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Yield-to-maturity on Sovereign Eurobonds and foreign-currency Sovereign borrowing in EMEs*

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Abstract

This paper studies the main determinants of the yield-to-maturity of Emerging Market Economies (EMEs)' Sovereign Eurobonds and emphasizes that not only the share of total government debt in GDP but also its decomposition into foreign-currency-denominated and domestic-currency-denominated debt matters for the yields to maturity in question. Indeed, while an increase in the ratio of domestic-currency-denominated sovereign debt to GDP has no significant effect on the yield to maturity of EMEs' Sovereign Eurobonds, an increase in the ratio of foreign-currency-denominated sovereign debt to GDP leads to a significant rise in the yield to maturity of EME Sovereign Eurobonds. This significant effect of the foreign-currency-denominated Sovereign debt on the yield to maturity of EME Sovereign Eurobonds holds even when we control for institutional quality in EMEs.

Key words: Yield-to-maturity on EMEs' Sovereign Eurobonds, share of domestic-currency-denominated and foreign-exchange-denominated debt, institutional quality, monetary policy in Türkiye.

JEL codes: E02, E43, E58.

1. Introduction

The evidence of a significant change in Türkiye's monetary policy around 2010s is well documented. For example, a common finding in Gürkaynak et al.

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(2015), Gürkaynak, Kısacıkoğlu, and Lee (2023), Tuğan (2024), and Yılmaz and Çiçekçi (2024) is that the responses of monetary policy to changes in inflation and the output gap weakened after 2010 compared to those before 2010, which we refer to as a loosening in monetary policy. As a matter of fact, the extent of the loosening had been so great between 2010 and 2023 that the studies mentioned above find that monetary policy in Türkiye did not abide by Taylor's principle, possibly giving rise to unstable dynamics after macroeconomic shocks. This situation continued until the Turkish presidential election in May 2023, soon after which Türkiye's monetary policy was tightened with the appointment of Mehmet Şimşek as the Minister of Treasury and Finance.

Could the violation of Taylor's principle during the period before the election have adverse consequences for the Turkish economy? This paper is concerned with this question and analyses the rise in the yield to maturity on Turkish Sovereign Eurobonds since 2015. Gürkaynak, Kısacıkoğlu, and Lee (2023) and Tuğan (2024) relate this rise to unduly loose monetary policy in Turkey after 2010 and emphasize the role of deterioration in institutional quality in Türkiye. This paper argues additionally that one major channel that can explain the significant rise in the yield to maturity of Turkish Sovereign Eurobonds between 2015 and 2023 is the significant rise in the ratio of the foreign-currency-denominated external debt to GDP in Türkiye, which we relate to the fact that the unpredictably high inflation after 2015 caused by loose monetary policy resulted in highly volatile and mostly negative ex-post real interest rates on Turkish-Lira-denominated Sovereign bonds and bills in Türkiye. This situation, in turn, has caused a decline in the share of Turkish Lira in the Sovereign borrowing, giving rise to a rapid increase in the share of foreign-currency-denominated borrowing in the total Sovereign borrowing. As a matter of fact, as of May 2023, the ratio of Turkish Sovereign external debt in foreign currencies to GDP stands as one of the highest among that of Emerging Market Economies (*EMEs*)' Sovereigns. In contrast, as of the same date, the ratio of total Sovereign debt to GDP in Türkiye remains low as compared to the ratio of the total Sovereign debt to GDP in other *EMEs*. Hence, the yield to maturity on Turkish Sovereign Eurobonds could be higher or lower than that on other *EMEs'* Sovereign Eurobonds, depending on whether the former or the latter effect dominates. However, despite the relatively low total borrowing of Turkish Sovereign noted above, the effect resulting from the rapid rise in the ratio of the foreign-currency-denominated Sovereign borrowing to GDP dominated after 2015, leading to a significant rise in the yield to maturity on Turkish Sovereign Eurobonds.

To show that a rise both in the share of foreign-currency-denominated Sovereign debt to GDP and in the inflation, which loose monetary policy in Türkiye before the election possibly played a significant role, are among the significant determinants of a rise in the yields of Turkish Sovereign Eurobonds, we employ a

panel model with *EME* yields being the dependent variable. In this model, we include country-specific fixed effects that capture time-invariant factors affecting *EME* yields such as whether the *EME* in question is rich in natural resources. We also control for the common co-movement across the EME Sovereign yields in 2009 due to the Global Financial Crisis by including a time dummy being equal to one in 2009 and to zero in all other years. Admittedly, a panel VAR model with interactive fixed effects considered in Tuğan (2021) can capture not only county-specific fixed effects and time-specific fixed effects *separately* but also any *interaction* between them as in the case that a global shock specific to a particular year affects each *EME* differently due to unmeasured country-specific factors. While it is desirable to allow such an interaction, the consistency of model parameters in panel VAR models with interactive fixed effects requires both the number of cross-section units and of periods to be large, as Tuğan (2021) notes. However, the data on the composition of Sovereign debt and on the quality of institutions were only available at yearly frequency during our period of study 2005-2021 (the number of periods is at most 17). This together with the fact that our sample includes only 20 EMEs led us to consider a more conventional panel model with country-fixed effects. Unlike the existing literature discussed below, our empirical model explicitly controls for the quality of institutions in all our sample of *EME*s when discussing the effect of the currency composition of Sovereign debt on *EME* yield spreads.

We find that the yield on these Eurobonds rises significantly due to a rise in the ratio of foreign-exchange-denominated Sovereign debt to GDP. However, the yield on EME Sovereign Eurobonds shows no significant change due to a rise in the ratio of domestic-currency-denominated Sovereign debt to GDP in *EMEs*. Consequently, the ability to borrow in domestic currency can affect the cost of external borrowing significantly for *EMEs*. In this regard, we corroborate the main message in Dell'Erba, Hausmann, and Panizza (2013) that the currency composition of Sovereign debt plays a significant *partial* role in Sovereign yield spreads beyond the role played by the total Sovereign debt to GDP.[1] We show that this conclusion holds even when we control for institutional quality in *EMEs* that Gürkaynak, Kısacıkoğlu, and Lee (2023) emphasize, implying that Türkiye could have prevented a significant rise in the cost of its Sovereign external borrowing after 2015 by avoiding excessively volatile and mostly negative ex-post real interest rates on Turkish-Lira-denominated Sovereign borrowing.

