Sequential Path of Yield Curve Integration: Evidence from Korea and the U.S.

Ye Jin Heo

Using daily government bond yield data for the U.S. and Korea from 2000 to 2025, this study examines how yield synchronization evolved differently across the Korean yield curve. Synchronization is evaluated using rolling correlation, rolling covariance, and dynamic conditional correlation measures, distinguishing between long-run alignment in yield levels and short-run co-movement in yield changes. Across specifications, structural break tests show that synchronization generally emerged earlier in the 10-year maturity than in the 5-year maturity, indicating a maturity-dependent synchronization pattern. To explain these differences, we decompose Korean yield changes into global and domestic components using a seemingly unrelated regression framework. Although both maturities are significantly associated with U.S. interest rate and global risk factors, the 5-year yield exhibits a substantially stronger association with domestic yield dynamics than the 10-year yield. Results suggest that domestic yield dynamics remained more important in the medium-term segment of the Korean yield curve and were more strongly associated with the 5-year maturity than with the 10-year maturity. In addition, covariance-based measures identify a simultaneous surge in shared yield volatility across both maturities during the post-2022 global inflation and monetary tightening cycle.

Keywords: Bond yield , synchronization, financial integration, DCC

JEL Classification: F36, E43, G15

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I. Introduction

Government bond yields in open economies are increasingly influenced by global financial conditions, particularly those originating from major financial centers such as the U.S. As cross-border capital flows and global monetary spillovers intensify, understanding how sovereign yield curves synchronize across countries has become an important issue for international finance and monetary policy. However, synchronization may not emerge uniformly across the yield curve. Although long-term yields are often closely tied to global inflation expectations and term premium shocks, medium-term yields may remain more strongly influenced by domestic monetary policy conditions (Diebold, Li, and Yue 2008; Yun 2023).

Using daily government bond yield data for Korea and the U.S. between 2000 and 2025, this study examines how yield synchronization evolved across the Korean yield curve over time. Particularly, we investigate whether synchronization emerged differently across maturities and whether these differences are associated with varying exposures to global and domestic factors.

Our results indicate clear maturity-dependent synchronization patterns. Across multiple synchronization measures, the 10-year Korean yield generally exhibited earlier structural breaks than the 5-year yield, suggesting that synchronization emerged first at the long end of the curve. The seemingly unrelated regression (SUR) decomposition further shows that although both maturities are strongly associated with global interest rate factors and global risk conditions, the 5-year yield remained more strongly linked to domestic yield dynamics throughout much of the sample period. In addition, covariance measures identify a simultaneous surge in shared volatility across maturities during the post-2022 global inflation regime.

This paper is positioned within a robust body of literature exploring how financial center economies influence peripheral economies through evolving channels of bond market synchronization.

First, this study contributes to the literature on global yield synchronization and financial spillovers. Existing research suggests that global yield synchronization is a dynamic process driven by core–periphery linkages in which the U.S. Federal Reserve and the European Central Bank act as primary anchors for international interest rates. Integration is generally found to be stronger at the long end of the yield curve; long-term yields are highly sensitive to global factors and term premium shocks, whereas shorter maturities often retain greater domestic policy influence (Barbieri, Guerini, and Napoletano 2024; Kearns, Schrimpf, and Xia 2023; Obstfeld 2015). Furthermore, synchronization tends to intensify during episodes of global financial turbulence, such as the 2008 Global Financial Crisis and the post-COVID inflation regime (Aizenman, Chinn, and Ito 2016; Guerini, Luu, and Napoletano 2023).

Second, this paper contributes to the literature on methodologies for measuring synchronization. Simple cross-country correlations are often criticized as incomplete measures of integration because markets may respond differently to multiple global shocks (Pukthuanthong and Roll 2009). Therefore, recent studies have employed dynamic and multidimensional frameworks to distinguish genuine synchronization from spurious co-movements. For example, Barbieri, Guerini, and Napoletano (2024) and Guerini, Luu, and Napoletano (2023) combined principal component analysis with random matrix theory to identify common synchronization factors, whereas dynamic conditional correlation (DCC) models facilitate the estimation of time-varying correlations that adjust to high-frequency market information (Engle 2002). Other approaches utilize hierarchical dynamic models based on the Nelson–Siegel framework to track global influences across different segments of the yield curve (Diebold, Li, and Yue 2008).

