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Too Much in One Basket? Debt Concentration and Sovereign Yields*

António Afonso† José Alves‡ Wojciech Grabowski§ Sofia Monteiro**

Abstract

We examine the effects of debt distribution characteristics, specifically skewness and maturity concentration, on sovereign yields across OECD countries over the period 1995Q1 to 2020Q4. After computing specific Lorenz curves and Gini coefficients, we find that positive skewness generally exerts a dominant influence. Employing Panel Cointegration Techniques, we show that greater skewness is associated with higher sovereign bond yields and higher short-term interest rates, whether measured in face or market value. In contrast, an increase in debt concentration tends to reduce both sovereign bond yields and short-term interest rates.

JEL: C23; C58; G15; E44

Keywords: sovereign debt concentration; yields; Gini coefficient; skewness; Panel Cointegration; OECD

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1. Introduction

Since the 2008 subprime crisis, there has been a significant increase in attention to government debt management practices. This heightened focus stems from the substantial rise in public debt levels and growing concerns about government solvency and stability (De Graeve and Mazzolini, 2023). More recently, the economic impact of the Covid-19 pandemic and the implementation of unprecedented government bond purchase programs by central banks have further intensified these concerns. Hence, increasing attention is being paid not only to the overall level of sovereign debt but also to its composition and maturity.

Early research identified a negative relationship between debt levels and maturity structure, particularly among highly indebted European Union (EU) countries and emerging markets (Missale and Blanchard, 1994; Arellano and Ramanarayanan, 2012; Broner et al. 2013). In contrast, more recent evidence from advanced economies paints a different picture: studies report a positive association between debt levels and maturity structure in the US and across OECD countries (Greenwood et al, 2015; Nöh, 2019).

Importantly, the relationship evolves with debt levels. Studies show that higher debt shortens maturities (De Graeve and Mazzolini, 2023), but as debt grows further, maturities tend to lengthen, often due to proactive debt management in rebalancing maturities. Longer maturities are also more common when long-term rates are low, or the yield curve flattens.

Debt maturity concentration is a key aspect of sovereign debt management, shaped by more than interest rate considerations. While minimizing cost is important, strategic goals also influence maturity choices. Longer maturities can strengthen fiscal credibility or support anti-inflation policies, while short-term debt may offer liquidity benefits but increase default risk. This underscores the complex trade-offs in maturity decisions (Missale and Blanchard, 1994; Greenwood et al, 2015; Beetsma et al, 2017; Nöh, 2019).

Building on this context, our study contributes to the current literature by examining sovereign debt maturity structures in advanced economies, revealing that countries like Italy, Spain, and the US have diversified maturities, while Japan and the UK increased short-term debt. Longer weighted average maturities and a higher share of fixed-rate debt are associated with lower long-term interest rates, reflecting reduced refinancing and interest rate risk, whereas foreign and floating-rate are linked to higher rates. Additionally, concentrated debt lowers short-term rates, while skewed maturity distributions raise them. Lastly, macroeconomic determinates like growth and inflation also push up interest rates, emphasizing the need for careful debt maturity and composition management to ensure stable, cost-effective financing.

2. Data and methodology

Our research is based on quarterly sovereign debt data covering the period 1995Q1- 2020Q4. We use both face value and market value of sovereign debt in local currency of 15 categories based on Debt maturities from 1 year until 30 years (including debt below 1 year in the first category and above 30 in the last category) and two groups, debt maturity between 1-10 and 1-30 years. The set of 20 countries is listed in Table A1, the 15 categories in Table A2, and the list of variables and data sources in Table A3 of the Appendix.

In our empirical research D_{it}^{c} denotes the value of outstanding debt of category *c* (*c=1,…,15*) for country *i* in period *t*. Therefore, this means that total outstanding debt of country *i* in period *t* is calculated as follows:

$$D_{it} = \sum_{c=1}^{15} D_{it}^{c}, \tag{1}$$

and, in addition, the debt shares of the several categories are calculated in the following way:

$$DS_{it}^{c} = \frac{D_{it}^{c}}{D_{it}}. \tag{2}$$

After calculating the debt shares for all countries and all periods, they are rearranged in descending order for all variants.