Our paper can be related to a few papers in the literature emphasizing the role of Sovereign debt to GDP in the yield spread on Sovereign bonds. Regarding the

[1] The increase in Sovereign yield spreads due to the heavier reliance of the government on foreign-currency borrowing for a given ratio of total Sovereign debt to GDP can result from the increase in the net foreign liabilities that is associated with a higher risk of an external crisis, as Catão and Milesi-Ferretti (2014) find.

global factors, Codogno et al. (2003) argue that yield spreads on Sovereign bonds of the members of economic and monetary union are driven mainly by the international risk factors that played a different role in these countries due to the difference in the Sovereign debt to GDP ratio. Regarding the role of domestic factors, Ebeke and Lu (2015) present evidence that while an increase in foreign participation in local-currency bond markets of *EME*s significantly lowers the cost of local-currency Sovereign borrowing, the favorable effect mentioned weakens in *EME*s with a high debt-to-GDP ratio. Kennedy and Palerm (2014) show that the domestic factors such as the fall in interest payments on external debt as a ratio of foreign reserves and the fall in the foreign debt to GNI contributed more to the decline in *EME* yield spreads between August 2002 and May 2007 than the external factors such as the anticipated changes in the U.S. Treasury rates.

Our paper is also related to the branch of the literature focusing on the effect of quality of institutions and of fundamentals on yield spreads of *EME* Sovereign bonds. Eichengreen and Gupta (2015) and Aizenman, Binici, and Hutchison (2016) find that the *EME*s with better fundamentals experienced more heightened financial stress than the ones with fragile fundamentals following the announcements made by the Federal Reserve officials during the taper tantrum. In contrast, using a larger set of indicators of fundamentals than both Eichengreen and Gupta (2015) and Aizenman, Binici, and Hutchison (2016) use, Ahmed, Coulibaly, and Zlate (2017) find that the *EME*s with good fundamentals experienced a lower degree of financial stress in the aftermath of the taper tantrum in the U.S. Audzeyeva and Fuertes (2018) contend that the fundamentals as a determinant of *EME* Sovereign spreads gained more importance following the Lehman Brothers' default, lending support to the view that international investors are more willing to incur the cost of acquiring information on *EME* fundamentals during turmoil periods than during tranquil periods. In contrast, Özmen and Doğanay-Yaşar (2016) show that the major drivers of *EME* Sovereign spreads during the Global Financial Crisis were global factors rather than country-specific factors.

Notably, the literature cited above barely emphasizes the role of currency-composition of Sovereign debt in *EME* yield spreads, which we focus on this paper. In this regard, our paper is most closely related to Dell'Erba, Hausmann, and Panizza (2013), who find that the yield spread on Sovereign bonds shows a stronger increase after a given rise in the debt to GDP ratio in countries whose Sovereign debt is issued mostly in foreign currencies with the eurozone countries not insulated from this effect despite having relatively good institutions. In our paper, unlike Dell'Erba, Hausmann, and Panizza (2013), we explicitly control for the quality of institutions in our sample of all *EME*s.

The organization of the paper is as follows: Section 2 illustrates the time behavior of monthly ex-post real interest rates on Turkish Treasury bills and bonds

at their maturity dates and compares Sovereign borrowing in *EMEs* regarding the ratio of Sovereign debt to GDP and currency of Sovereign borrowing. Section 3 discusses *World Bank*'s measures of institutional quality in Türkiye and presents an econometric model along with its results. Section 4 concludes.

2. Ex-post real interest rates and sovereign borrowing in Türkiye

Tuğan (2024) estimates the monthly ex-post real interest rate on Turkish Treasury bonds and bills either at their maturity dates or on May 15th, 2023, which is the last date of his study. Figure 1 shows the monthly ex-post real interest rates on Turkish Treasury bonds and bills estimated by Tuğan (2024). As discussed in Online Supplement to Tuğan (2024), Tuğan (2024) calculates the monthly ex-post real interest rates in the following way: Let t_{issue} and $t_{maturity}$ be the issue and the maturity date of a Sovereign security, respectively. Also, let d denote the duration of the security measured as the number of years between t_{issue} and $t_{maturity}$ calculated on a 30/360 basis. The net compound nominal interest rate of the security between t_{issue} and $t_{maturity}$ (CI_b) can be calculated as:

$$CI_b = (1 + i_b)^d - 1,$$

where i_b is the annual compound rate in decimal points on the security. To calculate the ex-post real interest rates on the security, a measure of the change in prices is required. Tuğan (2024) measures the approximate decimal change in prices between t_{issue} and $t_{maturity}$ (ΔP_b) as

$$\Delta P_b = ln\, P_{maturity} - ln\, P_{issue},$$

where P_{issue} and $P_{maturity}$ are the consumer price indices at t_{issue} and $t_{maturity}$, respectively. Notably, P_{issue} and $P_{maturity}$ are not directly observable since consumer price indices are not reported at the daily frequencies but are reported as the monthly averages of the corresponding months in *IMF's International Finance Statistics*. Tuğan (2024) uses the following approximate formula to calculate the consumer price index at a particular date (P_{date}) between the middle of two consecutive months (denoted by $\bar{m}_i$ and $\bar{m}_{i+1}$):

$$P_{date} = P_{\bar{m}_i} + \frac{\#\ of\ days\ between\ the\ date\ and\ \bar{m}_i}{\#\ of\ days\ between\ \bar{m}_i\ and\ \bar{m}_{i+1}} . \left(P_{\bar{m}_{i+1}} - P_{\bar{m}_i}\right),$$

where $P_{\bar{m}_i}$ is the consumer price index in the middle of month i, which Tuğan (2024) takes as the monthly average of the consumer price index reported in *IMF's International Finance Statistics*. Consequently, the formula above uses the approximation that the consumer price index between the middle of the two consecutive months increases by the same magnitude in each day, leading the monthly consumer price index to rise from $P_{\bar{m}_i}$ in the middle of month i to $P_{\bar{m}_{i+1}}$ in the middle of the subsequent month $i+1$. For example, if the issue date is January 18th, 2000 for some security, Tuğan (2024) approximates the consumer price index at the issue date as:

$$P_{issue} = P_{15\ Jan\ 2000} + \frac{3}{30} \cdot \left(P_{15\ Feb\ 2000} - P_{15\ Jan\ 2000}\right).$$

