ISSN 1518-3548

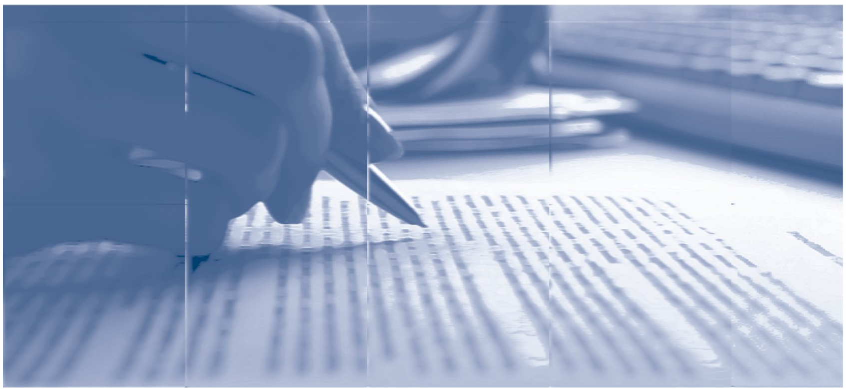
BANCO CENTRAL DO BRASIL

Loss Aversion and Search for Yield in Emerging Markets Sovereign Debt

Ricardo Sabbadini

September 2019

Working Papers



500

ISSN 1518-3548
CGC 00.038.166/0001-05

Working Paper Series	Brasília	no. 500	September	2019	p. 1-26

Working Paper Series

Edited by the Research Department (Depep) – E-mail: workingpaper@bcb.gov.br

Editor: Francisco Marcos Rodrigues Figueiredo

Co-editor: José Valentim Machado Vicente

Head of the Research Department: André Minella

Deputy Governor for Economic Policy: Carlos Viana de Carvalho

Citizen Service Division

Banco Central do Brasil

Deati/Diate

SBS – Quadra 3 – Bloco B – Edifício-Sede – 2º subsolo

70074-900 Brasília – DF – Brazil

Toll Free: 0800 9792345

Fax: +55 (61) 3414-2553

Internet: http//www.bcb.gov.br/?CONTACTUS

Non-technical Summary

Since the global financial crisis of 2008, risk-free interest rates in developed countries remain low and interest rates on emerging markets sovereign bonds have fallen even more. The decrease in the spread between these rates occurred despite the increase in the indebtedness of emerging countries, which suggests an increase in their risk. This reduction in spreads may be a manifestation of a search for higher yields on riskier investments by international investors. Recent empirical studies document this search for yield in other segments of the financial market and in controlled experiments with individual investors.

In this article, I show that this decrease in sovereign spreads after a risk-free interest rate decline does not happen in a theoretical model of strategic sovereign default in which international investors have conventional preferences (in line with expected utility theory). In this framework, simulated data reveal that, when the risk-free international interest rate falls, emerging countries increase their indebtedness, become riskier (the probability of sovereign default increases) and their spreads rise. This last result is at odds with the data from the last decade.

Next, I show that an alternative version of the model – in which international investors have preferences with loss aversion and reference dependence, features suggested by behavioral economics – replicates the pattern seen in the data. I assume that investors regard the typical risk-free interest rate as a reference point. They consider returns higher (lower) than such reference as gains (losses). Since they are loss-averse, a particular gain increases their utility less than an equivalent loss decreases it. With this change in the theoretical model, when the risk-free international interest rate falls below the reference point, emerging countries increase their debt level and become riskier, but their spreads decrease. This happens because international investors search for yields on risky bonds in order to achieve the return rate of reference, which is unattainable by investing only in risk-free assets, and avoid losses. Hence, they accept a smaller premium for the risk they bear.

Sumário Não Técnico

Desde a crise financeira global de 2008, as taxas de juros livres de risco em países desenvolvidos permanecem baixas e as taxas de juros dos títulos soberanos de mercados emergentes caíram ainda mais. A diminuição do spread entre essas taxas ocorreu apesar do aumento no endividamento dos países emergentes, o que sugere um aumento em seu risco. Essa redução dos spreads pode ser uma manifestação de busca por rendimentos mais altos em investimentos mais arriscados por parte dos investidores internacionais. Estudos empíricos recentes documentam essa busca por rendimentos em outros segmentos do mercado financeiro e em experimentos controlados com investidores individuais.

Neste artigo, mostra-se que essa diminuição dos spreads soberanos após uma queda do juro livre de risco não ocorre em um modelo teórico de default soberano estratégico em que os investidores internacionais possuem preferências convencionais (de acordo com a teoria da utilidade esperada). Nesse arcabouço, dados simulados mostram que, quando a taxa de juros internacional livre de risco cai, os países emergentes aumentam seu endividamento, ficam mais arriscados (aumenta a probabilidade de default soberano) e seus spreads sobem. Este último resultado está em desacordo com os dados da última década.

Em seguida, demonstra-se que uma versão alternativa do modelo – em que os investidores internacionais possuem preferências com aversão a perdas e dependência de referência, características sugeridas pela economia comportamental – replica o padrão observado nos dados. Supõe-se que os investidores consideram a taxa de juros livre de risco típica como um ponto de referência. Retornos superiores (inferiores) a essa taxa são vistos como ganhos (perdas). Devido à aversão a perdas, um ganho específico aumenta a utilidade dos investidores em magnitude menor do que uma perda equivalente a diminui. Com essa alteração no modelo teórico, quando a taxa de juros internacional livre de risco cai abaixo do nível de referência, os países emergentes aumentam sua dívida e ficam mais arriscados, mas seus spreads diminuem. Isso ocorre porque os investidores internacionais buscam rendimentos em títulos arriscados a fim de atingir a taxa de retorno de referência, que é inalcançável investindo somente em ativos livres de risco, e evitar perdas. Por isso, eles aceitam um prêmio menor pelo risco tomado.

Loss Aversion and Search for Yield in Emerging Markets Sovereign Debt*

Ricardo Sabbadini**

Abstract

Empirical evidence indicates that a decline in international risk-free interest rates decreases emerging markets (EM) sovereign spreads. A standard quantitative model of sovereign default, calibrated to match average levels of debt and spread, does not replicate this feature even if the risk aversion of lenders moves with international interest rates. In this paper, I show that a model with lenders that are loss-averse and have reference dependence, traits suggested by the behavioral finance literature, replicates the noticed stylized fact. In this framework, when international interest rates fall, EM sovereign spreads decline despite increases in debt and default risk. This happens because investors search for yield in risky EM bonds when the risk-free rate is lower than their return of reference. I find that larger spread reductions occur for i) riskier countries; ii) greater declines in the risk-free rate; and iii) higher degrees of loss aversion.