Next, the area under the Lorenz curve (LC) and the Gini coefficient (GC) for a given country and a given period are calculated as follows[1]:

$$LC_{it} = 0.5 * DS_{it}^{m(i,t)=1} * \frac{1}{15} + 0.5 * \sum_{n=2}^{15}\left(DS_{it}^{m(i,t)=n} + DS_{it}^{m(i,t)=n-1}\right) * \frac{2n-1}{15}, \tag{3}$$

$$GC_{it} = 2 * (0.5 - LC_{it}). \tag{4}$$

The measure for the Gini coefficient is calculated on the basis of both the market value and the face value of outstanding sovereign debt.

We also have tested the order of integration of variables considered in econometric model with the use of panel unit root tests (Harris and Tzavalis (1999), among others) and concluded that the majority of the variables are integrated of order zero with the exception of weighted

[1] While the category c is based on maturity, $m(i,t)$ is based on the share of category rearranged in descending order.

moving average debt, local and fixed coupon debts. For this reason, we have used panel cointegration techniques proposed by Westerlund (2008). The following models are estimated for the 3-month short-term (STIR) and 10-year Long-term (LTIR) interest rate variation:

$$\Delta STIR_{it} = (\alpha_1 - 1)(STIR_{it-1} - \boldsymbol{x}_{it-1}\boldsymbol{\beta}) + \boldsymbol{z}_{it}\boldsymbol{\gamma} + \varepsilon_{it}, \quad (5)$$

$$\Delta LTIR_{it} = (\alpha_1 - 1)(LTIR_{it-1} - \boldsymbol{x}_{it-1}\boldsymbol{\beta}) + \boldsymbol{z}_{it}\boldsymbol{\gamma} + \varepsilon_{it}. \quad (6)$$

In (5) and (6) $\boldsymbol{x}_{it-1}$ consists of integrated of order 1 variables presented in Table 1 (other than $LTIR_{it}$ and $STIR_{it}$), while $\boldsymbol{z}_{it} = [\Delta \boldsymbol{x}_{it} \quad \boldsymbol{v}_{it}]$ consists of first differences of I(1) variables and stationary variables and ε_{it} is the error term.