In the next step, Tuğan (2024) measures the monthly ex-post real interest rates on the security as:

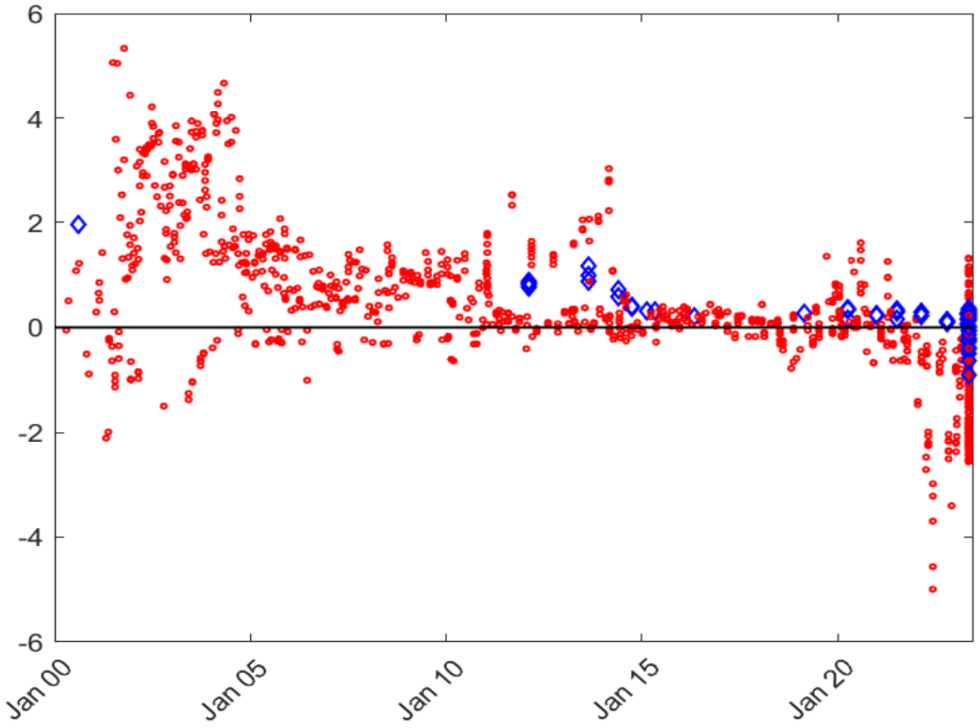
$$\left(\frac{CI_b - \Delta P_b}{d}\right)/12,$$

where the term inside the parenthesis gives the annual ex-post real interest rate, a division of which by 12 yields the monthly ex-post real interest rate. Lastly, it is notable that if a security has a maturity date later than the last day of Tuğan's (2024) study, namely 15 May 2023, than one may not compute the ex-post real interest rate at the maturity date of this security. Tuğan (2024), instead, uses 15 May 2023 in place of the maturity date of the security in question in the formulas discussed above to be able to compute its ex-post real interest rate as of 15 May 2023. For all other securities with an earlier maturity date of the last date of Tuğan's (2024) study, Tuğan (2024) was able to compute their ex-post real interest rates at the maturity dates. These ex-post real interest rates can answer the following question: If someone purchases a bond or a bill issued by Turkish Treasury and waits until its maturity (or 15 May 2023 if the maturity date of a bond is later than 15 May 2023), what is its monthly real yield with average monthly inflation netted out of average monthly nominal yield? A negative value of the ex-post real interest rate suggests that the bond's real return is negative despite its positive nominal return due to the inflation being higher than its nominal return between its issue and maturity dates. Figure 1 illustrates the monthly ex-post real interest rates of Turkish Treasury bonds and bills issued during the period studied by Tuğan (2024). As is evident from the figure, the ex-post real interest rates of Turkish Treasury bonds and bills remained mostly positive until 2020 with the highest ex-post real interest rates seen after the Turkish financial crisis in 2001, reflecting the fact that Treasury needed to offer very

high interest rates after the crisis to convince investors to lend in Turkish Liras due to the increased concern over the debt repayment capacity of the Turkish Treasury. Following the subsequent successful stabilization program, the ex-post real interest rates fell gradually after 2001. Since 2020, they became negative mostly due to the excessive inflation in the wake of the Covid pandemic, which was unforeseen at the issue dates of the Treasury bonds and bills in question.

Figure 1

Behavior of monthly ex-post (ex-ante) real interest rates at their maturity dates on the non-CPI-indexed (CPI-indexed) Turkish Treasury bills and bonds.



Notes: Red circles (blue diamonds) display the ex-post (ex-ante) real interest rates on the non-CPI-indexed (CPI-indexed) Treasury bills and bonds sold at auctions in Turkey. The ex-post real interest rates are computed with the method discussed above. The ex-ante real interest rates are directly obtained from *CBRT*.

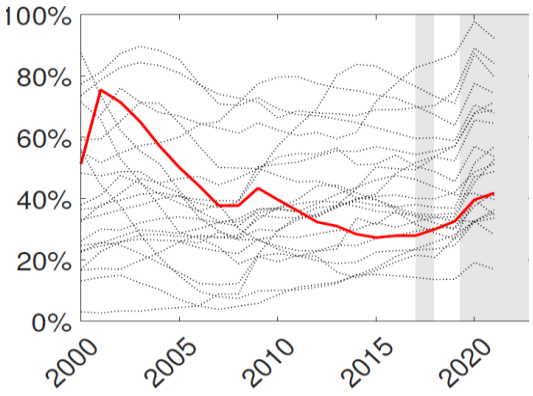
Source: Tuğan (2024)

Tuğan (2024) relates the fall in the ex-post real interest rates after 2020 to the loose monetary policy, causing excessive inflation. More specifically, Tuğan (2024) finds that Türkiye's monetary policy clearly violated Taylor's principle especially after 2015, shown by grey vertical shaded areas in Figure 2. This violation was manifested in the form of the insistence on low nominal interest rates and the rise in money supply despite the rapid rise in inflation, turning the real interest rates negative in Türkiye, as discussed in Tuğan (2024).