Finally, this study relates to the literature on the Korean sovereign yield curve. Korea represents an important case of an open emerging economy deeply integrated with the U.S. financial system. Korean sovereign yields have been shown to respond strongly to U.S. monetary policy surprises (Gilchrist, Yue, and Zakrajsek 2019), and U.S. yield factors significantly influence fluctuations in the Korean sovereign term structure, with the degree of synchronization differing across maturities (Yun 2023). Korea's gradual capital account liberalization over the sample period provides an important institutional backdrop for understanding these dynamics.[1]

Although existing studies have documented that U.S. yield factors influence Korean sovereign yields and that their effects may differ

[1] Key milestones include the abolition of withholding tax on foreign holdings of Korean Treasury bonds in 2011 and Korea's inclusion in the FTSE World Government Bond Index (WGBI) in 2022.

across maturities (Yun 2023), these analyses have primarily focused on average transmission from global factors to the Korean term structure. Less is known about how Korea–U.S. yield synchronization evolves across maturities, regimes, and different co-movement dimensions. This paper addresses this gap by examining maturity-dependent synchronization patterns and by linking them to the relative importance of global and domestic yield factors.

First, whereas Yun (2023) documented maturity-differentiated factor sensitivity in a full-sample framework, we provide systematic evidence that this heterogeneity has a temporal dimension: the 10-year maturity generally exhibited stronger synchronization with U.S. yields earlier than the 5-year maturity, although the pattern varies across synchronization measures and dimensions.

Second, we employ a multidimensional synchronization framework in which the DCC-generalized autoregressive conditional heteroskedasticity (GARCH) model serves as the primary measure of time-varying co-movement in daily yield innovations, complemented by rolling correlation and covariance measures that capture medium- to long-run co-movement in yield levels. By comparing results across these specifications and maturities, we show that synchronization patterns differ substantially depending on whether the focus is on co-movement in yield levels or co-movement in yield changes— a distinction that single-measure approaches cannot reveal.

Third, we link the observed maturity differences in synchronization timing to differences in the underlying global and domestic components. Using an SUR framework, we decompose daily yield changes into global components—the U.S. term premium, an expected-rate component, and risk sentiment—and an orthogonalized domestic factor. Results show that the 5-year maturity exhibits significantly stronger sensitivity to domestic yield dynamics than the 10-year maturity under alternative domestic-factor specifications. This finding suggests that differences in domestic-yield sensitivity constitute an important source of maturity heterogeneity in Korea–U.S. yield synchronization.

Fourth, by extending the sample period through the post-COVID global inflation regime, the paper documents a substantial increase in synchronization across maturities during the post-2022 global tightening cycle. Results suggest that global inflation and monetary tightening shocks strengthened common yield dynamics across the Korean sovereign yield curve.

The remainder of this paper is organized as follows. Section 2 describes the data. Section 3 discusses the econometric methods, and Section 4 presents the empirical results and robustness analyses. Section 5 concludes the paper.

II. Data

The raw data consists of daily government bond yields from the U.S. and Korea at the 3-, 5-, and 10-year maturities. For robustness purposes, we additionally employ the Korean 1-year Monetary Stabilization Bond (MSB) yield and the corresponding U.S. 1-year Treasury yield.[2] For the U.S., Treasury yield series are obtained from the Federal Reserve Economic Data (FRED) database, whereas Korean government bond yields are collected from the Bank of Korea's ECOS system. In this study, the 3-year yield primarily represents the policy-sensitive intermediate maturity, whereas the 5- and 10-year yields represent medium- and long-term bond yields, respectively.

In addition to raw Treasury yields, we employ the Adrian–Crump–Moench (ACM) term premium decomposition for the 1-, 3-, 5-, and 10-year U.S. Treasury maturities, obtained from the FRED database, as a measure of compensation for interest rate risk embedded in U.S. government bond yields.

