

# Analyzing Rate Moves Magnitude with Respect to Levels in LatAm Sovereign Bonds

Castro Zarate, Nelson<sup>1,2</sup>; Salirrosas Martínez, Giancarlo<sup>2,3</sup>

<sup>1</sup>Universidad Peruana Cayetano Heredia, PE; <sup>2</sup>Banco de Crédito del Perú, PE; <sup>3</sup>University College London, UK

Correspondence to: nelson.castro@upch.pe; giancarlo.martinez.21@ucl.ac.uk



## Introduction and Motivation

In the dynamic world of quantitative finance, the behavior of interest rates often dictates strategic decisions within banking institutions and the whole financial system. Particularly in Latin America, where assets traded in the financial markets presents low traded volumes, sovereign bonds play a pivotal role in shaping the financial landscape, being the most liquid assets in most of Latam countries. Thereby, the importance of their study. Our work offers a comprehensive examination of how the magnitude of rate moves fluctuate accordingly with their respective levels.

Currently, the banking sector in Peru, like many other regions in Latin America and the world, is grappling with higher interest rates. Yet, prevailing market sentiments and economic indicators hint at a potential downturn in the near future. Meanwhile, due to this backdrop of uncertainty, commercial banks face significant exposure to the volatilities inherent in interest rate fluctuations. Such volatilities not only influence the health of the bank's portfolio but also pose challenges for trading desks and risk management departments, tasked with mitigating risks and capitalizing on opportunities.

Our research aims to decode these intricacies, offering actionable insights for financial institutions with another quantitative tool to manage fixed income portfolios during normal and stressed market conditions where inflation scenarios are specifically important, taking into account interest rate movements which are a relevant topic in the current period. In this sense, we have seen that the relationship between the specific levels of fixed income rates and their volatility is a fascinating subject of study. It has been shown that in most cases of developed economies the levels of fixed income rates are a key determinant of the subsequent volatility within financial markets. Lower rates tend to foster a lower volatilities, while higher rates can induce more appetite for risk, i.e. higher volatility. This insight not only deepens our understanding of market dynamics but also informs investment strategies, risk management, and portfolio allocation, making it an important concept for any finance professional to grasp.

## The Data

This data set is composed by daily Sovereign and USD Global bond rates of Peru, Mexico, Colombia and Chile. Sovereign rates are listed from 01 July 2006 to 04 October 2023. Meanwhile, the USD Global bond rates data is from 03 March 2008 to 31 August 2023. For the data processing we have computed the relative variation of the sovereign and global rates, and then grouped them into buckets of 200 observations for each tenor. After this, we have obtain the statistical mean and standard deviation for the whole yield curve. The data sets that we consider in our analysis are described below:

Series	Start Date	End Date	Frequency
PE Sov rates	1/07/06	4/10/23	daily
MX Sov rates	1/07/06	4/10/23	daily
CO Sov rates	1/07/06	4/10/23	daily
CL Sov rates	1/07/06	4/10/23	daily
USD Global PE Sov rates	3/03/08	31/08/23	daily
USD Global MX Sov rates	3/03/08	31/08/23	daily
USD Global CO Sov rates	3/03/08	31/08/23	daily
USD Global CL Sov rates	3/03/08	31/08/23	daily

Table 1. Daily Sovereign and USD Global bond rates of Peru, Mexico, Colombia and Chile.