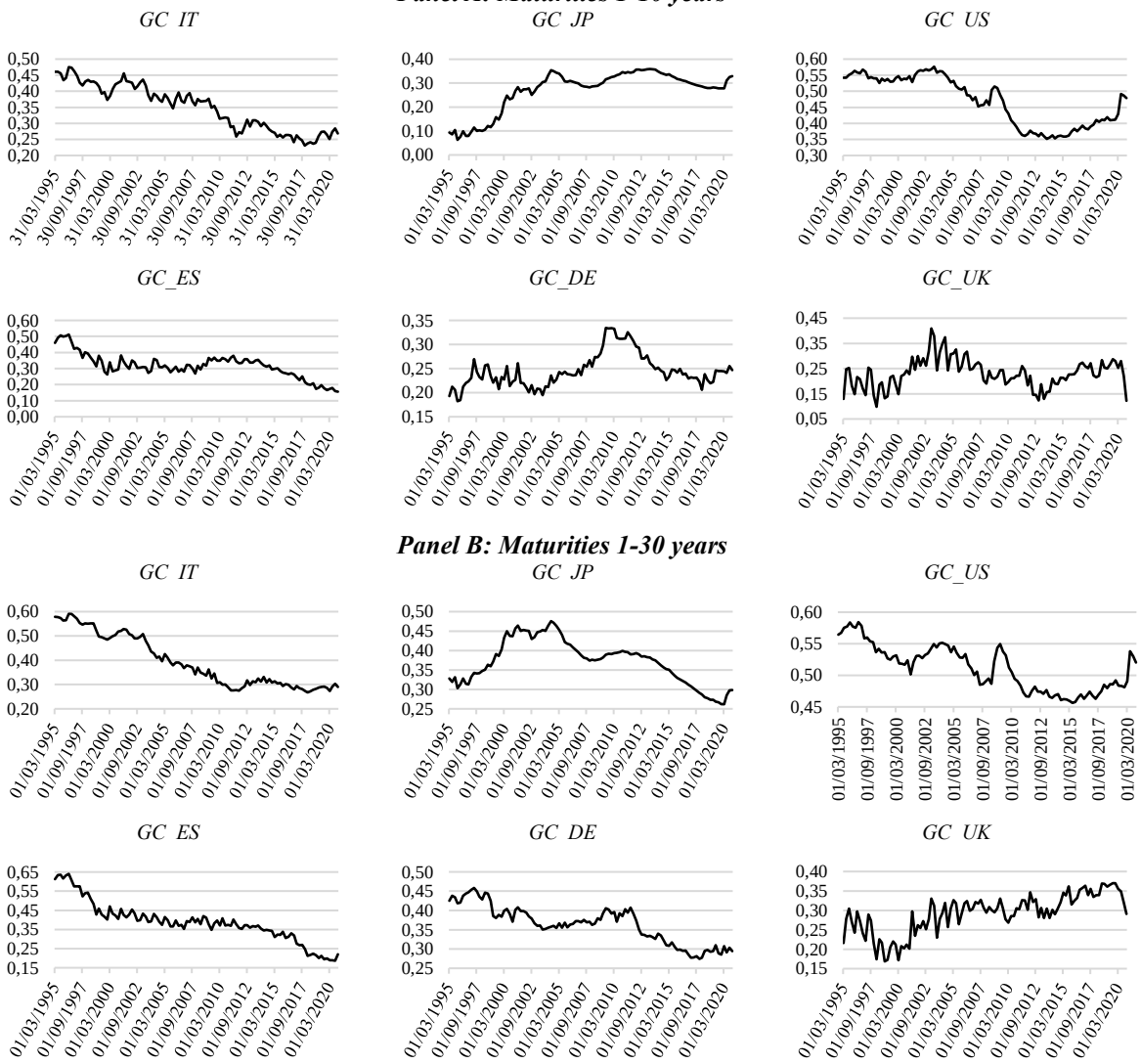
3. Results

Figure 1 illustrates the evolution of the Gini coefficient for different market value debt maturities. Results in Panel A shows a small downward trend in the Gini coefficient for Italy, Spain, and the US over maturities up to 10 years which suggests a deliberate effort to smooth short- and medium-term debt redemption profiles. This trend aligns with theoretical expectations of sovereign debt management aiming to avoid bunching of repayments that could expose governments to rollover risks. In contrast, Japan and the UK show an increase in the Gini coefficient for short maturities. This could reflect a greater reliance on short-term financing, possibly influenced by persistent deflationary pressures and near-zero interest rates, which reduce the cost of short-term borrowing and may make it politically or economically attractive despite the associated risks.

Empirically, the Gini coefficients exhibit substantial fluctuations, and noticeable drop particularly during periods of financial distress, suggesting a policy response aimed at reducing concentration to ensure more stable debt markets.

Panel B, covering maturities up to 30 years, shows a clearer and more consistent downward trend in concentration for all countries over time, especially for Italy, Spain, Japan, and Germany indicating a strategic shift toward lengthening debt maturities and diversifying issuance.

Figure 1. Evolution of Gini coefficient for maturities 1-10 (Panel A) and 1-30 years (Panel B)



Notes: This table reports on the market value Gini Coefficients (GC) evolution of the 1-10 years (Panel A) and 1-30 years (Panel B) maturities between 1995Q1-2020Q4 for Italy(IT), Japan(JP), the US, Spain(ES), Germany(DE), and the UK.

Apart from debt concentration, we evaluate whether short-term debt or long-term debt prevails by calculating the percentages of significantly positive and negative skewness for market value and face value of debt, for maturities 1-10 and 1-30 years by country.[2] Results (in Table A4 of the Appendix) show that most of the countries have positive skewness indicating a dominance of short-term debt issuing and right-tailed distribution of debt maturities. The literature argue that short-term debt may carry advantages over longer debt through liquidity premia gains and lower concerns over default risk (Broner et al.,2013; Beetsma et al., 2017).

[2] We calculated the skewness, which takes non-zero values, if the results of the D'Agostino (1971) test indicate that skewness significantly differs from 0.

Thus, some countries issue larger amounts of short-term debt, specially, Canada, the US, Italy, and Japan.

Furthermore, Table 1 presents the results of the estimation of the parameters of the panel error correction model with the use of the method proposed by Westerlund (2008). In the Long-run equations (Panel A), both the weighted average maturity of debt (WAM) and the fixed-rate Debt are negatively associated with interest rates. A longer WAM suggests that the government has secured financing at existing interest rates for an extended period, reducing the frequency of refinancing and thereby lowering exposure to short-term interest rate volatility (Equiza-Goñi, 2016). Similarly, a higher proportion of fixed-rate debt enhances predictability in debt servicing costs. These characteristics indicate lower refinancing risk, which can contribute to reduced long-term interest rates. Contrarily, foreign, floating-rate, and other forms of debt exhibit a positive relationship with long-run interest rates. This may reflect heightened exchange rate risk, market uncertainty, and potentially higher debt servicing costs, all of which can increase the risk premium demanded by investors and thus push interest rates higher.