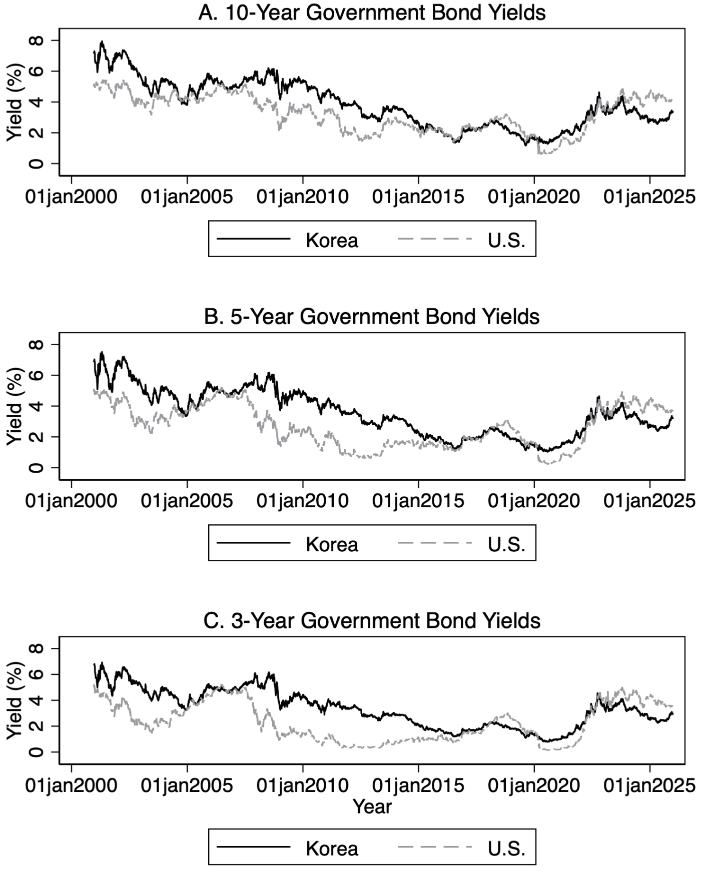
Since the 10-year government bond yield for Korea is only available from December 18, 2000, observations prior to that date were excluded. In addition, observations corresponding to nonmatching trading dates arising from differences in holiday systems between Korea and the U.S. were removed. The resulting raw yield sample period spans from December 18, 2000 to December 31, 2025, yielding a total of 5,975 daily observations.

Figure 1 visually illustrates the daily government bond yield graphs for the 10- (A), 5- (B), and 3-year (C) maturities of each country. The solid line represents Korea, and the dashed line represents the U.S. Korea's yield was consistently higher than that of the U.S. until 2015. However, after that point, the positions of the yields switched slightly,

[2] The Korean 1-year MSB yield is used because the daily 1-year Korean government bond yield is not consistently available over the full sample period. The MSB yield provides a more continuous short-maturity Korean yield series for the robustness exercise.

and since approximately 2022, the positions have completely reversed, such that the U.S. yield is now higher than the Korean yield across most maturities.

However, the 25 years of daily yields shown in Figure 1 tend to obscure the independence of each series, making the movements between the two countries appear very similar. Technically, if two



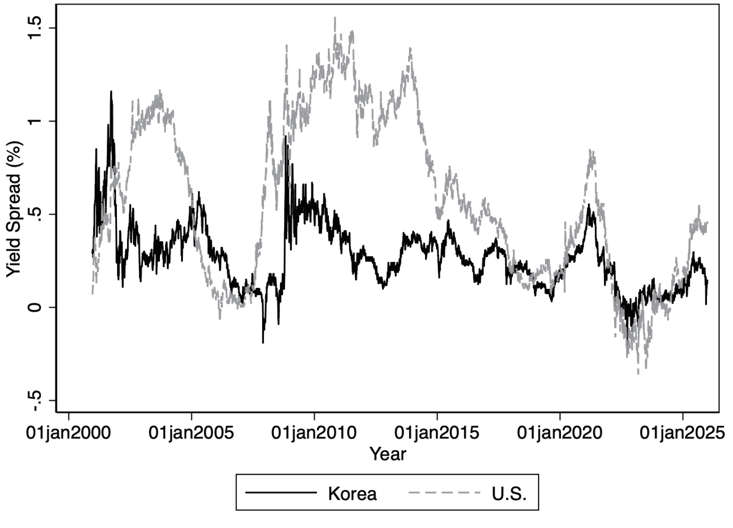
Notes: The solid line represents Korea, and the dashed line represents the U.S. Panels A, B, and C report daily 10-, 5-, and 3-year government bond yields, respectively. The sample period is December 2000 to December 2025.

FIGURE 1
DAILY GOVERNMENT BOND YIELDS: KOREA AND THE U.S.

series change at the same speed and in the same direction, the gap between them—the term spread—should remain relatively stable across countries. If medium- and long-term yields were closely integrated, then the movements in their term spreads would also exhibit similar dynamics.

Therefore, in Figure 2, we plot the term spreads calculated from the raw 10Y and 5Y yields. Different from Figure 1, where all series appear to move in the same direction and at the same speed, the term spread reveals that their trajectories diverge substantially for most of the sample period, with meaningful convergence emerging most prominently around 2022. Although the term spreads of the two countries overlapped temporarily in the past, they soon moved in opposite directions.

To examine the time-series properties of the yield data, we perform augmented Dickey–Fuller (ADF) unit root tests on the Korean and U.S. yield series. The results of the ADF tests are presented in Table A1 in the Appendix. Following standard practice for daily financial data, we



Notes: The solid line represents Korea, and the dashed line represents the U.S. The figure reports daily 10Y–5Y government bond yield spreads from December 2000 to December 2025.