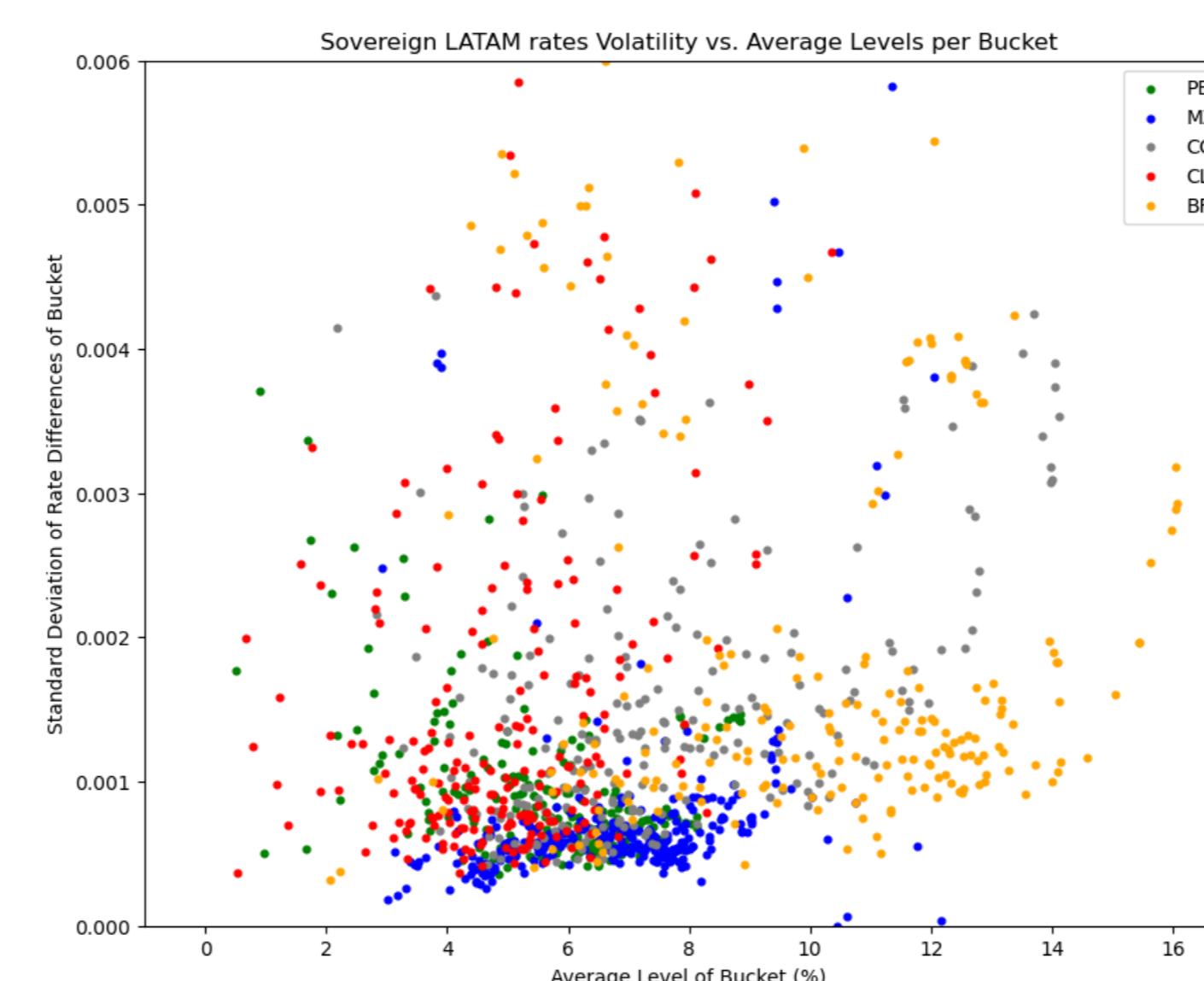


Figure 1. Standard deviation of LatAm Sovereign Bonds rates against the level of the yields