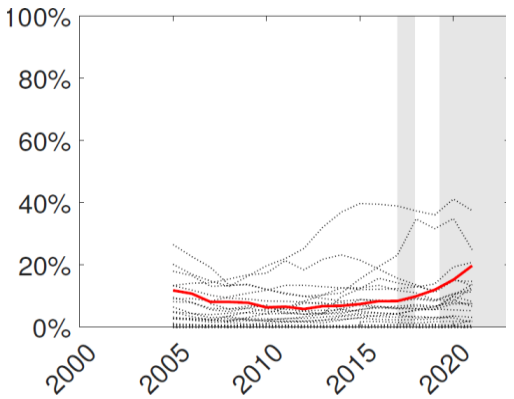
Figure 2 shows the recent developments in *EME* Sovereign debt markets. In this figure, the variables pertinent to Türkiye and the other *EMEs* are shown with solid (red) lines and dotted (black) lines, respectively. Due to the impracticability of indicating all *EME* legends in the same figure, Tuğan (2024) compares the developments in Türkiye's and other *EMEs'* Sovereign debt markets without indicating legends for other *EMEs*. We refer the reader to Tuğan (2024, Online Supplement) for a clear illustration of a country-wise comparison of the variable's time behavior in Türkiye with that in each of other *EMEs*. Three points are noteworthy in Figure 2. Firstly, the ratio of total Sovereign debt to GDP has remained low in Türkiye, as compared to that in other *EMEs*. As a matter of fact, Türkiye's Sovereign debt to GDP ratio was one of the highest in 2001 among all *EMEs'*, reaching 80%. Türkiye's rapid growth after 2001 and Turkish Sovereign's reduced appetite for borrowing resulted in a meaningful fall in the ratio of Turkish Sovereign debt to GDP. As of 2021, the last year of Onen, Shin, and von Peter (2023)'s study with which one can make a comparison of *EME* Sovereign debt market, Türkiye succeeded in lowering its ratio of Sovereign debt to GDP to such a level that it was one of the lowest among *EMEs*.

Figure 2
Government debt in *EMEs*

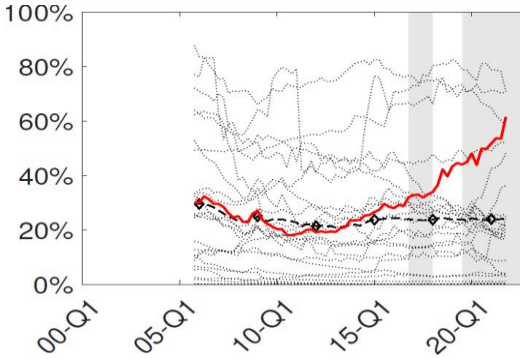
(i) Total Government Debt (Percent of GDP)



(ii) Long-Term Foreign-Currency Government Debt (Percent of GDP)



(iii) Share of Foreign Currencies in Outstanding Government Bonds



Notes: Tuğan (2024)'s calculations based on the data from IMF's *IFS*, IMF's *Government Statistics*, and Onen, Shin, and von Peter (2023). Solid lines, dotted lines without a marker, and the dotted line with diamonds in panel (iii) show, respectively, the time behavior of the variables in Türkiye, in the other *EMEs*, and of the sample mean across EMEs contained in our sample of the share of the foreign-currency-denominated bonds in total long-term government bonds outstanding. Gray shaded area is the period that Tuğan (2024) finds a clear violation of Taylor's principle in Turkish monetary policy. Due to the large number of *EMEs* in the sample, Tuğan (2024) does not indicate legends for identifying *EMEs* but relegate a discussion of a country-wise comparison between each *EME* and Türkiye to Tuğan's (2024) Online Supplement.

Source: Reproduced from Tuğan (2024).

This favorable feature of Türkiye, however, fades somehow if one looks at the composition of its Sovereign debt. As seen in panel (iii) of Figure 2, Turkish Sovereign has recently borrowed heavily in foreign exchanges rather than in Turkish Liras. As of 2021, about two thirds of Turkish Sovereign debt occurs in the vehicle currencies such as euros and U.S. dollars. At this point, it deserves mentioning that the fall in the ex-post real interest rates after 2020 went in tandem with a rise in the share of the foreign-currency-debt in total Turkish Sovereign borrowing. This situation contrasts with the period after the Turkish financial crisis in 2001 when the fall in the former went in tandem with a *fall* rather than a rise in the latter.

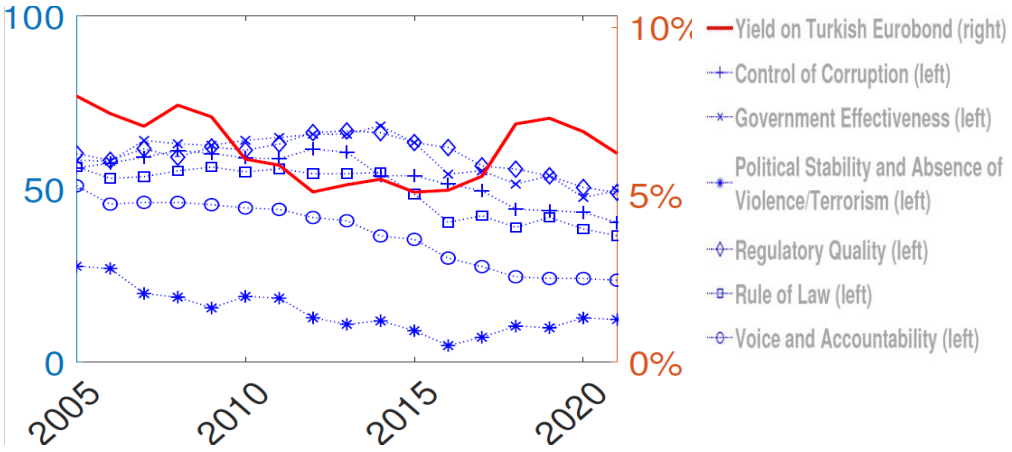
It is also striking to notice that the rise in the share of the foreign currencies in total Turkish Sovereign borrowing gained momentum after 2015, a period that Tuğan (2024) finds a clear violation of Türkiye's monetary policy. With such a rise in foreign-currency borrowing, it is evident from panel (ii) of Figure 2 that the Turkish Sovereign foreign-currency-denominated debt as a ratio of GDP was one of the highest among *EME* Sovereigns'.