Keywords: search for yield, loss aversion, low interest rate, sovereign spread
JEL Classification: E43, E71, F34, F41, G41

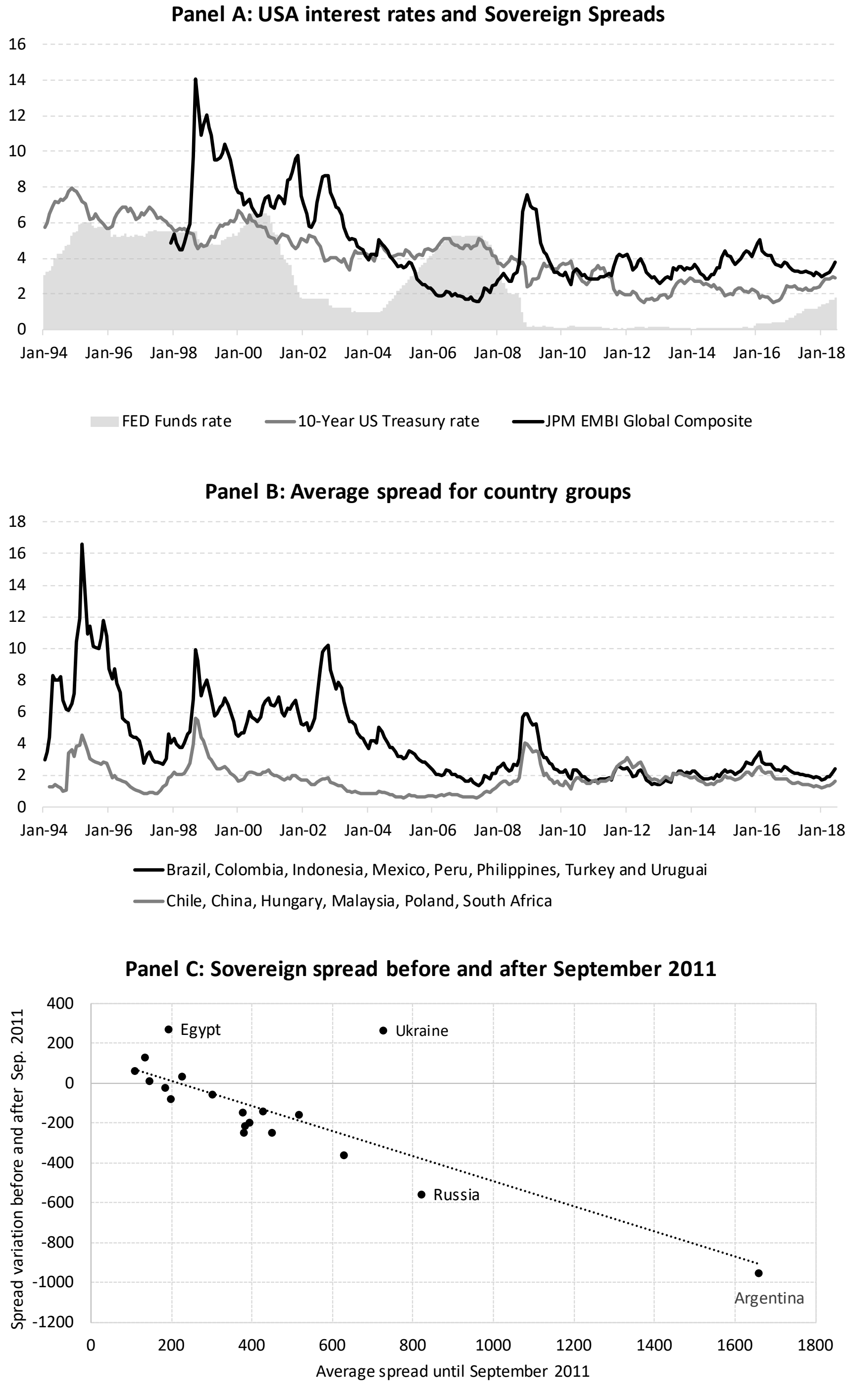
* The views expressed here are of my own and do not necessarily reflect those of the Central Bank of Brazil. This paper is part of the dissertation written as a requirement to a doctorate degree in Economics at University of São Paulo. I thank an anonymous reviewer, Julia Passabom Araujo, Alisson Curatola, Fabio Kanczuk, Gian Paulo Soave, Danilo Paula Souza, André Minella and Carlos Viana de Carvalho for valuable comments and suggestions.
** Department of Economics, Central Bank of Brazil. E-mail: ricardo.sabbadini@bcb.gov.br.

1. Introduction

Since the global financial crisis (GFC), international risk-free interest rates remain low (panel A of Figure 1). Empirical evidence (Arora and Cerisola, 2001, Uribe and Yue, 2006, Gonzáles-Rozada and Levy Yeyati, 2008; and Foley-Fisher and Guimarães, 2013) indicates that such low rates reduce sovereign spreads for emerging markets (EM), in line with data in Figure 1. For Shin (2013), the current decline of risk premiums for debt securities in EM is a manifestation of a search for yield (SFY), a shift towards riskier investments when risk-free rates are low, by foreign lenders. This view also appears in the financial press, that noted the appetite of foreign investors for risky EM sovereign bonds (Doff and Provina, 2017; Russo, Cota and Verma, 2017). Besides, SFY behavior is widely documented in several other financial markets, such as bank loans (Maddaloni and Peydró, 2011; Jiménez et al, 2014), money market funds (Chodorow-Reich, 2014; Di Maggio and Kacperczyk, 2017), mutual funds (Choi and Kronlund, 2018), corporate bonds (Becker and Ivashina, 2015), pension funds (Chodorow-Reich, 2014; Andonov, Bauer and Cremers, 2017), and long-term government bonds (Hanson and Stein, 2015).

In this paper, I extend an otherwise standard quantitative model of strategic sovereign debt and default to investigate if lower international risk-free rates lead to SFY in EM bonds, defined as lower spreads even under higher risk. This type of model is suitable for this inquiry because it offers a micro-foundation of the sovereign risk and the associated spread. I alter the model so that the emerging economy faces periods of high or low international risk-free interest rates, instead of a constant one. Then, I observe that this model, calibrated to match average levels of debt and spread, does not generate lower spreads when the risk-free rate falls, even if the risk aversion of foreign lenders declines simultaneously to the interest rate. In this setting, when international rates fall, EM countries borrow more and become riskier. Consequently, their spreads rise.

Figure 1 – USA interest rates and spreads in emerging markets.



Note: Panel A plots a measure of the sovereign interest rate spread for emerging countries (JP Morgan Emerging Markets Bond Index Global Composite) and short (Fed Funds) and long-run (10-year treasuries) interest rates in the USA. Panel B presents the same spread measure for two groups of countries, with average spread higher or lower than 300 bps until September 2011 (the month when 10-Year US Treasury Constant Maturity Rate reach 2% for the first time in the sample). I select countries with data available for spread and sovereign debt (Arslanalp and Tsuda, 2014) and exclude Argentina, Egypt, Russia and Ukraine due to default, war or political unrest. Panel C shows the correlation between average spread until September 2011 and the spread change before and after such date.

Therefore, I propose an explanation for the SFY in EM bonds. I replace the traditional preference of foreign lenders with one grounded on traits of investor psychology. Following Prospect Theory (Kahneman and Tversky, 1979), I assume they are loss-averse and have reference dependence. I choose this behavioral approach inspired by the recent paper of Lian, Ma and Wang (2018) [1]. Until then, most theoretical work on SFY, as Acharya and Naqvi (2016) and Matinez-Miera and Repullo (2017), relied on informational and principal-agent problems to explain the phenomenon. Since most evidence comes from intermediated markets, these are reasonable frameworks, because financial institutions might overinvest in risky assets to search for yield. However, recent experimental evidence with individual investors (Lian, Ma and Wang, 2018; Ganzach and Wohl, 2018) suggests that SFY exists even in the absence of this type of institutional friction. Additionally, Lian, Ma and Wang (2018) show that SFY by individuals is incompatible with conventional portfolio theory and provide evidence in favor of a theory based on investor psychology.

