerging economies' country risk premiums movements throughout the last two decades.

Concluding remarks

Based on the empirical literature, mainly on works by FMI (2019) and Aidar and Braga (2020), this paper presented a model, with two different econometric approaches, to evaluate the main drivers of the country risk premium for a group of emerging economies. In time series models, we have found that the two main external or *push* variables were the VIX index and the international oil price. The first variable had a positive or direct effect on emerging country risk premiums; the second, in its turn, had a negative or inverse effect on those premiums. Furthermore, the *pull* variables that stood out were the growth rate of international reserves stock (negative effects) and the inflation rate (positive effects).

In our panel data GMM-DIFF approach the *push* variables related to the VIX Index and international oil price kept playing the same roles as determinants of the emerging country risk premiums. However, the country-specific variables we have selected for the panel data models, the growth rate of the international reserves stock and the inflation rate concerning the previous period, only the first has demonstrated (negative) significant effects on the emerging country risk premiums. We highlight the large coefficients estimated for that variable, mainly in the CDS 5 Years panel data models, which explain the importance for emerging economies in accumulating international reserves. It can be considered by international investors as a sign of sound external accounts of the emerging economies and also a necessary condition for an economy to grow without the balance of payments constraints. The inflation rate, in its turn, was insignificant in all eight models we have tested.

Although the 2020 data was not included in our sample, we can interpret what happened with CDS 5 Years and EMBI+ during the COVID-19 pandemic, based on our findings. In the first four months of 2020, emerging economies' country risk premiums measured by CDS 5 Years and EMBI+ had raised in all the countries of our sample - an expected result given our models. According to FRED Economic Data, Vix Index raised 34,70 points from January to March 2020, the period that the first impacts of the pandemic started to be globalized. From January to April 2020 the international oil price has decreased, in nominal terms, $ 40,26. The impact of the reversal of international liquidity, mainly through VIX Index and the international oil price, was sizeable.

However, the impact on the international reserves stock was not so strong according to IMF. Between January and March 2020, except for Mexico and Russia, all countries lost international reserves in order to deal with the pandemic economic impacts. It was, according to our results, another force contributing to elevating the country risk premium. Throughout 2020, the most impacted country in terms of international reserves stock was Chile, which lost almost 8 billion dollars.

We conclude that the emerging economies, in a financialized world, are exposed to global shocks and it can be reflected in their country risk spreads. Besides, country-specific variables such as the positive growth rate of the international reserves stock (mainly) and the low inflation rate may act as a buffer for those external shocks.

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Appendices

Table 1 – Time series and panel data variables: descriptions and sources.

Variable	Description	Source
LN_CDS_5Y*	Natural logarithm of the country risk premium CDS 5 Years.	J.P. Morgan
LN_EMBI*	Natural logarithm of the country risk premium EMBI+.	J.P. Morgan
LN_CDS_5Y(-1)*	One lag of the country risk premium CDS 5 Years natural logarithm.	J.P. Morgan
LN_EMBI(-1)*	One lag of the country risk premium EMBI+ natural logarithm.	J.P. Morgan
GDP_DOM_YOY*	GDP growth rate (%) concerning the same quarter previous year. Quarterly models.	FRED Economic Data
IND_PROD_YOY*	Industrial production growth rate (%) concerning the same month previous year. Variable used for Brazil, Chile, Mexico, Russia, and Turkey. Monthly models. Proxy for the monthly economic growth.	International Financial Statistics (IMF)
IND_PROD_MANUF_YOY*	Manufacturing industrial production growth rate (%) concerning the same month previous year. Variable used for South Africa, Colombia, and Indonesia. Monthly models. Proxy for the monthly economic growth.	International Financial Statistics (IMF)

RT4_LN_INT_RES*	Growth rate (%) concerning the same quarter previous year of the natural logarithm of the international reserves stock (constant prices). Quarterly models.	International Financial Statistics (IMF)
RT12_LN_INT_RES*	Growth rate (%) concerning the same month previous year of the natural logarithm of the international reserves stock (constant prices). Monthly models.	International Financial Statistics (IMF)
INF_YOY*	The growth rate of inflation concerning the same period previous year. Monthly and quarterly models.	FRED Economic Data and OECD
CA*	Net balance (constant prices) of the balance of payments current account. Quarterly models.	International Financial Statistics (IMF)
GDP_US_YOY*	U.S. GDP growth rate (%) concerning the same quarter previous year. Quarterly models.	FRED Economic Data
IND_PROD_US_YOY*	U.S. industrial production growth rate (%) concerning the same month previous year. Monthly models. Proxy for the U.S. monthly economic growth.	FRED Economic Data
LN_INTEREST_5Y_US*	Natural logarithm of the Market Yield On U.S. Treasury Securities at 5-Year Constant Maturity. End of period for monthly and quarterly models.	FRED Economic Data
LN_OIL*	Natural logarithm of the international oil price (Brent crude). End of period constant prices for monthly and quarterly models.	FRED Economic Data
LN_VIX*	Natural logarithm of the VIX Index, end of period. Monthly and quarterly models.	FRED Economic Data
RT1_LN_CDS_5Y**	Growth rate (%) of the country risk premium CDS 5 Years natural logarithm concerning previous period.	J.P. Morgan
RT1_LN_EMBI**	Growth rate (%) of the country risk premium EMBI+ natural logarithm concerning previous period.	J.P. Morgan
RT1_LN_INT_RES**	Growth rate (%) of the international reserves stock natural logarithm concerning previous period.	International Financial Statistics (IMF)
INF_QOQ**	Inflation rate (%) concerning previous period.	FRED Economic Data and OECD
RT1_LN_VIX**	Growth rate (%) VIX Index natural logarithm concerning previous period.	FRED Economic Data
RT1_LN_OIL**	Growth rate (%) international oil price (Brent crude) natural logarithm concerning previous period.	FRED Economic Data