Gürkaynak, Kısacıkoğlu, and Lee (2023) list a worsening in intuitional quality as the primary reason behind the recent rise in the yield to maturity of Turkish Treasury bonds. In the next section, we support their argument by studying the determinants of yields to maturity of *EME* Sovereign Eurobonds. We add to their analysis by showing that the recent rise in the ratio of the Turkish Sovereign foreign-currency-denominated debt to GDP also played a significant role in the rise in the yield to maturity of Turkish Sovereign Eurobonds. This effect remains significant even when one controls for a deterioration in institutional quality in Türkiye in the period of study.

3. Worldwide governance indicators and yields on sovereign Eurobonds in EMEs

Gürkaynak, Kısacıkoğlu, and Lee (2023) argue that a worsening in institutional quality in Türkiye can be a major driver of the rise in the yield to maturity on Turkish Sovereign Eurobonds after 2015, implying that investors attach a high-risk premium when holding Turkish Eurobonds due to the apparent decline in institutional quality since 2015. Indeed, as is evident from Figure 3, Türkiye witnessed a sharp decline in five of the six dimensions of the institutional quality reported in the World Bank's Worldwide Governance Indicators (WGI for short) and a concurrent rise in the yield to maturity on the Turkish Sovereign Eurobond with an ISIN code of US900123AL40 since 2015. Consequently, a deterioration in institutional quality seen in Türkiye especially after 2020 is associated with a rise in the yield to maturity of Turkish Eurobond selected.

Figure 3
Indicators of institutional quality in Türkiye and the yield to maturity on Turkish Sovereign Eurobond selected.



Notes: Our sources of the data are World Bank's Worldwide Governance Indicators (WGI) and Börse Frankfurt. The solid line shows the behavior of the yield to maturity (YTM) per annum on Türkiye's Sovereign Eurobond with an ISIN code of US900123AL40 computed with the method described in Section S10 of Tuğan (2024, Online Supplement) as the simple mean of the YTMs in the trading dates of a given year. Dotted lines display the percentile ranks of each of the six dimensions of institutional quality from WGI for Türkiye.

Next, we show that the argument in Gürkaynak, Kısacıkoğlu, and Lee (2023) made for Türkiye that the degree of institutional quality can be an important determinant of the borrowing cost on Sovereign external debt can be broadened to all *EMEs*. In performing our analysis, we obtain the data from several sources with different frequencies; see Section S2 of Tuğan (2024, Online Supplement) for the description of the sources of our data. We convert the frequency of the series into the annual frequency if the series is not reported at the annual frequency, resulting in the sample period covering 2005-2021. To measure the borrowing cost of Sovereign external debt in *EMEs*, we use the yield to maturity on the *EME* Sovereign Eurobonds (denoted by $ytm_{i,t}$). We select only one Sovereign Eurobond for each *EME* in our sample. In case that the *EME* in question has multiple Eurobonds in our sample, we select the one with the longest data availability in our sample period; see Section S11 of Tuğan (2024, Online Supplement) for the list of the EME Sovereign Eurobonds selected for our analysis. Due to the data availability

of the series used in our analysis being different among our sample *EME*s, our panel data is unbalanced. We estimate the following panel model with country-fixed effects (denoted by Model I):

$$ytm_{i,t} = \alpha_i + \gamma \,.residualmaturity_{it} + \theta \,.dt_{2009} + \sum_{j=1}^{6} \beta_j \,.iq_{it}^{j} + u_{i,t}, \quad (Equation\ 1)$$

where $ytm_{i,t}$ is the yield to maturity of *EME* Sovereign Eurobond; $residualmaturity_{it}$ is the number of years remaining until the maturity of the Eurobond, intending to capture the term premium if an *EME* Sovereign Eurobond has a later maturity date; α_i is a fixed effect specific to *EME* indexed with i, capturing such factors as whether a country is rich in natural resources or its other time-invariant features that can help the country have a low Sovereign debt relative to its GDP so that it can have a lower borrowing cost on its Sovereign Eurobond than that implied by its institutional quality. dt_{2009} is a time dummy being equal to one if t = 2009, capturing the observation that all EMEs faced with a rise in the yields of their Sovereign Eurobonds in the aftermath of the Global Financial Crisis. iq_{it}^{j} is the percentile rank of the country in dimension *j* of institutional quality with the order shown in Figure 3: iq_{it}^{1}, iq_{it}^{2}, iq_{it}^{3}, iq_{it}^{4}, iq_{it}^{5}, and iq_{it}^{6} are the percentile rank in control of corruption, in government effectiveness, in political stability and absence of violence/terrorism, in regulatory quality, in rule of law, and in voice and accountability, respectively. Table 1 shows the least squares estimates along with their robust standard errors. As seen in the table, the estimator of the coefficients has mostly the expected signs. For example, *EME*s witnessed a significant rise in the aftermath of the Global Financial Crisis ($\theta > 0$). As the maturity date of *EME* Sovereign Eurobonds approaches, the yield to maturity on the *EME* Eurobond falls, implying a fall in the term premium ($\gamma > 0$). Also, an indicator of institutional quality, namely the rule of law, has a significant and negative effect on the borrowing cost on the *EME* external Sovereign bond. More importantly, the null hypothesis that all β_js in Equation (1) are zero is strongly rejected in Model I (with an F statistic of 7.05). Consequently, our finding supports the argument in Gürkaynak, Kısacıkoğlu, and Lee (2023) that institutional quality is crucial in lowering yields on EME Sovereign Eurobonds.