Hence, I assume that foreign lenders have the typical international risk-free rate (4%, for example) as a reference point, because they are used to it. When safe returns are lower than this (decrease to 2%, for example), a rare occurrence, they are considered losses relative to the return of reference. Since investors are loss-averse, they dislike such loss more than they like an equivalent gain, increasing their SFY in risky EM bonds. In this setting, investors search for these securities because they offer the opportunity to achieve their reference return (4%).

Simulated data from a calibrated model with loss aversion and reference dependence show that EM countries borrow more and become riskier when the international interest rate declines. However, their sovereign spreads fall, in accordance with the empirical evidence and the pattern seen since the GFC. The magnitude of changes in average debt and spread is similar to the observed in EM in recent years of low interest rates in developed countries.

Results are robust to changes in the main parameters of the model. The conclusions remain regardless of the duration of the bouts of low risk-free rates. Spread reductions are larger for riskier countries, in line with the information in panels B and C

[1] Furthermore, predictions of Prospect Theory find empirical support in experimental and financial data and offer solutions to puzzles of the conventional theory (Barberis, 2018).

of Figure 1. Countries with very low risk of default, that rarely have spreads high enough to achieve the return of reference, exhibit lower spread reductions when international interest rates go down. If the drop in risk-free rates is larger (for example, from 4% to zero, instead of 2%), EM countries increase their indebtedness even more. The model also reveals that greater degrees of loss aversion of lenders are associated with larger increases in indebtedness and reductions in spreads, i.e., more SFY.

The model also offers some guidance on the risks to EM debt of normalization of monetary policy in developed countries. In the first year with high international risk-free interest rates after a cycle of low rates, an EM sovereign default is more likely. During periods of high and low risk-free rates, the default frequency is 1.8% and 2.3% respectively. Restricting the sample only to the first year of periods of high risk-free rates, default frequency climbs to 2.6%. In addition, average spreads rise from 3.5 p.p. to 4.5 p.p. from the last year with low rates to the first year with high rates.

This paper contributes to the literature of quantitative models of strategic default as a micro foundation of sovereign spreads. This approach, based on the theoretical models of Grossman and van Huyck (1988) and Eaton and Gersovitz (1981), was developed by Alfaro and Kanczuk (2005), Arellano (2008), and Aguiar and Gopinath (2006). [2] In particular, this work is closely related to studies that investigate how external financial conditions influence debt sustainability and spreads. Using quantitative models, Lizarazo, (2013), Arellano and Ramanarayanan (2012), Uribe and Schimittt-Grohé (2017), and Bianchi, Hatchondo and Martinez (2018) analyze the risk aversion of lenders.[3]

Just as Alfaro and Kanczuk (2017), I also incorporate features from behavioral economics in this type of open economy macroeconomic model. While I introduce loss aversion in the preference of lenders and study changes in international interest rates, they investigate the optimality of fiscal rules when the sovereign is present-biased due to quasi-hyperbolic preferences (Laibson, 1997).

The present work also offers an alternative interpretation for the positive relation between international risk-free interest rates and sovereign spreads and defaults in EM. Among the studies exploring this question empirically with a broad variety of methods

[2] Stahler (2013), Aguiar and Amador (2014), and Aguiar et al (2016) survey this literature.
[3] In a theoretical model with analytical solutions, Guimarães (2011) corroborates the importance of shocks to the international risk-free rate to explain the level of sustainable debt.

we have: Arora and Cerisola (2001), Uribe and Yue (2006), Gonzáles-Rozada and Levy Yeyati (2008), Hartelius, Kashiwase and Kodres (2008), Ciarlone, Piselli and Trebeschi (2009), Hilscher and Nosbusch (2010), Longstaff et al (2011), Akinci (2013), Foley-Fisher and Guimarães (2013), Kennedy and Palerm (2014), Kaminsky and Vega-Garcia (2016), and Kaminsky (2017). Likewise, this paper relates to the recent theoretical and empirical literatures on search for yield already mentioned in this introduction.

The remainder of the paper is organized as follows. Sections 2 and 3 present the model and the calibration, respectively. Results from the quantitative model appear in Section 4 and Section 5 presents concluding remarks.

2. Model

In a dynamic small open economy, a central planner receives a stochastic endowment, issues debt to foreign lenders, and decides whether to default on the stock of debt every period. If he defaults, the country is excluded from international markets for a random number of periods and experiences an output loss. Equation (1) presents the preferences of the domestic representative agent. E denotes the expectation operator, c_t is the consumption of goods in period t, β is the domestic subjective discount factor, and σ is the coefficient of constant relative risk aversion:

$$U = E\left[\sum_{t=0}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma}\right] \quad . \tag{1}$$

Equation (2), in which ε_t represents a white noise with standard normal distribution, describes the stochastic process of the endowment of the single good available in the economy, y_t:

$$ln(y_t) = \rho ln(y_{t-1}) + \eta\varepsilon_t \quad . \tag{2}$$

If the sovereign honors his obligations, d_t, he can issue new debt, d_{t+1}, and his budget constraint is (3). The price of debt, a security that pays one unit of the good in the next period if the government chooses not to default, is q_t:

$$c_t = y_t + q_t d_{t+1} - d_t \quad . \tag{3}$$

In case of default, the sovereign is in autarky, cannot borrow and consumes his endowment, y_t^a, as in (4):

$$c_t = y_t^a \quad . \tag{4}$$

Equation (5) exhibits the direct output cost after a default according to the functional form proposed by Arellano (2008), frequently used in this class of models[4]:

$$y_t^a = \begin{cases} y_t, if\ y_t \leq \psi \\ \psi,\ if\ y_t > \psi \end{cases} \quad . \tag{5}$$

This non-linear function means that direct output costs of default start when the endowment is above a certain amount (ψ). The particular specification captures the idea that, if the economy defaults, high output is not feasible even under a good productivity shock. The reason is that defaults disrupt the domestic financial market and credit is an essential input for production.[5]

International risk-free interest rate, r_t, follows a two-state Markov process with values r^* and r_L, with $r^* > r_L$ and transition probabilities π_{HL} (from high to low rates) and π_{LH} (from low to high rates). Equations (6) to (8) represent the problem in recursive form. Variables with apostrophe symbolize values at $t+1$. Given the debt price, the solution to this problem is represented by the policy functions for default (f), debt issuance (d'), and consumption in case of repayment (c). If the government defaults, $f = 1$, otherwise, $f = 0$. The parameter θ in equation (8) expresses the exogenous probability of regaining access to the international markets without debt.

Every period the sovereign decides to default or repay according to:

$$v(y,d,r) = \max_{f\in\{0,1\}}\{(1-f)v^R(y,d,r) + fv^D(y,d,r)\}, \tag{6}$$

in which the value of repaying is expressed by

[4] Aguiar et al (2016) point that an asymmetric output cost of default is indispensable for this type of model to produce realistic values of average debt and default frequencies.
[5] Mendoza and Yue (2012) develop a general equilibrium model of sovereign debt and business cycles that generates asymmetric output losses from default. Working capital financing constraints for imported inputs and the lack of perfect domestic substitutes are essential for the emergence of the non-linearity.

$$v^R(y,d,r) = \max_{c,d',}\{\, u(c) + \beta E_y[\, v(y',d',r')\,]\,\}, \tag{7}$$

subject to (3), $d' > 0$, and the value of defaulting is given by

$$v^D(y) = u(y) + \beta E_y[\theta v(y',0,r') + (1-\theta)v^D(y'), \tag{8}$$

subject to (4) and (5).