In Panel B, which reports the short-run equations, the WAM coefficient becomes positive for the short-term interest rate, while the fixed-rate debt is positive for the long-term interest rate which may reflect lagged adjustment costs

Of particular interest is the result that a higher GC, indicating greater concentration of debt maturities, is associated with lower interest rates in the short run. On the other hand, higher skewness, representing a more asymmetric or uneven maturity distribution, is linked to higher interest rates, likely due to the increased uncertainty and potential liquidity mismatches perceived by investors.

Additional variables also confirm macro-financial theory. A higher share of rollover debt and zero-coupon debt is associated with lower interest rates in the short run, possibly due to reliance on short-dated or discounted instruments that temporarily reduce fiscal pressure or reflect lower current yields. Finally, consistent with macroeconomic expectations, higher GDP growth and inflation rates are both associated with higher interest rates, which reflects tighter monetary policies and inflation risk premia.

Table 1. Results of estimation of Panel Error Correction Models

Panel A: Long-run equations

	$LTIR$	$STIR$
$Const$	8.237***	6.564***
	(0.264)	(0.282)
$WAM\ Debt$	-0.686***	-0.534***
	(0.031)	(0.031)
$Foreign\ Debt$	17.653***	16.157***
	(1.368)	(1.334)
$Fixed\ Rate\ Debt$	-2.173***	-3.595***
	(0.256)	(0.257)
$Floating\ Rate\ Debt$	7.468***	10.532***
	(2.113)	(2.118)
$Other\ Debt$	12.897***	18.744***
	(1.452)	(1.453)

Panel B: Short-run equations

	$\Delta LTIR$				$\Delta STIR$			
	M30	F30	M10	F10	M30	F30	M10	F10
ECT_{t-1}	-0.024***	-0.024***	-0.021***	-0.022***	-0.043***	-0.042***	-0.039***	-0.040***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$\Delta\ WAM\ Debt$	-0.008	-0.013	-0.005	-0.006	0.111***	0.109***	0.118***	0.120***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.032)	(0.032)	(0.033)	(0.032)
$\Delta\ Foreign\ Debt$	0.728	0.700	1.048	1.078	0.593	0.735	1.032	1.241
	(1.697)	(1.698)	(1.702)	(1.700)	(1.792)	(1.797)	(1.803)	(1.802)
$\Delta\ Fixed\ Rate\ Debt$	1.163**	1.122**	1.036**	1.057**	0.514	0.482	0.378	0.447
	(0.467)	(0.467)	(0.469)	(0.470)	(0.492)	(0.493)	(0.496)	(0.497)
$\Delta\ Float\ Rate\ Debt$	-0.392	-0.276	-0.578	-0.513	0.323	0.489	0.053	0.172
	(2.128)	(2.126)	(2.137)	(2.134)	(2.248)	‘(2.251)	(2.264)	(2.262)
$\Delta\ Other\ Debt$	7.676**	7.711***	8.328**	8.198**	13.791***	13.860***	14.491***	14.317***
	(3.264)	(3.258)	(3.280)	(3.270)	(3.446)	(3.448)	(3.472)	(3.463)
$Gini\ Coeff$	-0.209***	-0.247***	-0.152***	-0.201***	-0.343***	-0.337***	-0.294***	-0.292***
	(0.045)	(0.048)	(0.057)	(0.061)	(0.048)	(0.051)	(0.061)	(0.065)
$Skewness$	0.028***	0.020*	0.020*	0.023**	0.035***	0.032***	0.035***	0.044***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
$Rollover\ Debt$	-0.003*	-0.002	-0.004**	-0.003	-0.011***	-0.011***	-0.013***	-0.013***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
$Buyback\ Debt$	-0.002	-0.002	-0.004	-0.004	-0.004	-0.005	-0.006	-0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
$Zero\ Debt$	-0.383**	-0.354**	-0.367**	-0.386**	0.190	0.164	0.153	0.072
	(0.162)	(0.171)	(0.163)	(0.171)	(0.171)	(0.181)	(0.173)	(0.181)
$GDP\ Growth$	0.005*	0.006**	0.003	0.004	0.032***	0.032***	0.030***	0.029***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$Inflation$	0.022***	0.024***	0.016**	0.017**	0.052***	0.050***	0.043***	0.041***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)

Notes: Panel A and B present the long- and short-term equation estimates where each column represents a regression. In Panel B, *M* stands for market value and *F* for face value, while *30* refers to debt maturities up to 30 years and *10* to debt up to 10 years. *ECT* is the error correction term, *WAM Debt* is the Weighted moving Average of debt, *Δ* represents the variation/first difference, *Standard* errors of estimates are provided in brackets. *,**,*** denote significance at the 0.1, 0.05 and 0.01 level of significance respectively.