* Time series models.
** Panel data models.

Table 2 – Number of observations and period of the time series models.

Country	**Monthly model**	**Quarterly model**
South Africa	140 (Jan/07 to Ago/18)	46 (2007.Q1 to 2018.Q2)
Brazil	204 (Jan/03 to Dec/19)	68 (2003.Q1 to 2019.Q4)
Chile	156 (Jan/07 to Dec/19) (CDS_5Y) and 168 (Jan/06 to Dec/19) (EMBI)	55 (2006.Q1 to 2019.Q3)
Colombia	201 (Jan/03 to Sep/19)	55 (2006.Q1 to 2019.Q3)
Indonesia	124 (Jan/09 to Apr/19)	41 (2009.Q1 to 2019.Q1)
Mexico	204 (Jan/03 to Dec/19)	68 (2003.Q1 to 2019.Q4)
Russia	156 (Jan/07 to Dec/19)	56 (2006.Q1 to 2019.Q4)
Turkey	204 (Jan/03 to Dec/19)	68 (2003.Q1 to 2019.Q4)

Tables 3 and 4 – Unit root tests for monthly and quarterly panel data models.

MONTHLY MODELS		Constant				Constant and trend			
		LLC	**IPS**	**ADF**	**PP**	**LLC**	**IPS**	**ADF**	**PP**
TX1_LN_CDS_5Y	Stat.	-38,6466	-34,3393	646,4200	646,6140	-44,4444	-35,9866	613,8880	613,6130
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
TX1_LN_EMBI	Stat.	-38,7579	-35,0172	659,7110	660,0260	-43,9617	-36,3998	622,2140	622,5530
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
TX1_LN_INT_RES	Stat.	-24,0273	-22,5298	405,9360	561,8510	-30,5693	-25,2666	415,7900	542,2510
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
INF_QOQ	Stat.	-16,0959	-18,7547	325,7150	304,9940	-18,1665	-19,0303	299,6060	274,2720
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
TX1_LN_VIX	Stat.	-52,1809	-45,5979	771,5430	695,9780	-59,4011	-48,0350	735,2480	655,5150
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
TX1_LN_OIL	Stat.	-27,7227	-22,0507	398,4230	384,6160	-31,6231	-22,0012	356,8180	342,8180
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

Lags according to Schwarz information criterion.

Newey-West automatic bandwidth selection and Bartlett kernel.

1.152 observations - 2008M01 to 2019M12.

QUARTERLY MODELS		Constant				Constant and trend			
		LLC	**IPS**	**ADF**	**PP**	**LLC**	**IPS**	**ADF**	**PP**
TX1_LN_CDS_5Y	Stat.	-15,7529	-15,1617	203,8440	203,8460	-15,7801	-14,6600	177,3570	177,9890
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
TX1_LN_EMBI	Stat.	-14,6371	-16,1398	220,0460	233,4340	-11,8573	-14,1919	175,3530	199,8410
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
TX1_LN_INT_RES	Stat.	-11,2639	-10,9524	140,8530	152,2080	-12,9944	-11,6666	141,9780	142,1530
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
INF_QOQ	Stat.	-7,8254	-7,5620	93,2836	159,1770	-8,0962	-7,1857	85,2438	144,5380
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
TX1_LN_VIX	Stat.	-3,6111	-19,7831	278,5020	332,4910	0,2123	-18,9879	249,0830	1.123,90
	Prob.	0,0002	0,0000	0,0000	0,0000	0,5841	0,0000	0,0000	0,0000
TX1_LN_OIL	Stat.	-19,3460	-15,8067	214,2930	217,1740	-19,2942	-14,7149	177,8470	179,7170
	Prob.	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

Lags according to Schwarz information criterion.

Newey-West automatic bandwidth selection and Bartlett kernel.
384 observations – 2008.Q1 to 2019Q4.

For both models:
LLC: Levin, Lin e Chu t - H0: common unit root.

ADF - Fisher Chi-square - H0: individual unit root (for each i).

IPS: Im, Pesaran e Shin W-stat - H0: individual unit rott (for each i).

PP - Fisher Chi-square - H0: individual unit root (for each i).