So far, the model is exactly the same one of Arellano (2008), except for the two possible values of r_t. As in the benchmark model, the price of debt still reflects the sovereign's incentives to repay as perceived by foreign lenders. For the lenders, the relevant decision of the sovereign is his choice to default or not in the next period. If the sovereign chooses to honor his obligations, the lender receives one unit of the good. Otherwise, the repayment is zero. The default decision, in its turn, depends on the future values of the endowment, the risk-free rate, and the quantity of debt. Different from the first two variables, the future quantity of debt is known in the current period. Since the current endowment and interest rate bring information about their next realization, the price of debt is a function of y, r' and d'.

From now on, I present the case in which foreign lenders price the sovereign bond according to the Prospect Theory (Kahneman and Tversky, 1979), i.e., they are loss-averse and have reference dependence. Next, I present the traditional risk-neutral pricing according to Expected Utility Theory as a particular case.[6]

Assume that the international risk-free interest rate is high (r^*) most of the time and that investors consider it a reference point of investment returns. Experimental results with individual investors from Lian, Ma and Wang (2018) corroborate this assumption. They find that individuals search for yield, i.e., invest a larger share of their portfolio in risky assets when risk-free returns are low even if the risk premium is constant. Moreover, their results show that individuals who face high risk-free interest rates before low rates search for yield even more than individuals who face interest rates in reverse order (first low and later high). The scenario of high and then low interest rates mimics the decade after the GFC, as Figure 1 suggests.

[6] In Section 4, as a robustness exercise, I also solve the model assuming the investors are risk-averse. In order to keep the exposition as simple as possible, I present the required changes in the pricing equations later.

Additionally, as in Benartzi and Thaler (1995), foreign lenders have preferences over returns, rather than over the consumption levels that such returns help to bring. Thus, lenders consider returns higher (lower) than r^* as gains (losses). Since they are loss-averse, gains increases utility in one unit while losses decreases it in λ units ($\lambda \geq 1$) [7]. In this framework, equations (9a) and (9b) present the sovereign debt price.

If $q(y,d',r') < \frac{1}{(1+r^*)}$, then:

$$E_y\left\{(1-f'(y',d',r'))\left[\frac{1}{q(y,d',r')}-(1+r^*)\right]+\lambda f'(y',d',r')[0-(1+r^*)]\right\} = \lambda[(1+r_t)-(1+r^*)] \quad \textit{(9a).}$$

The expression above defines the EM debt price by assuming that foreign investors obtain the same utility buying risk-free (right hand side, RHS, of the equation) or risky bonds (left hand side, LHS, of the equation). On the RHS, if $r_t < r^*$, the investor considers the current risk-free return a loss. Since r_t is never higher than r^*, the RHS is at most zero, and therefore is multiplied by λ. The LHS presents the possibilities of default and repayment with respective gross returns of $\frac{1}{q(y,d',r\prime)}$ and zero. In equation (9a), the current price of EM debt is supposed to be low enough to generate returns higher than the reference in case of repayment. If $r_t = r^*$, then $q(y,d',r') < \frac{1}{(1+r^*)}$ is always valid. If $r_t = r_L$, it is possible that the EM debt is not risky enough to yield returns as high as r^*. In this situation, the first term in the LHS is a loss and must also be multiplied by λ. In such case, equation (9b) reveals the price of EM debt. One can obtain the standard risk-neutral pricing simply using $\lambda = 1$ in equation (9a) as it collapses to the same expression as in (9b).

If $q(y,d',r') \geq \frac{1}{(1+r^*)}$, then:

$$q(y,d') = E_y\left\{\frac{1}{1+r_t}[(1-f(y',d',r')]\right\}, \quad \textit{(9b)}$$

[7] I disregard other characteristics of Prospect Theory, as probability weighting and decreasing sensitivity of utility to returns, because they are not crucial to the results. Therefore, I assume that lenders have piecewise linear utility over returns. For gains $u(x) = x$ and for losses $u(x) = \lambda x$.

The environment described is a dynamic game played between the sovereign against a continuum of small identical foreign lenders. I focus on Markov Perfect Equilibrium because agents cannot commit to future actions.

Definition. A Markov perfect equilibrium is defined by:

i) A set of value functions $v(s), v^R(s), v^D(s)$,

ii) Policy functions $f(s)$, $d'(s)$, and $c(s)$,

iii) Bond price function $q(y, d')$,

such that

I) Given the bond price, the policy functions solve the Bellman equations (6) - (8).

II) Given the policy functions, the bond price satisfies equations (9a) and (9b).

3. Calibration

The benchmark values for the parameters in the model appear in Table 1. As usual in the related literature, the domestic risk aversion coefficient is $\sigma = 2$. The parameters for the endowment equation match the cyclical properties of GDP of EM countries (Alfaro and Kanczuk, 2009; Uribe and Schimitt-Grohé, 2017). I use the simulation method of Schimitt-Grohé and Uribe (2009) to discretize this output process. In order to get an average stay in autarky for two years, in line with estimates by Gelos, Sahay and Sandleris (2011), I set the probability of redemption after default, θ, to 0.5.

Since a period in the model indicates one year, I use $r^* = 0.04$ and $r_L = 0.02$ based on the recent behavior of the 10-Year US Treasury rate. The transition probabilities of the risk-free interest are $\pi_{\mathrm{HL}} = 0.01$ and $\pi_{LH} = 0.10$ to generate, on average, 90 years with risk-free rates equal to the reference return followed by a 10-year period of low rates, resembling the recent experience of international financial markets. I conduct robustness exercises with alternative values for these parameters.

Table 1 – Parameter values

Parameter	Description	Value
β	Domestic discount factor	0.80
ψ	Direct output cost of default	0.85
σ	Domestic risk aversion	2.00
ρ	GDP persistence	0.85
η	Std. deviation of innovation to GDP	0.04
θ	Probability of re-entry after default	0.50
r^*	High risk-free rate	0.04
r_L	Low risk-free rate	0.02
π_{HL}	Probability of transitioning to low risk-free rate	0.01
π_{LH}	Probability of transitioning to high risk-free rate	0.10
λ	Degree of loss aversion	2.25

The parameter governing the degree of loss aversion, λ, takes value 2.25, in line with experimental evidence (Tversky and Kahneman, 1992; Kahneman, Knetsch, and Thaler, 1990). This is the customary choice in the behavioral economics and finance literature (Benartzi and Thaler, 1995), but replacing it with 1.50 or 3.00 does not modify the main findings in a meaningful way.

I calibrate the remaining two parameters (β, ψ) to produce average values of sovereign debt and spreads for the model without loss aversion $(\lambda = 1)$ close to the observed in the data during periods of high-interest rates. I obtain, $\beta = 0.80$ and $\psi = 0.85$, similar to the values of other works in this literature, as Alfaro and Kanczuk (2018), Uribe and Schimittt-Grohé (2017), and Nuno and Thomas (2016). The main results are robust to changes in the values of these parameters.

Value function iteration in a discrete state space is used to solve the model numerically. The equilibrium is obtained as the limit of the equivalent finite-horizon version of the model, as recommended by Hatchondo, Martinez and Sapriza (2010).