4. Conclusions

We show that debt maturity and composition influence interest rates. Longer maturities and fixed-rate debt are linked to lower long-run interest rates, while foreign and floating-rate debt raise them. Countries like the US, Italy, and Spain have reduced concentration in short-term debt, whereas Japan and the UK have increased it, reflecting differing market conditions.

Lastly, higher debt concentration tends to lower short-term rates, but skewed maturity structures raise them, reflecting liquidity and uncertainty concerns. Growth and inflation also contribute to rising interest rates.

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Appendix

Table A1. List of countries included in empirical research

ISO	*Country*	*ISO*	*Country*	*ISO*	*Country*
AT	Austria	ES	Spain	NO	Norway
AU	Australia	FI	Finland	NZ	New Zealand
BE	Belgium	FR	France	PT	Portugal
CA	Canada	IE	Ireland	SE	Sweden
CH	Switzerland	IT	Italy	UK	United Kingdom
DE	Germany	JP	Japan	US	United States
DK	Denmark	NL	Netherlands		

Table A2. Categories of debt based on maturities

Category	*Debt maturity*
1	1 year (debts with maturities 9 months, 6 months and 3 months are included in this category)
2	2 years
3	3 years
4	4 years
5	5 years
6	6 years
7	7 years
8	8 years
9	9 years
10	10 years
11	12 years
12	15 years
13	20 years
14	25 years
15	30 years (debts with maturity above 30 years are included in this category)

Table A3. Variables considered in the empirical research

Name	***Definition***	***Source of data***
GC	Gini coefficient	Own calculations
Skew	Skewness	Own calculations
STIR	Short-term (3-months bill) interest rate (%)	De Graeve and Mazzolini (2023) Database
LTIR	Long-term (10-years bond) interest rate (%)	
GDP Gr	Yearly rate of growth of GDP (current prices, local currency)	
Inflation	Yearly inflation	
WAM Debt	WAM of outstanding debt (years)	
ROLL Debt	Roll-over debt (% total)	
BUY Debt	Buyback debt (% total)	
Local Debt	Local debt to GDP ratio	
For Debt	Foreign debt to GDP ratio	
Fixed Debt	Fixed debt to GDP ratio	
Float Debt	Float debt to GDP ratio	
Zero Debt	Zero coupon debt to GDP ratio	
Other Debt	Other type debt to GDP ratio	

Table A4. Percentages of significantly positive and significantly negative skewness for different variants.

	Maturities 1-30 years				**Maturities 1-10 years**			
	Market		***Face***		***Market***		***Face***	
	POS	*NEG*	*POS*	*NEG*	*POS*	*NEG*	*POS*	*NEG*
AT	3.9	1	1.0	0	2.9	3.9	2.9	2.9
AU	27.2	0	25.0	0	23.3	0	27.9	5.8
BE	49.5	0	71.2	0	46.6	0	73.1	0
CA	100.0	0	100.0	0	100.0	0	100.0	0
CH	41.7	0	69.2	0	45.6	0	63.5	0
DE	32.0	0	37.5	0	36.9	0	48.1	0
DK	23.3	0	6.7	0	5.8	0	3.8	0
ES	67.0	0	84.6	0	63.1	0	76.0	0
FI	45.6	0	34.6	0	35.9	0	21.2	0
FR	60.2	0	80.6	0	68.9	0	88.5	0
IE	24.3	0	25.0	0	24.3	0	23.1	1.9
IT	82.5	0	94.2	0	64.1	0	76.9	0
JP	77.7	0	80.8	0	86.4	0	92.3	0
NL	35.9	0	51.9	0	44.7	0	55.8	1.9
NO	58.3	0	63.5	0	39.8	0	42.3	0
NZ	38.8	0	44.2	0	18.4	0	25.0	0
PT	35.0	0	23.1	0	34.0	0	31.7	0
SE	64.1	0	72.1	0	32.0	0	47.1	0
UK	56.3	0	67.3	0	11.7	0	25.0	1.9
US	100.0	0	80.8	0	100.0	0	80.8	0