Next, we investigate the effect of the ratio of foreign-currency long-term outstanding Sovereign debt to GDP on the yield of *EME* Sovereign Eurobonds with the help of the following unbalanced panel model (denoted by Model II):

$$ytm_{i,t} = \alpha_i + \gamma \,.residualmaturity_{it} + \theta \,.dt_{2009} + \delta_1 \,.fc\_debttoGDP_{i,t}$$

$$+ \delta_2 \,.totaldebttoGDP_{i,t} + u_{i,t}, \quad (Equation\ 2)$$

where $totaldebttoGDP_{i,t}$ and $fc\_debttoGDP_{i,t}$ denote, respectively, the ratio of the total Sovereign debt and of the foreign-currency denominated debt to GDP in each *EME*. The results from (Equation 2) reported in column Model II of Table 1 indicate that a higher ratio of the foreign-currency denominated debt is associated with a significant increase in the borrowing cost of *EME* Sovereign external debt (i.e., $\delta_1 > 0$). Notably, this estimate shows the partial effect of the $fc\_debttoGDP_{i,t}$ by holding $totaldebttoGDP_{i,t}$ constant. Consequently, one can argue that even if two *EME*s have similar total Sovereign debt to GDP ratios, the yield on the Eurobond of the one with a higher share of foreign-currency-denominated Sovereign debt than the other can be significantly higher. Conversely, if two EMEs have a comparable $fc\_debttoGDP_{i,t}$ but one has a larger $totaldebttoGDP_{i,t}$ than the other, the yields on Sovereign Eurobonds do not differ significantly (i.e., the estimate of δ_2 is insignificant).

Table 1
Yields on EME Sovereign Eurobonds and Institutional Quality

	Dependent Variable:				
	Yield to Maturity			Foreign-Currency Debt to GDP Ratio	
	Model I	Model II	Model III		Model IV
γ	0.25 ***	0.24 ***	0.24***		
	(0.03)	(0.04)	(0.03)		
θ	0.65 ***	0.90 ***	0.68***		
	(0.12)	(0.14)	(0.12)		
β_1	-0.02	—	-0.02**	ϑ_1	-0.05
	(0.01)		(0.01)		(0.04)
β_2	-0.01	—	0.00	ϑ_2	-0.05
	(0.02)		(0.01)		(0.04)
β_3	-0.01	—	-0.01	ϑ_3	0.05
	(0.01)		(0.01)		(0.06)
β_4	-0.05	—	-0.05*	ϑ_4	-0.07
	(0.03)		(0.02)		(0.10)
β_5	-0.06 ***	—	-0.04**	ϑ_5	-0.11
	(0.02)		(0.02)		(0.11)
β_6	0.04	—	0.04	ϑ_6	0.09
	(0.04)		(0.03)		(0.13)
δ_1	—	0.13**	0.09**		
		(0.06)	(0.04)		
δ_2	—	-0.01	-0.02		
		0.03	(0.02)		
Obs.	194	194	194	Obs.	194
R^2	0.73	0.66	0.75	R^2	0.14
$F(6, 20)$	7.05***	—	8.32***	$F(6, 20)$	1.50

Notes: The numbers report the OLS estimates. Numbers in parenthesis are the robust standard errors computed with the method in Arellano (1987).

*,** ,*** indicate the estimates that are significant at the 1%, the 5%, and the 10% significance level, respectively. Parameters of models I, II, III, IV are reproduced below for the reader's convenience.

Models I, II, and III	Model IV
$ytm_{i,t} = \alpha_i + \gamma \,.\, residualmaturity_{it} + \theta \,.\, dt_{2009} + \sum_{j=1}^{6} \beta_j \,.\, iq_{it}^{j} + \delta_1 \,.\, fc\_debttoGDP_{i,t} + \delta_2 \,.\, totaldebttoGDP_{i,t} + u_{i,t}$	$fc\_debttoGDP_{i,t} = \alpha_i + \sum_{j=1}^{6} \varphi_j \,.\, iq_{it}^{j} + u_{i,t}$

Does $fc\_debttoGDP_{i,t}$ remain to be powerful at predicting the yield on *EME* Sovereign Eurobonds after controlling for changes in institutional quality? We study this question by estimating the following panel model (denoted by *Model III*):

$$ytm_{i,t} = \alpha_i + \gamma \,.\, residualmaturity_{it} + \theta \,.\, dt_{2009} + \sum_{j=1}^{6} \beta_j \,.\, iq_{it}^{j} + \delta_1 \,.\, fc\_debttoGDP_{i,t} + \delta_2 \,.\, totaldebttoGDP_{i,t} + u_{i,t} \quad (Equation\ 3)$$

Results from *Model III* in Table 1 show that $fc\_debttoGDP_{i,t}$ remains to be an important determinant of the yield on EME Sovereign Eurobonds even when one controls for institutional quality (the estimate of δ_1 still remains significant). Similarly, institutional quality remains a crucial factor in explaining the yield on *EME* Sovereign Eurobonds if one controls for $fc\_debttoGDP_{i,t}$ (the null hypothesis that all β_js are zero is strongly rejected with a F statistics of 8.32). In addition, the indicators of institutional quality that we find as significant has the expected negative effect on the Sovereign borrowing cost.

One can conjecture that institutional quality can be a major driver of the share of foreign-currency-denominated Sovereign debt such that a worsening in institutional quality can cause a concurrent increase in $fc\_debttoGDP_{i,t}$. To show that there is little evidence in favor of this conjecture, we consider the following panel model (denoted by *Model IV*):

$$fc\_debttoGDP_{i,t} = \alpha_i + \sum_{j=1}^{6} \varphi_j \,.\, iq_{it}^{j} + u_{i,t} \quad (Equation\ 4)$$

In this model, α_i can capture factors slowly changing over time such as the situation of an *EME* that plans to join the euro area soon and thus borrow heavily

in the euro, resulting in a high foreign-currency Sovereign debt to GDP ratio. The results from Model IV in Table 1 show that institutional quality is not a significant determinant of the ratio of the foreign-currency-denominated debt to GDP (the null hypothesis that all φ_js are zero cannot be rejected with an F statistics of 1.50).