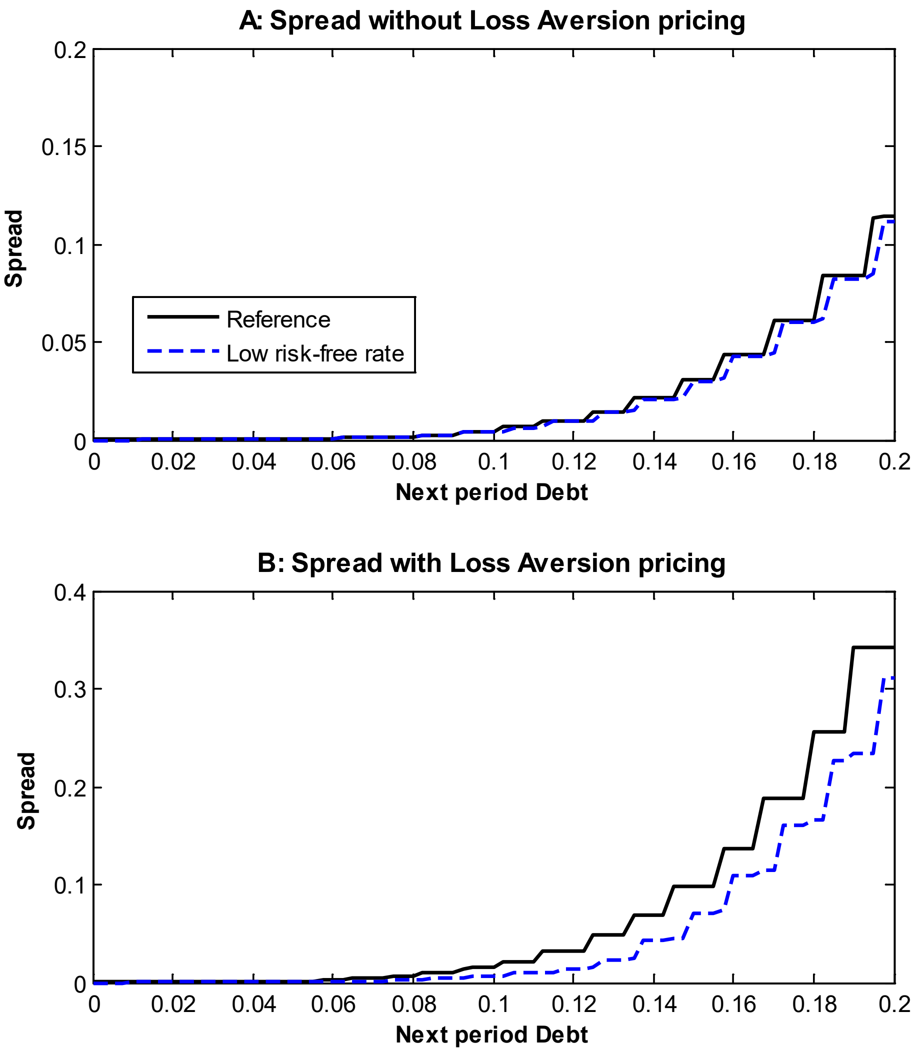
4. Results

Figure 2 exhibits the spread function, obtained from $q(y, d')$, for the baseline economies with $\lambda = 1$ (panel A) and $\lambda = 2.25$ (panel B). Regardless of the degree of loss aversion, spreads increase with the debt level, reflecting that defaults are more likely for higher indebtedness. Also for both economies, when endowment is high, defaults are less likely, spreads are lower, and countries issue more debt (policy functions not shown here). Consequently, spreads and trade balance are counter cyclical. Introducing loss aversion, therefore, does not hinder the model's ability to replicate such relevant features of the business cycles in EM economies.

However, there is a striking difference between figures in panels A and B. When the international risk-free rate falls from r^* to r_L, spreads barely change in one case ($\lambda = 1$) and decline substantially in the other ($\lambda = 2.25$). The economy without loss aversion generates reduced average spreads during periods of low international rates (r_L) only if the sovereign is less indebted (and consequently is less risky) exactly at these times. Nonetheless, simulations in the next table show that this is not the case. A different result emerges in panel B. The reduction in spreads for any level of debt when r_t falls is much more pronounced than in the case without loss aversion pricing. Such reduction is particularly sizable for higher debt levels, when the EM economy is riskier. In the case with loss averse lenders, when the international risk-free rate is low, investors accept a smaller compensation for the risk to get returns closer to their reference rate, a form of SFY. Therefore, as debt increases, spreads do not rise as much as when the risk-free rate is r^*.

Tables 2 to 5 compare statistics from emerging economies, always in row 1, and simulated data, in the remaining rows. The first three columns bring the number of each row, a brief description of the model, and an indication if it contains loss-averse lenders. The next three columns present the default frequency and the averages for spread and debt when the risk-free rate is r^*. The same statistics when the risk-free rate is r_L appear in the last three columns.

Figure 2 – Spread Function for the Median Output Level



Note: This figure plots the spread (bond price) function for the median levels of output. The horizontal axis represents the choice of next period debt in relation to the median output. Each line represents the spread function for a different value of the international risk-free interest rate. Panels A and B show the cases without and with loss aversion respectively.

Actual data shows that indebtedness rises and spreads reduce when international risk-free interest rates fall (before and after September 2011, the month when 10-Year US Treasury Constant Maturity Rate reach 2% for the first time in the sample[8]). This result does not emerge from the benchmark model without loss-averse lenders (row 2 in Table 2). When the risk-free rate falls, it becomes cheaper to frontload consumption. Thus, EM countries borrow more, become riskier and, consequently, their spreads rise.

[8] Splitting the sample in January 2009, when the Fed Funds rate goes below 0.25%, does not change the results.

According to panel A of Figure 2, even in the benchmark model without loss aversion, spreads decline modestly when the risk-free rate falls if the level of debt remains constant. This happens because when $r_t$diminishes the value of defaulting does not change and the value of repaying increases. But the simulations results in row 2 of Table 2 reveal that the sovereign optimally chooses to increase the debt level, instead of keeping it constant, when r_t drops. Due to the increase in the default risk, spreads rise.

Table 2 – Basic Statistics: Model and Data

	Loss Aversion	When risk-free rate is r^* Default freq.	Average Spread	Average Debt	When risk-free rate is r_L Default freq.	Average Spread	Average Debt
1 Data	--	--	5.2	14.0	--	3.6	14.9
2 Benchmark	No	4.3	5.0	16.6	4.4	5.1	17.1
3 Benchmark	Yes	1.8	4.4	12.8	2.3	3.6	14.1
4 $\pi_{LH} = 0.20$	No	4.3	5.0	16.6	4.5	5.3	16.7
5 $\pi_{LH} = 0.20$	Yes	1.8	4.4	12.8	2.0	3.5	13.6
6 $\pi_{LH} = 0.50$	No	4.2	5.0	16.6	4.4	5.2	16.7
7 $\pi_{LH} = 0.50$	Yes	1.9	4.4	12.8	2.0	3.3	13.4
8 $\pi_{LH} = 0.01$	No	4.3	4.9	16.6	4.5	5.3	17.2
9 $\pi_{LH} = 0.01$	Yes	1.7	4.4	12.9	2.3	3.6	14.5

Note: Row 1 presents statistics for a sample of 18 emerging countries with debt and spread information available. Spread is the JP Morgan EMBI Global Composite for the periods before and after September 2011, when 10-Year US Treasury Constant Maturity Rate reaches 2% for the first time in the sample. Debt comes from Arslanalp and Tsuda (2014). Countries are Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Turkey, Ukraine, and Uruguay. Each row from 2 to the last one brings statistics calculated from 200,000 simulated observations of a different model.