FIGURE 2
EVOLUTION OF THE 10Y–5Y TERM SPREAD

include a maximum of 20 lags in the test specification to account for high persistence and potential seasonality (Schwert 1989). The test results show that the Korean and U.S. yield series are nonstationary in levels, whereas their first differences are stationary at the 1% level. This confirms that the yield series are integrated of order one, $I(1)$. Accordingly, the empirical analysis distinguishes between level-based measures, which capture long-run alignment in yield levels, and difference-based measures, which capture synchronization in yield changes.

Table 1 reports summary statistics for Korean and U.S. government bond yields, U.S. term premium measures, and their first differences. Panel A shows that Korean yields are generally higher than U.S. yields across the 3-, 5-, and 10-year maturities, consistent with the view that emerging markets tend to exhibit higher sovereign yields than advanced economies (Arellano 2008). The ACM term premium measures are positive on average across all maturities, indicating persistent compensation for interest rate risk in U.S. Treasury markets.

Table 1
Summary Statistics of Raw Variables and Changes

Variable	Obs.	Mean	SD	Min	Max
Panel A. Levels (%)					
Korea 10Y Yield	5,975	3.827	1.545	1.172	7.950
Korea 5Y Yield	5,975	3.556	1.498	1.031	7.520
Korea 3Y Yield	5,975	3.330	1.443	0.795	6.930
U.S. 10Y Yield	5,975	3.215	1.198	0.520	5.540
U.S. 5Y Yield	5,975	2.639	1.349	0.190	5.230
U.S. 3Y Yield	5,975	2.275	1.500	0.100	5.260
U.S. 10Y Term Premium	5,975	1.130	0.944	−0.795	3.495
U.S. 5Y Term Premium	5,975	0.786	0.768	−0.775	2.605
U.S. 3Y Term Premium	5,975	0.521	0.597	−0.695	1.935
Panel B. First Differences (basis points)					
Korea 10Y Yield Change	5,974	−0.064	4.998	−45.000	44.000
Korea 5Y Yield Change	5,974	−0.059	5.509	−40.000	46.000
Korea 3Y Yield Change	5,974	−0.061	5.195	−35.000	51.000
U.S. 10Y Yield Change	5,974	−0.015	5.955	−51.000	29.000

Variable	Obs.	Mean	SD	Min	Max
U.S. 5Y Yield Change	5,974	−0.019	6.224	−46.000	34.000
U.S. 3Y Yield Change	5,974	−0.024	5.907	−43.000	37.000
U.S. 10Y Term Premium Change	5,974	−0.002	2.459	−18.600	13.160
U.S. 5Y Term Premium Change	5,974	−0.001	2.124	−14.920	11.560
U.S. 3Y Term Premium Change	5,974	−0.001	1.819	−12.290	9.880
Change in log VIX	5,974	−0.000	0.074	−0.442	0.768

Notes: Panel A reports raw variables in percent. Panel B reports first-differenced variables in basis points. The sample covers daily observations from December 2000 to December 2025.

Panel B reports daily changes in yields and term premium measures. The first-differenced variables exhibit means close to zero and substantial daily variation across all series.

III. Empirical Methodology

A. Yield Synchronization

To capture different dimensions of Korea–U.S. bond market integration, this study employs multiple synchronization measures. Rolling correlation measures the directional co-movement of yields, whereas rolling covariance captures the magnitude of shared volatility. In addition, the DCC model identifies time-varying synchronization in yield innovations. Together, these measures provide complementary perspectives on the evolution of yield synchronization across maturities and over time.

To account for time zone differences between the Korean and U.S. financial markets, synchronization is measured between Korean yields and one-trading-day-lagged U.S. yields. This lag structure reflects the fact that U.S. Treasury market information becomes available to Korean markets with a delay due to nonoverlapping trading hours.

a) Rolling Correlation

The first synchronization measure we employ is the rolling correlation of Korean and U.S. government bond yields. Rolling correlation is computed using yield levels and first-differenced yields to capture different dimensions of bond market integration. Correlation in levels reflects long-run co-movement in interest rate cycles, whereas correlation in first differences captures synchronization in daily yield changes and short-run market movements.