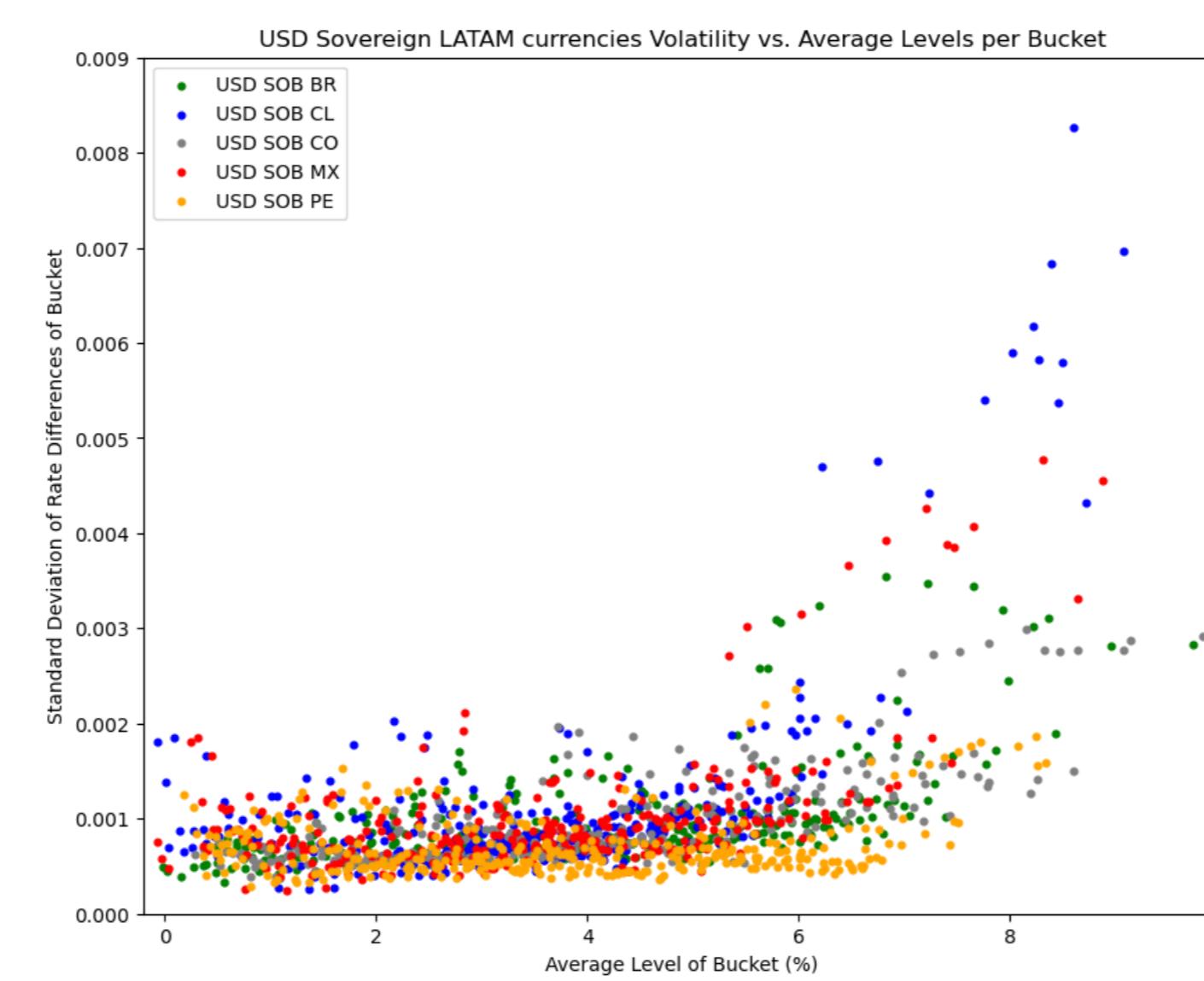


Figure 2. Standard deviation of Global LatAm Sovereign Bonds rates against the level of the yields

## Description of the Methodology

We denote today as time  $i$  and an arbitrary past date  $\omega_i$ . Call the rate today  $y(i)$  and the rate observed in the past  $Y(\omega_i)$ . We define our  $\sigma$ -function by

$$\sigma(y) = \begin{cases} \sigma_G \frac{y}{y_L} & \text{for } 0 < y \leq y_L \\ \sigma_G & \text{for } y_L < y \leq y_R \\ \sigma_G [1 + K(y - y_R)] & \text{for } y_R < y \end{cases} \quad (1)$$

Given a  $\sigma$ -function, we define its corresponding  $\Sigma : \mathbb{R}^+ \rightarrow \mathbb{R}$  by:

$$\Sigma(y) := y_L + \sigma_G \int_{y_L}^y \frac{ds}{\sigma(s)}$$

So, we have

$$\Sigma(y) = \begin{cases} y_L \left(1 + \log\left(\frac{y}{y_L}\right)\right) & \text{for } 0 < y \leq y_L \\ y & \text{for } y_L \leq y < y_R \\ y_R + \frac{1}{K} \log(1 + K(y - y_R)) & \text{for } y_R \leq y \end{cases}$$

with this definitions, we obtain

$$\Sigma(Y(w_{i+s})) - \Sigma(Y(w_i)) = \Sigma(y(i+s)) - \Sigma(y(i))$$

for  $s = 1, 2, \dots$ , this is the step-size-independence property of  $\Sigma(y)$ .

## Results

We have shown in this study that the lower rates from all the Latam countries like Peru, Mexico, Colombia and Chile, are indifferent from their current levels to the volatility correspondant to

their tenors. This could be explained that investors would prefer to have exposition to other developed economies like US, UK or JPY economies which would have lower sovereign risk.

Moreover, we have found the best  $\Sigma$ - function in a calibration process by grouping the rates between Sovereign rates and Global Sovereign rates in USD.