The model with loss aversion and reference dependence with the benchmark calibration ($\lambda = 2.25$ and $r^* = 4\%$), row 3 in Table 2, reproduces the pattern seen in the data. In this case, when the international interest rate declines, EM countries borrow more, become riskier, and their spreads fall. This reduction in spreads despite the escalation of default risks is a consequence of the SFY of investors used to higher risk-free rates. Although this model is not calibrated to match average debt and spread, both statistics are still close to the data. Furthermore, the magnitude of changes in these two variables between interest rate regimes is similar to the observed in EM recently.

Beyond the statistics exhibited in Tables 2 to 5, all the models also perform well in other dimensions. As usual in EM data, all specifications display: i) counter cyclical spreads and trade balance, ii) debt and consumption positively correlated with GDP, and iii) consumption more volatile than output. The inclusion of loss aversion also improves the model performance in one more aspect. As pointed by Uribe and Schimittt-Grohé (2017), average spreads typically exceeds observed default frequency by 230 basis points, and a model with risk-neutral lender does not deliver such result. Introduction of lenders with a degree of loss aversion in line with experimental evidence ($\lambda = 2.25$) generates excessive spreads in the correct amount[9].

From now on, I show that the main conclusion so far is robust to changes in the values of the model parameters. Still in Table 2, rows 4 to 9 present how the same outcomes emerge if the π_{LH} is modified to alter the average length of the bouts of low risk-free rates. Setting the value of π_{LH} to 0.2, 0.5 or 0.01 changes the average duration of the periods with low risk-free rates. Regardless of the persistence of such intervals, only the model with loss-averse lenders generates SFY: higher default risk and lower spreads.

Table 3 – Basic Statistics: Model and Data

		Loss Aversion	When risk-free rate is r^* Default freq.	Average Spread	Average Debt	When risk-free rate is r_L Default freq.	Average Spread	Average Debt
1	Data	--	--	5.2	14.0	--	3.6	14.9
2	Benchmark	No	4.3	5.0	16.6	4.4	5.1	17.1
3	Benchmark	Yes	1.8	4.4	12.8	2.3	3.6	14.1
4	β = 0.70	No	6.2	7.7	18.6	6.4	7.9	19.1
5	β = 0.70	Yes	3.0	7.6	14.2	3.4	6.4	14.6
6	β = 0.90	No	1.9	2.1	12.0	2.3	2.6	12.8
7	β = 0.90	Yes	0.7	1.6	9.3	1.2	1.5	11.3
8	β = 0.90, ψ = 0.80	No	1.1	1.2	20.7	1.3	1.4	22.0
9	β = 0.90, ψ = 0.80	Yes	0.5	1.1	17.5	0.9	1.0	20.2

Note: Row 1 presents statistics for a sample of 18 emerging countries with debt and spread information available. Spread is the JP Morgan EMBI Global Composite for the periods before and after September 2011, when 10-Year US Treasury Constant Maturity Rate reaches 2% for the first time in the sample. Debt comes from Arslanalp and Tsuda (2014). Countries are Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Turkey, Ukraine, and Uruguay. Each row from 2 to the last one brings statistics calculated from 200,000 simulated observations of a different model.

[9] Lizarazo (2013) demonstrate that a similar result is attainable with risk-averse lenders.

In Tables 3 to 5, as in Table 2, the rows 1 to 3 bring statistics calculated with EM data or with simulated data from the benchmark calibrations. Solving the model for different values of β and ψ (rows 4 to 9 in Table 3) leads to different average levels of debt and spread and default frequency. However, it still reveals that SFY only appears in models with loss aversion. Besides, we see that spreads reductions between international interest rate regimes are larger in calibrations with higher default frequencies. Row 9 in Table 3, the case with lower default risk, displays a situation in which spreads fall only 0.1 p.p. when r_t goes from 4% to 2%. The reason is that foreign investors do not search for yield in these markets because they rarely have spreads high enough to achieve the return of reference. This finding is in line with the information in panels B and C of Figure 1 that show bigger spread declines for the group of riskier countries. Comments in the financial press (Doff and Provina, 2017; Russo, Cota and Verma) corroborate this view by suggesting that investors shift their portfolios particularly towards riskier EM sovereign bonds.

Table 4 – Basic Statistics: Model and Data

		When risk-free rate is r^*			When risk-free rate is r_L		
	Loss Aversion	Default freq.	Average Spread	Average Debt	Default freq.	Average Spread	Average Debt
1 Data	--	--	5.2	14.0	--	3.6	14.9
2 Benchmark	No	4.3	5.0	16.6	4.4	5.1	17.1
3 Benchmark	Yes	1.8	4.4	12.8	2.3	3.6	14.1
4 $r_L = 0$	No	4.2	5.0	16.7	4.6	5.6	17.5
5 $r_L = 0$	Yes	1.8	4.4	12.8	2.8	3.7	15.2
6 $\lambda = 1.50$	Yes	2.7	4.7	14.5	3.0	4.3	15.7
7 $\lambda = 3.00$	Yes	1.3	4.2	11.9	1.9	2.9	13.5

Note: Row 1 presents statistics for a sample of 18 emerging countries with debt and spread information available. Spread is the JP Morgan EMBI Global Composite for the periods before and after September 2011, when 10-Year US Treasury Constant Maturity Rate reaches 2% for the first time in the sample. Debt comes from Arslanalp and Tsuda (2014). Countries are Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Turkey, Ukraine, and Uruguay. Each row from 2 to the last one brings statistics calculated from 200,000 simulated observations of a different model.

Distinctions between the models with and without loss aversion are even more pronounced if we assume that $r_L = 0$, as results in rows 4 and 5 of Table 4 demonstrate. This case reflects the assumption that the Fed Funds rate is the relevant measure of an international risk-free interest rate instead of the 10-years US government yield. Focusing in the case with loss aversion (row 5), there is more SFY when $r_L = 0$, because spreads decline the same amount as in the benchmark case while the economy becomes riskier (default frequency jumps from 1.8% to 2.8%, instead of 2.3% in the baseline scenario). Model outcomes are also qualitatively invariant to the degree of loss aversion of lenders (rows 6 and 7 of Table 4). Even the quantitative performance does not change drastically despite the use of two very different values for λ. Moreover, when lenders are more averse to losses, there are greater increases in indebtedness and reductions in spreads.

To investigate if changes in risk-aversion generate SFY in the model, I replace the pricing equations, (9a) and (9b), by expressions (10) and (11).

$$m_{t+1} = exp(-r_t - \kappa\eta\varepsilon_{t+1} - 0.5\kappa^2\eta^2) \tag{10}$$

$$q(y, d', r') = E_y\{m_{t+1}[(1 - f(y', d', r')] \tag{11}$$

Instead of fully modelling the behavior from freeing lenders, I assume that they price debt using the stochastic discount factor, m_t, present in equation (10). Such formulation was already used by Arellano and Ramanarayanan (2012) and Bianchi, Hatchondo and Martinez (2018) in quantitative models of sovereign default. The parameter κ governs the risk premium and its correlation with the stochastic process for y_t. Positive values of κ imply that foreign lenders value more returns in states with negative income shocks in the EM economy, when default is more likely to happen.