The rolling correlation is defined as:

$$\rho_{Roll,t} = \frac{Cov\left(y_{KR}, y_{US}\right)_w}{\sigma_{KR,w}\sigma_{US,w}},$$

where w denotes the rolling window length. As a baseline, we use a window of w = 1,250 days (approximately 5 years), following standard approaches in financial studies using daily data (Pukthuanthong and Roll 2009; Fama and French 1992). To facilitate structural break analysis and improve the statistical properties of the correlation series, the rolling correlation is Fisher z-transformed.

b) Rolling Covariance

The second synchronization measure we employ is the rolling covariance between Korean and U.S. government bond yields. Similar to rolling correlation, covariance is computed using yield levels and first-differenced yields to capture different aspects of yield synchronization. Covariance in levels reflects long-run co-movement in the absolute magnitude of yields, whereas covariance in first differences captures shared volatility in daily yield movements.

The rolling covariance is defined as

$$Cov_{w,t} = E\left[\left(y_{KR,t} - \mu_{KR,w}\right)\left(y_{US,t} - \mu_{US,w}\right)\right],$$

where w denotes the rolling window length. Unlike correlation, which only measures the directional co-movement between two series, covariance also reflects the magnitude of joint yield fluctuations. As a result, covariance captures not only whether yields move together but also how strongly they move together.

c) *DCC-GARCH*

The final synchronization measure we employ is the DCC model proposed by Engle (2002). While rolling correlation and covariance summarize co-movement within a fixed rolling window, the DCC model directly estimates the time-varying correlation of yield shocks. This allows us to capture dynamic synchronization in daily bond market innovations and identify periods in which the correlation structure changes more rapidly over time.

In the DCC-GARCH model, the daily change in yields is modeled as follows:

$$\Delta y_t = \mu_t + \varepsilon_t, \qquad \varepsilon_t \mid \Omega_{t-1} \sim N\left(0, H_t\right),$$

$$H_t = D_t R_t D_t,$$

where μ_t is the conditional mean vector, which we specify as a first-order autoregressive process, $AR(1)$, to account for serial correlation in daily bond yields. As a baseline specification, the innovations are assumed to follow a conditional Gaussian distribution. ε_t is the vector of residuals (shocks), assumed to have a mean of zero and a time-varying covariance matrix H_t; and Ω_{t-1} is the information set available at time $t - 1$. The covariance matrix H_t is decomposed into a diagonal matrix of conditional standard deviations (D_t) and a time-varying correlation matrix (R_t). This structure allows us to isolate the dynamic correlation of shocks from individual market volatility.

Since GARCH models are designed to capture the persistence of volatility shocks, using daily yield levels, which are highly persistent and exhibit trends, would result in poorly defined innovations. Therefore, by using first-differenced yields, the model effectively captures the synchronization of daily shocks rather than the long-term drift of interest rates.

Based on the methods described above, we compute three synchronization measures for Korean and U.S. government bond yields: rolling correlation, rolling covariance, and DCC-GARCH. Rolling correlation measures the directional co-movement of yields, rolling covariance captures the magnitude of joint yield fluctuations, and DCC-GARCH identifies time-varying synchronization in daily yield innovations. By combining these measures, the analysis can distinguish long-run alignment in yield levels from short-run synchronization in yield changes.

The computed synchronization measures are subsequently collapsed into monthly means to minimize the noise inherent in daily data. By utilizing monthly averages of daily synchronization measures, we effectively reduce high-frequency idiosyncratic noise and the persistence

Table 2

Summary Statistics and Correlation Matrix of Synchronization Measures

	Summary Statistics		Correlation Matrix		
Variable	Mean	SD	(1)	(2)	(3)
Panel A. Level-Based Measures: 10-Year Yield					
(1) Correlation	0.833	0.435	1.000		
(2) Covariance	0.328	0.297	0.835	1.000	
Panel B. Level-Based Measures: 5-Year Yield					
(1) Correlation	0.719	0.600	1.000		
(2) Covariance	0.376	0.418	0.830	1.000	
Panel C. Difference-Based Measures: 10-Year Yield					
(1) Correlation	0.293	0.072	1.000		
(2) Covariance	7.406	2.161	0.014	1.000	
(3) DCC	0.311	0.081	0.496	0.191	1.000
Panel D. Difference-Based Measures: 5-Year Yield					
(1) Correlation	0.275	0.072	1.000		
(2) Covariance	7.652	3.227	0.087	1.000	
(3) DCC	0.287	0.084	0.461	0.127	1.000

Notes: Correlation measures are Fisher z-transformed. Rolling measures use a 1,250-day window. DCC refers to the Gaussian DCC-GARCH baseline specification. The monthly mean of daily synchronization measures is used. Total observations: 250.

caused by rolling windows, while retaining the granular information observed in the daily data (Diebold and Yilmaz 2012).