3.1. Differential partial effect of composition of sovereign debt to GDP depending on institutional quality

A natural question arises as to whether the composition of Sovereign debt has a differential *partial* effect depending on institutional quality. Indeed, a sufficiently high level of institutional quality can possibly mitigate the *partial* adverse effect of a rise in Sovereign debt in either domestic or foreign currencies on the yield on EME Sovereign Eurobonds. To study this possibility, we add an interaction term between the composition of Sovereign debt and a measure of overall institutional quality to our panel model (denoted by Model V):

$$ytm_{i,t} = \alpha_i + \gamma\,.residualmaturity_{it} + \theta\,.dt_{2009} + \beta.\bar{\imath q}_{it} + \delta_1\,.fc\_debttoGDP_{i,t} + \delta_2\,.totaldebttoGDP_{i,t} + \mu_1.(fc_{debttoGDP\,i,t} \times \bar{\imath q}_{it}) + \mu_2.\,.totaldebttoGDP_{i,t} \times \bar{\imath q}_{it}) + u_{i,t}, \quad (Equation\ 5)$$

where $\bar{\imath q}_{it}$ is an overall measure of governance indicators defined as the average of the six institutional quality measures discussed above. In this model, a rise of one unit in $fc\_debttoGDP_{i,t}$ ($totaldebttoGDP_{i,t}$) has a *partial* effect of $\delta_1 + \mu_1.\bar{\imath q}_{it}$ ($\delta_2 + \mu_2.\bar{\imath q}_{it}$). Two points are noteworthy about these partial effects. Firstly, each *EME* has a different partial effect of the foreign-currency and domestic-currency Sovereign debt to GDP due to their overall measure of institutional quality being different. Secondly, these partial effects are a combination of model parameters and institutional quality, resulting in determining whether they are significant or not impractical.[2] Consequently, it would be misleading to infer whether such partial effects are significant or not from the significance of estimated individual model parameters of δ_j and μ_j.

[2] The same point can be made about the partial effect of the overall measure of institutional quality given by $\beta + \mu_1.fc\_debttoGDP_{i,t} + \mu_2.\,.totaldebttoGDP_{i,t}$.

Table 2
Partial Effect of Currency Composition of Sovereign Debt in

Dependent Variable:			
Yield to Maturity			
	Model V		Model VI
		γ	0. 2209 *** (0.0315)
		θ	0. 6021 *** (0.0808)
γ	0.2549 *** (0.0240)	β_5	− 0. 0353 ** (0.0158)
θ	0.7856 *** (0.0979)	β_6	0. 0502 * (0.0262)
β	-0.0751 ** (0.0347)	δ_1	0. 0645 * (0.0325)
δ_1	0.1298 (0.1037)	δ_2	− 0. 0171 (0.0151)
δ_2	0.0129 (0.0294)	ρ_1	0. 04737 * (0.0228)
μ_1	-0.0004 (0.0020)	ρ_2	0. 07073 ** (0.0326)
μ_2	-0.0005 (0.0008)	ρ_3	− 0. 01595 * (0.0082)
Obs.	194	Obs.	194
R^2	0.72	R^2	0.78

Notes: The numbers report the OLS estimates. Numbers in parenthesis are the robust standard errors computed with the method in Arellano (1987).

* ,** ,*** indicate the estimates that are significant at the 1%, the 5%, and the 10% significance level, respectively. Parameters of models V and VI are reproduced below for the reader's convenience. In Model VI, only significant estimates of dimensions of institutional quality are reported for reasons of brevity.

Model V	Model IV
$ytm_{i,t} = \alpha_i + \gamma\,.residualmaturity_{it} + \theta\,.dt_{2009} + \beta.\bar{iq}_{it} + \delta_1\,.fc\_debttoGDP_{i,t} + \delta_2\,.totaldebttoGDP_{i,t} + \mu_1.(fc_{debttoGDP\,i,t} \times \bar{iq}_{it}) + \mu_2.\,.totaldebttoGDP_{i,t} \times \bar{iq}_{it}) + u_{i,t}$	$ytm_{i,t} = \alpha_i + \gamma\,.residualmaturity_{it} + \theta\,.c + \sum_{j=1}^{6} \beta_j\,.iq_{it}^{j} + \delta_1\,.fc\_debttoGDP_{i,t} + \delta_2\,.totaldebttoGDP_{i,t} + \rho_1.\pi_{it} + \rho_2.\text{net\_exports\_to\_GDP}_{it} + \rho_3.tot_{it} + u_{i,t}$

Table 2 reports the regression results of Model V. Two points can be noted. Firstly, as expected, an improvement in institutional quality lowers the adverse partial effect of both domestic- and foreign-currency debt to GDP since the estimates of μ_1 and μ_2 are both negative. Secondly, as is evident from this table, δ_j and μ_j are individually insignificant. However, the partial effect of a unit change in the foreign-currency (domestic-currency) to GDP is $\delta_1 + \mu_1.\bar{iq}_{it}$ $(\delta_2 + \mu_2.\bar{iq}_{it})$, the standard error of whose estimates depend on the covariance between δ_j and μ_j and differ among *EME*s due to the institutional quality being different. While this situation makes determining the significance of the partial effects in question impractical in Model V, an interesting observation is that the partial effect of the foreign-currency debt to GDP remains positive for all possible levels of $\bar{iq}_i$. Indeed, the partial effect noted above falls below zero only for $\bar{iq}_i$ greater than 324.5 (0.1298/0.0004), which is not possible since $\bar{iq}_i$ are percentile ranks of institutional quality that can be at most 100. In contrast, the partial adverse effect of a unit rise in the domestic-currency Sovereign debt to GDP, which is equal to that in the total Sovereign debt to GDP since the model controls for the foreign-currency Sovereign debt to GDP, vanishes for *EMEs* whose overall rank of institutional quality is above around 25.8 (0.0129/0.0005). Since all *EMEs* in our sample have a percentile rank of the overall measure of institutional quality greater than 25.8, Model V implies that evidence that a rise in the domestic-currency Sovereign debt to GDP affects yields of Sovereign bonds of *EMEs* adversely is weak. To sum up, the results from this section indicate that while an improvement in institutional quality mitigates the adverse effect of a rise in the foreign-currency Sovereign debt to GDP, it cannot eliminate the adverse effect entirely.