I use $\kappa = 7$ (row 4 of Table 5), because with this value the model generates the same average spread during periods of high international rates as the benchmark case (row 2 of Table 5). As in the case of risk-neutral pricing, there is no SFY. The next step is to assume that κ takes over two different values following the same Markov process as r_t. When $r_t = r^*$, κ is positive and lenders are risk-averse, but when r_t changes to r_L, lenders automatically become risk-neutral ($\kappa = 0$). Hence, the risk-aversion decreases mechanically with the risk-free rate. This hypothesis is a very straightforward way to try to force the model to deliver lower spreads when the risk-free rate falls. Rows 5 to 7 differ by the parameter value for κ when $r_t = r^*$; all of them demonstrate that even the strong assumption of variable risk aversion perfectly correlated with r_t does not produce SFY.

In this case, although the risk premium disappears, EM borrow even more and become much riskier to the point that their spreads increase.

Table 5 – Basic Statistics: Model and Data

		When risk-free rate is r^*			When risk-free rate is r_L		
	Loss Aversion	Default freq.	Average Spread	Average Debt	Default freq.	Average Spread	Average Debt
1 Data	--	--	5.2	14.0	--	3.6	14.9
2 Benchmark	No	4.3	5.0	16.6	4.4	5.1	17.1
3 Benchmark	Yes	1.8	4.4	12.8	2.3	3.6	14.1
4 $\kappa = 7$	No	2.3	4.9	13.5	2.3	5.3	13.8
5 $\kappa = 7, \kappa = 0$	No	2.3	5.0	13.4	4.2	5.3	16.2
6 $\kappa = 5, \kappa = 0$	No	2.7	5.0	14.4	4.2	5.3	16.5
7 $\kappa = 3, \kappa = 0$	No	3.3	5.1	15.2	4.3	5.3	16.9

Note: Row 1 presents statistics for a sample of 18 emerging countries with debt and spread information available. Spread is the JP Morgan EMBI Global Composite for the periods before and after September 2011, when 10-Year US Treasury Constant Maturity Rate reaches 2% for the first time in the sample. Debt comes from Arslanalp and Tsuda (2014). Countries are Argentina, Brazil, Chile, China, Colombia, Egypt, Hungary, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Russia, South Africa, Turkey, Ukraine, and Uruguay. Each row from 2 to the last one brings statistics calculated from 200,000 simulated observations of a different model.

This quantitative result, using an ad hoc stochastic discount factor to represent risk-averse lenders, is in line with the theoretical findings of Lian, Ma and Wang (2018). Assuming a constant distribution for the excess return of a risky asset, they show that an investor with conventional utility function (decreasing absolute risk aversion or CRRA) with access to two assets (one risk-free and one risky) allocates a smaller share of his wealth to the risky one as the risk-free return decreases. This happens because the investor becomes poorer when the risk-free rate falls. If he has decreasing absolute risk aversion and the risk premium is constant, the optimal allocation in the risk-free asset increases. This is the opposite of the SFY observed in their empirical findings with individual investors in an experimental setting and the reason why they propose behavioral theories to interpret the data. Hence, my results coupled with theirs suggest that modelling foreign lenders as risk-averse agents who solve a portfolio problem between risky and risk-free assets, as Aguiar et al (2016) and Uribe and Schimitt-Grohé (2017), would lead to similar consequences.

In general, debt accumulation and default risk always increase when the risk-free rate declines, but spreads only fall if lenders exhibit loss aversion. Therefore, loss aversion is a determinant factor of SFY in this class of models.

I conduct a last exercise to show that this model might be useful to understand the risks to EM debt of normalization of monetary policy in developed countries. Using the simulated data from the benchmark model with loss aversion (row 3 of Table 2), I find the first year with $r_t = r^*$ after a spell with $r_t = r_L$. In these years, sovereign default frequency is 2.6%, higher than the average frequency both during periods of high and low risk-free rates, 1.8% and 2.3% respectively. In addition, from the last year with low rates to the first year with high rates, average spreads move from 3.5 p.p. to 4.5 p.p.. This is partially a consequence from higher average debt in during spells of low international interest rates.

5. Conclusion

EM sovereign spreads move in the same direction as international risk-free interest rates, and, therefore, are low since the aftermath of the GFC. This might reflect a search for yield (SFY) by foreign investors – a shift in the composition of their portfolios towards riskier assets when risk-free rates fall – leading to lower spreads in EM. I show that a standard quantitative model of sovereign default does not replicate this result even if the decline in the international interest rate comes with a fall in the risk aversion of foreign lenders. In this conventional approach, when international rates fall, EM countries borrow more, become riskier and their spreads rise.

Nevertheless, if foreign lenders are loss-averse and have reference dependence, the model replicates the SFY by foreign lenders. In this setting, investors buy EM sovereign bond because they offer the opportunity to achieve their reference return, a goal higher than the current risk-free rate. Thus, when the international interest rate decreases, EM countries borrow more and become riskier, and their spreads fall, in accordance with the evidence. The model also shows that spread reductions are larger for: i) riskier countries; ii) greater declines in the external risk-free rate; and iii) higher degrees of loss aversion of investors. Such results suggest that aspects of investor psychology might have consequences for international sovereign bonds markets.

References

Acharya, V., & Naqvi, H. (2016). On Reaching for Yield and the Coexistence of Bubbles and Negative Bubbles. *Working Paper*.

Aguiar, M., & Amador, M. (2014). Sovereign Debt. Em G. Gopinath, E. Helpman, & K. Rogoff, *Handbook of International Economics* (Vol. 4, pp. 647-687). Elsevier.

Aguiar, M., & Gopinath, G. (2006). Defaultable debt, interest rates and the current account. *Journal of International Economics, 69*, pp. 64-83.

Aguiar, M., Chatterjee, S., Cole, H., & Stangebye, Z. (2016). Quantitative Models of Sovereign Debt Crises. Em J. Taylor, & H. Uhlig, *Handbook of Macroeconomics* (Vol. 2B). Elsevier.

Akıncı, Ö. (2013). Global financial conditions, country spreads and macroeconomic fluctuations in emerging countries. *fluctuations in emerging countries, 91*, pp. 358–371.

Alfaro, L., & Kanczuk, F. (2005). Sovereign debt as a contingent claim: a quantitative approach. *Journal of International Economics, 65*, pp. 297-314.

Alfaro, L., & Kanczuk, F. (2009). Optimal reserve management and sovereign debt. *Journal of International Economics, 77*, pp. 23-36.

Alfaro, L., & Kanczuk, F. (2017). Fiscal Rules and Sovereign Default. *NBER Working Paper23330*.

Alfaro, L., & Kanczuk, F. (2018). Debt Redemption and Reserve Accumulation. *IMF Economic Review*.

Andonov, A., Bauer, R. M., & Cremers, K. J. (2017). Pension Fund Asset Allocation and Liability Discount Rates. *The Review of Financial Studies, 30*, pp. 2555-2595.

Arellano, C. (2008). Default Risk and income Fluctuation in Emerging Economies. *American Economic Review, 98*, pp. 690-712.

Arellano, C., & Ramanarayanan, A. (2012). Default and the Maturity Structure in Sovereign Bonds. *Journal of Political Economy, 120*, pp. 187-232.