Table 2 presents the summary statistics and correlation matrices for the monthly means of the synchronization measures by maturity and specification. Panels A and B report level-based measures, whereas Panels C and D report difference-based measures.

The results show that synchronization patterns differ substantially depending on the measure employed. In the level-based specifications, rolling correlation and covariance are relatively high for the 10- and 5-year maturities, providing descriptive evidence of medium- to long-run co-movement between Korean and U.S. bond yields. In the difference-based specifications, however, the synchronization measures exhibit lower average values and greater variation over time, reflecting the more volatile nature of daily yield changes.

The correlation matrices confirm that the synchronization measures capture distinct aspects of bond market integration. Correlation and covariance are highly correlated in the level-based specifications, whereas the relationship becomes substantially weaker in the difference-based specifications. Particularly, covariance exhibits relatively low correlations with rolling correlation and DCC, suggesting that shared volatility intensity and directional co-movement represent different dimensions of synchronization. The moderate correlation between DCC and rolling correlation further indicates that dynamic shock synchronization is related to, but distinct from, broader co-movement measured over rolling windows.

B. Structural Break

Using the synchronization measures computed above, we conduct structural break tests to identify the timing of regime shifts in Korea–U.S. yield synchronization. Since each synchronization measure constitutes a single bilateral time series rather than a panel, we employ the single unknown break date framework of Andrews (1993), which is the appropriate choice for this setting. For each synchronization measure, we specify a model of the following form:

$$S_t = \delta_j + \varepsilon_t, \qquad t = T_{j-1} + 1, \ldots, T_j,$$

where $j \in \{1, 2\}$ denotes the regimes before and after a potential break. The test searches for a break date T_b that maximizes the difference between the regime means, δ_1 and δ_2. To determine the statistical significance of a break, we calculate the supremum Wald statistic, which identifies the point of maximum structural change within the sample.

The structural break tests are applied separately to level- and difference-based synchronization measures. This dual approach allows us to identify whether structural changes in long-run yield alignment and short-run shock co-movement occurred at different points in time. Following the literature, the sample period is trimmed to ensure the robustness of the test. The trimming parameter is set to 15% of the total sample size, which ensures that parameters δ_1 and δ_2 can be estimated consistently within each subperiod by maintaining a sufficient number of observations. By applying this test across multiple synchronization measures, we identify statistically significant shifts in Korea–U.S. yield synchronization across maturities and specifications.

C. Empirical Framework for Global and Domestic Factors

To better understand the sources of the maturity-dependent synchronization patterns identified above, we further examine the extent to which Korean bond yields are driven by global financial factors versus domestic influences. Particularly, we investigate whether differences in exposure to global and domestic factors can help explain why synchronization emerges at different times across maturities.

To do so, Korean yield changes are decomposed into global and domestic components using an SUR framework. The analysis focuses on daily changes in Korean 10- and 5-year government bond yields. The SUR framework allows the two maturity equations to be estimated jointly while accounting for contemporaneous correlation across error terms. It also enables formal cross-equation Wald tests of whether coefficient estimates differ across the two maturity equations.

We estimate the following SUR specification:

$$\Delta KR_{m,t} = \alpha_m + \beta_{1,m}\Delta TP_{m,t-1} + \beta_{2,m}\Delta ERC_{m,t-1} + \beta_{3,m}\Delta \ln\left(VIX\right)_{t-1} \\ + \beta_{4,m} Domestic_t + \varepsilon_{m,t},$$

where $m \in \{5Y, 10Y\}$ denotes bond maturity. The dependent variable $\Delta KR_{m,t}$ represents the daily change in the Korean government bond yield of maturity m, measured in basis points. The global component consists of the lagged change in the U.S. ACM term premium ($\Delta TP_{m,t-1}$), the lagged change in the expected-rate component ($\Delta ERC_{m,t-1}$), and the lagged change in global risk sentiment proxied by $\Delta\ln(VIX)_{t-1}$. All U.S. variables are lagged by one trading day to account for time zone differences between U.S. and Korean financial markets.

The expected-rate component is defined as:

$$ERC_{m,t} = US_{m,t} - TP_{m,t},$$

where $US_{m,t}$ denotes the U.S. Treasury yield of maturity m, and $TP_{m,t}$ denotes the corresponding ACM term premium component. The expected-rate component therefore captures the portion of Treasury yields associated with expectations regarding the future path of short-term policy rates after removing the term premium component.