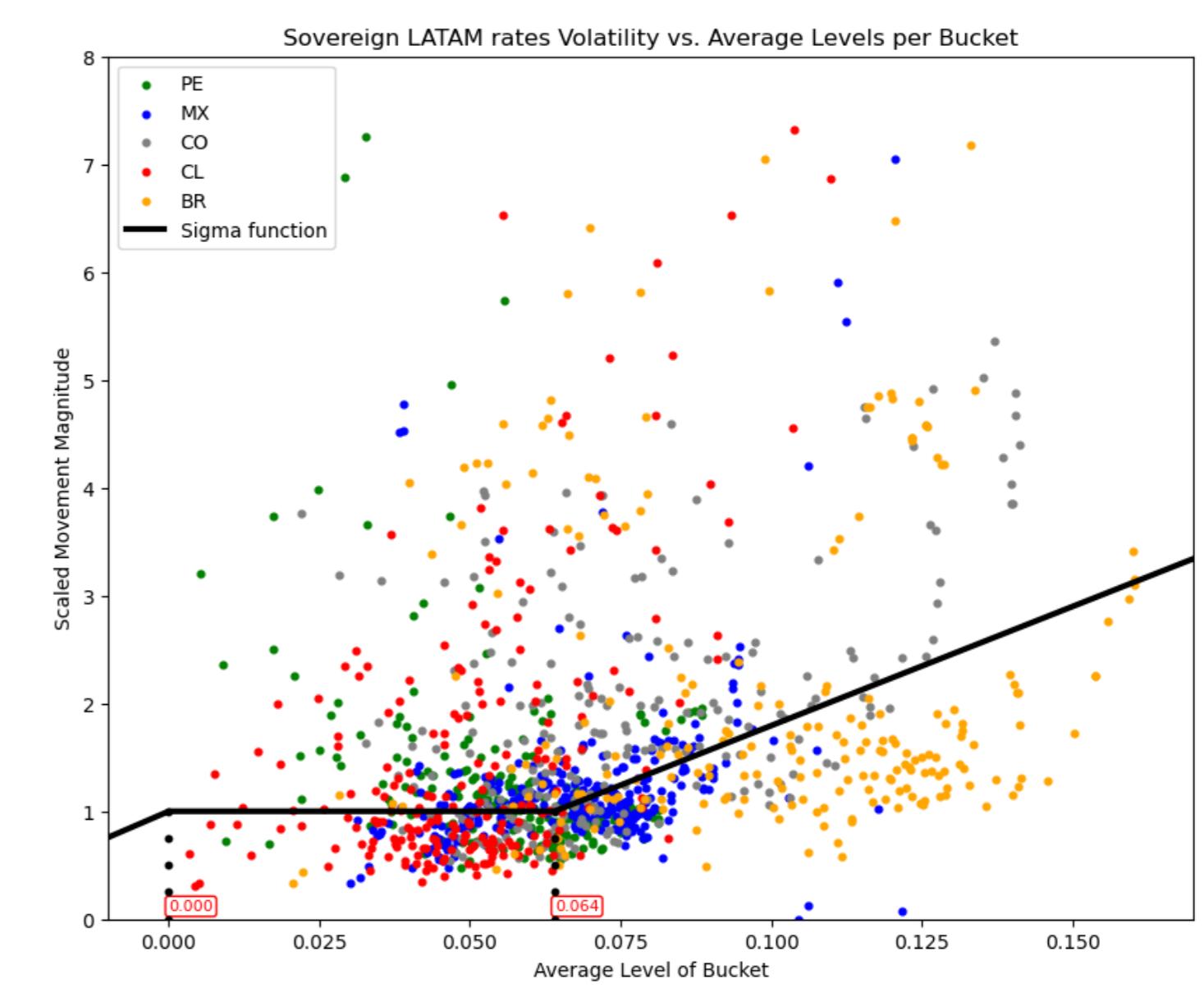


Figure 3. Calibration of LatAm Sovereign Bonds rates.