Arora, V., & Cerisola, M. (2001). How Does U.S. Monetary Policy Influence Sovereign Spreads in Emerging Markets? *IMF Staff Papers, 48*, pp. 474-498.

Barberis, N. (2018). Psychology-Based Models of Asset Prices and Trading Volume. Em D. Bernheim, S. DellaVigna, & D. Laibson, *Handbook of Behavioral Economics - Foundations and Applications 1* (pp. 79-175). Elsevier.

Becker, B., & Ivashina, V. (2015). Reaching for Yield in the Bond Market. *The Journal of Finance, 70*.

Benartzi, S., & Thaler, R. H. (1995). Myopic Loss Aversion and the Equity Premium Puzzle. *The Quarterly Journal of Economics, 110*, pp. 73-92.

Bianchi, J., Hatchondo, J. C., & Martinez, L. (2017). International Reserves and Rollover Risk.

Chodorow-Reich, G. (2014). Effects of Unconventional Monetary Policy on Financial Institutions. *Brookings Papers on Economic Activity* , pp. 155-204.

Choi, J., & Kronlund, M. (2018). Reaching for Yield in Corporate Bond Mutual Funds. *The Review of Financial Studies, 31*, pp. 1930-1965.

Ciarlone, A., Piselli, P., & Trebeschi, G. (2009). Emerging markets' spreads and global financial conditions. *Journal of International Financial Markets, Institutions and Money, 19*, pp. 222-239.

Di Maggio, M., & Kacperczyk, M. (2017). The unintended consequences of the zero lower bound policy. *Journal of Financial Economics, 123*, pp. 59–80.

Doff, N., & Pronina, L. (11 de September de 2017). *Junk Bond Fever Hits a New High in Tajikistan*. Fonte: Bloomberg: https://www.bloomberg.com/news/articles/2017-09-11/junk-fever-hits-new-high-as-tajikistan-narrows-bond-sale-spread

Eaton, J., & Gersovitz, M. (1981). Debt with Potential Repudiation: Theoretical and Empirical Analysis. *The Review of Economic Studies, 48*, pp. 289-309.

Foley-Fisher, N., & Guimarães, B. (2013). U.S. Real Interest Rates and Default Risk in Emerging Economies. *Journal of Money, Credit and Banking, 45*, pp. 967-975.

Ganzach, Y., & Wohl, A. (2018). A behavioral theory of the effect of the risk-free rate on the demand for risky assets. *Journal of Behavioral and Experimental Economics, 76*, pp. 23-27.

Gelos, R. G., Sahay, R., & Sandleris, G. (2011). Sovereign borrowing by developing countries: What determines market access? *Journal of International Economics, 83*, pp. 243-254.

González-Rozada, M., & Levy Yeyati, E. (2008). Global Factors and Emerging Market Spreads. *The Economic Journal, 118*, pp. 1917–1936.

Grossman, H., & Van Huyck, J. B. (1988). Sovereign debt as a contingent claim: excusable default, repudiation, and reputation. *American Economic Review, 78*, pp. 1088-1097.

Guimarães, B. (2011). Sovereign default: Which shocks matter? *Review of Economic Dynamics, 14*, pp. 553–576.

Hanson, S. G., & Stein, J. C. (2015). Monetarypolicyandlong-termrealrates. *Journal ofFinancialEconomics, 115*, pp. 429–448.

Hartelius, K., Kashiwase, K., & Kodres, L. E. (2008). Emerging Market Spread Compression:Is it Real or is it Liquidity? *IMF Working Paper*.

Hatchondo, J. C., Martinez, L., & Sapriza, H. (2010). Quantitative properties of sovereign default models: Solution methods matter. *Review of Economic Dynamics, 13*, pp. 919-933.

Hilscher, J., & Nosbusch, Y. (2010). Determinants of Sovereign Risk: Macroeconomic Fundamentals and the Pricing of Sovereign Debt. *Review of Finance*, pp. 1-28.

Jiménez, G., Ongena, S., Peydró, J.-L., & Saurina, J. (2014). Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking? *Econometrica, 82*, pp. 463–505.

Kahneman, D., & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica, 47*, pp. 263-292.

Kahneman, D., Knetsch, J., & Thaler, R. (1990). Experimental Tests of the Endowment Effect and the Coase Theorem. *Journal of Political Economy*, pp. 1325-1348.

Kaminsky, G. L. (2017). The Center and the Periphery: Two Hundred Years of International Borrowing Cycles. *NBER Working Papers*.

Kaminsky, G. L., & Vega-García, P. (2016). Systemic and Idiosyncratic Sovereign Debt Crises. *Journal of the European Economic Association, 14*, pp. 80-114.

Kennedy, M., & Palerm, A. (2014). Emerging market bond spreads: The role of global and domestic factors from 2002 to 2011. *Journal of International Money, 43*, pp. 70–87.

Laibson, D. (1997). Golden Eggs and Hyperbolic Discounting. *The Quarterly Journal of Economics, 112*, pp. 443–478.

Lian, C., Ma, Y., & Wang, C. (Forthcoming). Low Interest Rates and Risk Taking: Evidence from Individual Investment Decisions. *The Review of Financial Studies.*

Lizarazo, S. V. (2013). Default risk and risk averse international investors. *Journal of International Economics, 89*, pp. 317-330.

Longstaff, F. A., Pan, J., Pedersen, L. H., & Singleton, K. J. (2011). How Sovereign Is Sovereign Credit Risk? *American Economic Journal: Macroeconomics, 3*, pp. 75–103.

Maddaloni, A., & Peydró, J.-L. (2011). Bank Risk-Taking, Securitization, Supervision, and Low Interest Rates: Evidence From Euro-Area and U.S. Lending Standards. *Review of Financial Studies, 24*, pp. 2121--2165.

Martinez-Miera, D., & Repullo, R. (2017). Search for yield. *Econometrica, 85*, pp. 351–378.

Mendoza, E., & Yue, V. (2012). A General Equilibrium Model of Sovereign Default and Business Cycles. *The Quarterly Journal of Economics, 127*, pp. 889-946.

Nuño, G., & Thomas, C. (2016). Monetary Policy and Sovereign Debt Sustainability.

Russo, C., Cota, I., & Verma, S. (21 de June de 2017). *From Papua New Guinea to Argentina, Bond Risks Are Going on a World Tour*. Fonte: Bloomberg: https://www.bloomberg.com/news/articles/2017-06-22/bonds-get-junkier-yields-fall-and-investors-don-t-seem-to-mind

Schmitt-Grohé, S., & Uribe, M. (2009). Finite-State Approximation Of VAR Processes: A Simulation Approach. *Columbia University*.

Shin, H. S. (2013). The second phase of global liquidity and its impact on emerging economies. *Remarks at 2013 Federal Reserve Bank of San Francisco Asia Economic Policy Conference.*

Stahler, N. (2013). Recent Developments in Quantitative Models of Sovereign Default. *Journal of Economic Surveys, 27*, pp. 605-633.

Tversky, A., & Kahneman, D. (1992). Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty, 5*, pp. 297-323.

Uribe, M., & Schmitt-Grohé, S. (2017). *Open Economy Macroeconomics.* Princeton: Princeton University Press.

Uribe, M., & Yue, V. (2006). Country spreads and emerging countries:Who drives whom? *Journal of International Economics, 69*.