To isolate domestic influences, we construct a domestic factor using the Korean 3-year government bond yield. The 3-year yield is used as a benchmark domestic yield because it is closely linked to Korea-specific yield dynamics and occupies an intermediate position on the Korean sovereign yield curve. Rather than including it as an additional synchronization measure, we incorporate it as a domestic factor by extracting the component of KR 3Y yield changes orthogonal to U.S. factors (TP and ERC). The resulting residual captures domestic yield movements not explained by global rate channels, including domestic monetary policy expectations, local liquidity conditions, fiscal factors, and Korea-specific bond market dynamics.

Specifically, the following auxiliary regression is estimated:

$$\Delta KR_{3,t} = \gamma_0 + \gamma_1 \Delta TP_{3,t-1} + \gamma_2 \Delta ERC_{3,t-1} + u_t.$$

The residual term from this regression is defined as the domestic factor:

$$Domestic_t \equiv u_t.$$

As a robustness check, the domestic factor is alternatively constructed using the Korean 1-year MSB yield and the corresponding U.S. 1-year ACM decomposition. This alternative specification allows us to assess whether the results depend on the use of the 3-year benchmark yield.

Particularly, we test whether the sensitivity to the domestic factor differs statistically across maturities using a cross-equation Wald test:

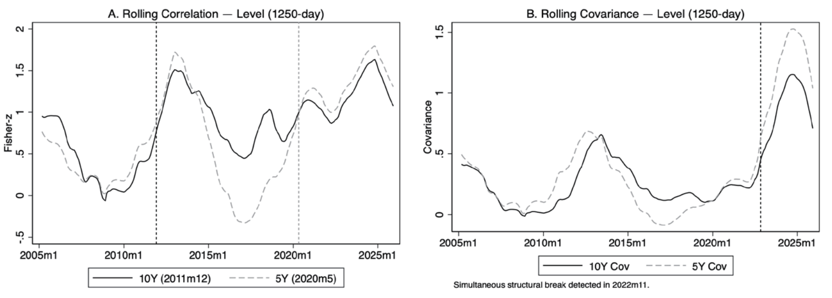
$$H_0 : \beta_{4,10Y} = \beta_{4,5Y}.$$

IV. Results

A. Synchronization Dynamics and Structural Breaks

a) Level-Based Synchronization

Figure 3 presents the level-based synchronization measures for Korean and U.S. government bond yields at the 10- and 5-year



Notes: Panel A: Rolling Correlation. Panel B: Rolling Covariance. All measures are computed from yield levels using a 1,250-day rolling window. Fisher z-transformation is applied to rolling correlation. Dashed vertical lines indicate structural break dates identified by the supremum Wald test: black for the 10-year maturity and gray for the 5-year maturity. Covariance shows a simultaneous break for both maturities in 2022m11. Sample: 2005m3–2025m12.

Figure 3

Level-Based Synchronization Measures: Rolling Correlation and Covariance

maturities. The structural break tests confirm that regime shifts occurred across both measures, though the timing differs substantially depending on the dimension of synchronization examined.

The break dates for the rolling correlation measure indicate that synchronization in the 10-year yield emerged substantially earlier than in the 5-year yield, suggesting a sequential integration process across maturities. By contrast, the rolling covariance measure identifies a simultaneous structural break for both maturities in 2022. Figure 3 illustrates the monthly averages of the daily synchronization measures and their associated structural break dates.

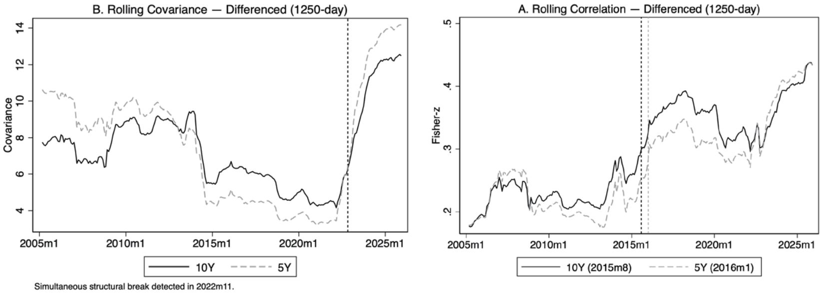
Rolling correlation (Figure 3A) shows that the 10-year Korean yield became increasingly aligned with the U.S. yield beginning in the early 2010s, whereas the 5-year yield remained substantially less synchronized until after 2020. Particularly, the 5-year rolling correlation declined sharply and even turned negative during parts of the mid-2010s, indicating a period in which medium-term Korean yields moved independently of U.S. Treasury trends.