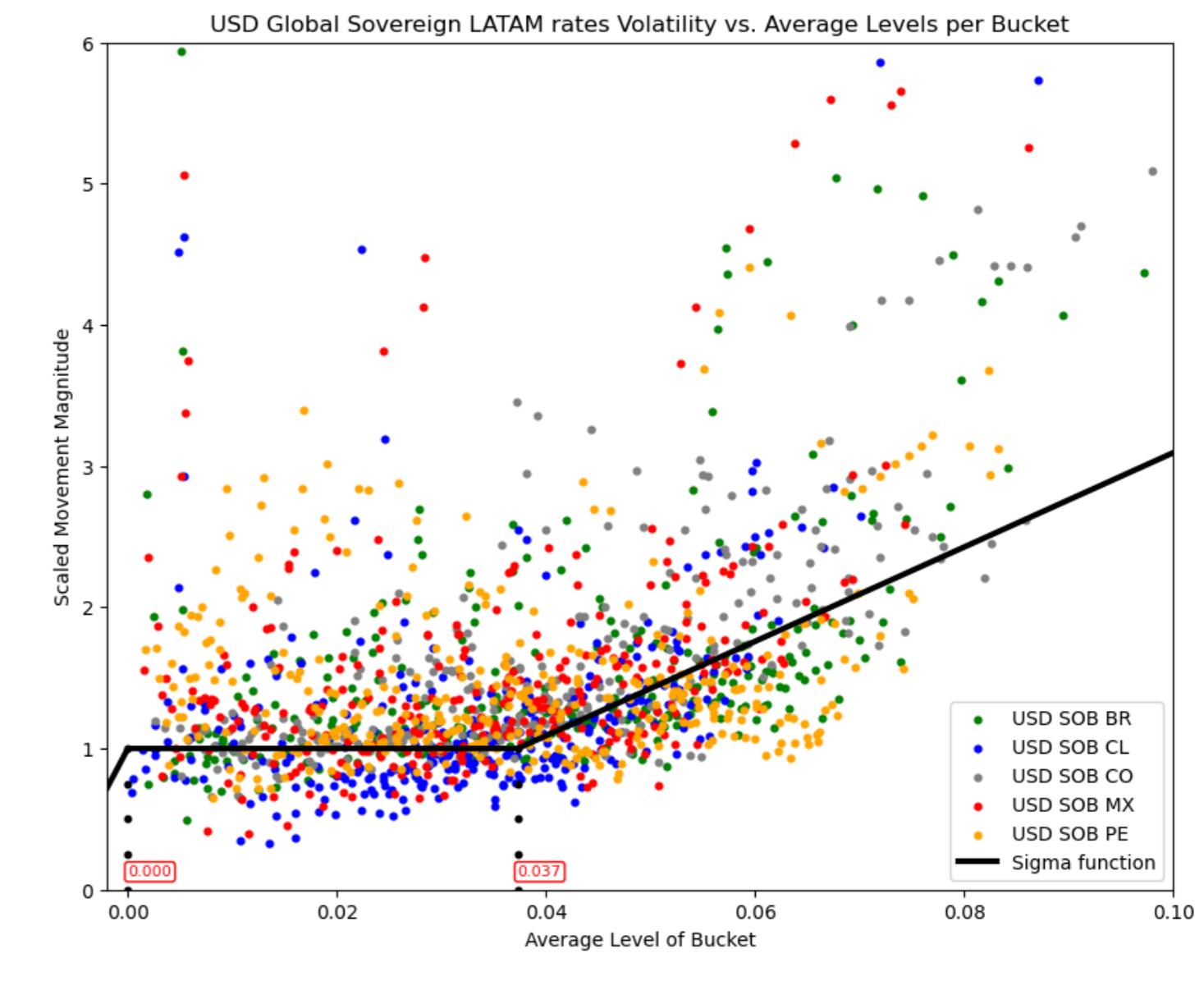


Figure 4. Calibration of Global LatAm Sovereign Bonds rates.

## Conclusions

In our study on the dependency of rate move magnitudes on rate levels in Latin American markets, we corroborated the primary thesis of the referenced paper: higher rates are associated with higher volatilities. This was observed across rates in Peru (PE), Mexico (MX), Colombia (CO), Chile (CL), and Brazil (BR). However, a key distinction in our findings from the original paper—which focused on USS Gov rates, JPY gov rates, GBP gov rates, and CHF swap rates—is the absence of proportional behavior at lower rate levels in the Latin American context.

## References

- [1] Nick Deguillaume, Riccardo Rebonato, and Andrey Pogudin. The nature of the dependence of the magnitude of rate moves on the rates levels: a universal relationship. *Quantitative Finance*, 13(3):351–367, 2013.

## Funded by



UNIVERSIDAD PERUANA  
CAYETANO HEREDIA