3.2. Partial effect of composition of sovereign debt to GDP when other domestic- and external-risk factors are added as controls

Hilscher and Nosbusch (2010) document that a worsening in the terms of trade, along with a rise in its volatility, leads to a significant increase on the yield spreads of *EME* Sovereign Eurobonds. In addition, Ahmed, Coulibaly, and Zlate (2017) emphasize the role of economic fundamentals such as inflation and the ratio of current account balance to GDP. Based on these previous studies, we next study the effect of a rise in the ratio of either domestic- or foreign-currency Sovereign debt to GDP on *EME* Sovereign yields when the annual inflation in the GDP deflator (π_{it}), the ratio of the net exports to GDP ($\text{net\_exports\_to\_GDP}_{it}$), and the net barter terms of trade (tot_{it}) are controlled for. The source of all these additional variables in our panel model is World Bank's *World Development Indicators*. With these additional variables, our panel model (Model VI) can be written as

$$ytm_{i,t} = \alpha_i + \gamma\,.residualmaturity_{it} + \theta\,.dt_{2009} + \sum_{j=1}^{6} \beta_j\,.iq_{it}^{j} + \delta_1\,.fc\_debttoGDP_{i,t} + \delta_2\,.totaldebttoGDP_{i,t} + \rho_1.\pi_{it} + \rho_2.\text{net\_exports\_to\_GDP}_{it} + \rho_3.tot_{it} + u_{i,t}. \quad (Equation\ 6)$$

Table 2 reports the results from Model VI. A few points are noteworthy about these results. Firstly, we only report the estimates of the coefficient of dimensions of institutional quality that are significant at 10% or lower significance levels. The results indicate that while an improvement in the rule of law results in a significant fall in the yields of *EME* Sovereign eurobonds ($\beta_5 < 0$), an improvement in the voice and accountability is associated with a weakly significant *increase* in these yields ($\beta_6 > 0$). This finding can be indicative of a situation that international investors are primarily concerned with the return on their financial investment in *EMEs*. To this end, they may be willing to lend *EME* Sovereigns on more favorable terms after an improvement in the rule of law. However, they are not so much concerned with the other dimensions of institutional quality including the voice-and-accountability dimension. Secondly, in conformity with the expectations, this model implies that while an increase in inflation is associated with a significant rise in the *EME* Sovereign yields ($\rho_1 > 0$), an improvement in the terms of trade leads to a fall in the *EME* Sovereign yields ($\rho_3 < 0$). Thirdly, a striking observation is that an increase in the net exports to GDP ratio is associated with significantly higher *EME* Sovereign yields ($\rho_2 > 0$). A possible explanation for this finding can be that

a rise in this ratio occurs possibly during periods of a contraction in GDP, which not only lowers the denominator term in the ratio but also increases the nominator term in the ratio by reducing imports due to the output contraction. By causing a rise in the net exports to GDP, a fall in the output could be a factor behind a rise in *EME* Sovereign yields. This interpretation is consistent with the emphasis in Clark and Kassimatis (2015) of the crucial role played by the expectation of international investors about future economic performance of *EME*s in explaining the movement in *EME* Sovereign spreads.

Lastly, it is notable that the ratio of the domestic-currency Sovereign debt to GDP does not affect the *EME* Sovereign yields significantly. In contrast, both the ratio of the foreign-currency Sovereign debt to GDP and the inflation raise the *EME* Sovereign yields significantly at the 10% significance level. One can argue that the results from Model VI offer yet another supportive evidence for our hypothesis that Türkiye's loose monetary policy, which most likely resulted in a rise both in the foreign-currency Sovereign debt to GDP and in the inflation, contributed to the rise in the cost of Turkish Sovereign's international borrowing.

To sum up, our findings lend support to the view that Türkiye witnessed a sharp increase in its borrowing cost on its Sovereign external debt since 2015 not only due to the deterioration in its institutional quality but also due to the rise in inflation and the difficulty of the Turkish government to borrow in the domestic currency.

4. Conclusion

This paper argues that unduly loose monetary policy in Türkiye recently before Turkish Presidential Election in 2023 resulted in high inflation unforeseen in the issue dates of Turkish Treasury bonds and bills in Turkish Lira, turning their ex-post real interest rate to negative. Turkish Treasury had difficulty in borrowing in Turkish Lira due to such negative ex-post real interest rates during the period, giving rise to a significant increase in the ratio of the foreign-currency-denominated Sovereign debt to GDP in Türkiye. Due to the high inflation and the rise in the ratio of foreign-currency Sovereign debt to GDP, the yield to maturity in Turkish Sovereign Eurobond increased significantly, an effect remaining significant even when we control for worsening institutional quality in Türkiye before the election.

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Özet

YPE'de hazine eurobondları faiz oranları ve döviz cinsinden hazine borcu

Bu çalışma, Yükselen Piyasa Ekonomileri (YPE) hazineleri tarafından ihraç edilen Eurobondların faiz oranlarını etkileyen etmenleri incelemektedir ve bu faiz oranlarının sadece devlet borcunun GSMH'ye oranına değil, devlet borcunun YPE'nin ulusal paraları cinsinden mi yoksa döviz cinsinden mi olduğuna da bağlı olduğunu vurgulamaktadır. Daha açık bir ifadeyle, YPE'nin ulusal para birimi cinsinden borçları GSMH'ye oranla arttığında bu ülkelerin hazine eurobond faiz oranları anlamlı bir şekilde değişmezken, YPE'nin döviz cinsinden borçları GSMH'ye oranla arttığında YPE hazine eurobond faiz oranları anlamlı bir şekilde yükselmektedir. Döviz cinsinden borçların bahsi geçen etkisi YPE'deki kurumsal gelişmişlik düzeyini kontrol etsek dahi anlamlı kalmaktadır.

Anahtar kelimeler: YPE hazine eurobondları faiz oranları, YPE hazine borçlanmasında döviz ve yerli paranın payları, kurumsal gelişmişlik, Türkiye'de para politikası.

JEL kodları: E02, E43, E58.