Rolling covariance (Figure 3B) provides a different perspective by focusing on the magnitude of shared yield movements rather than their directional alignment. Although the covariance series remained relatively stable for much of the sample period, both maturities experienced a sharp and simultaneous increase beginning around 2022. This pattern suggests that although earlier increases in level-based synchronization were more apparent at the long end of the curve, the absolute intensity of shared yield fluctuations surged across the entire Korean yield curve during the recent global inflation and tightening cycle.

b) Difference-Based Synchronization

The difference-based synchronization measures provide a complementary perspective by focusing on co-movement in daily yield changes rather than yield levels. Compared to the level-based measures, the difference-based rolling correlation and covariance exhibit substantially smaller break-time gaps between the 10- and 5-year maturities, suggesting that synchronization in short-run yield innovations emerged more closely across the yield curve.

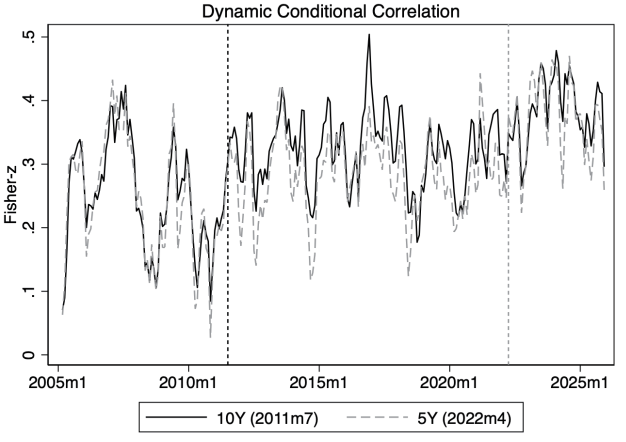
Rolling correlation (Figure 4A) shows that synchronization in daily yield changes increased steadily over time for both maturities.



Notes: All rolling measures are computed from first-differenced yields using a 1,250-day rolling window. Fisher z-transformation is applied to rolling correlation. Dashed vertical lines indicate structural break dates identified by the supremum Wald test: black for the 10-year maturity and gray for the 5-year maturity. Covariance shows a simultaneous break for both maturities in 2022m11. Sample: 2005m3–2025m12.

FIGURE 4

DIFFERENCE-BASED SYNCHRONIZATION MEASURES: ROLLING CORRELATION AND COVARIANCE



Notes: The DCC model is estimated from first-differenced yields using a Gaussian distribution as the baseline specification. Fisher z-transformation is applied to the estimated dynamic correlations. Dashed vertical lines indicate structural break dates identified by the supremum Wald test: black for the 10-year maturity (2011m7) and gray for the 5-year maturity (2022m4). Sample: 2005m3–2025m12.

Figure 5
DCC

Unlike the level-based specification, the 5-year series does not exhibit prolonged periods of negative synchronization, and the break dates for the 10- and 5-year maturities occur within only a few months of each other. This pattern suggests that short-run informational co-movement across maturities evolved more uniformly than long-run synchronization in yield levels.

Rolling covariance (Figure 4B) similarly indicates a sharp increase in shared volatility beginning around 2022. As in the level specification, the covariance measure identifies a simultaneous structural break for both maturities, implying that the recent surge in common yield volatility occurred across the entire Korean yield curve rather than being concentrated at a specific maturity.

Figure 5 reports the DCC estimates based on first-differenced yields. The DCC series shows that synchronization in daily yield innovations increased over time for both maturities, although the trajectories remain highly time-varying throughout the sample. The 10-year maturity exhibits an earlier structural break in 2011, whereas the 5-year maturity experiences a substantially later break in 2022. Despite these differences in timing, both maturities display elevated levels of dynamic synchronization during the post-2020 period, suggesting stronger transmission of global yield shocks across the Korean bond market.

To further assess whether the increase in synchronization reflects stronger co-movement rather than changes in relative volatility, Appendix Figure A1 reports the rolling volatility ratio between Korean and U.S. yields. The volatility ratio remains relatively stable throughout the sample and does not exhibit structural changes comparable to those observed in rolling correlation and DCC measures. This stability suggests that the rise in synchronization is primarily associated with stronger co-movement in yield changes rather than shifts in the relative volatility of the two bond markets.

c) Structural Break Comparison

Table 3 summarizes the structural break dates and the associated

Table 3

Structural Break Comparison across Synchronization Measures

Measure	Maturity	Break Date	Δ(Post–Pre)
Panel A. Level-Based Measures			
Correlation	10Y	2011m12	+0.636***
	5Y	2020m5	+0.869***
Covariance	10Y	2022m11	+0.664***
	5Y	2022m11	+0.993***
Panel B. Difference-Based Measures			
Correlation	10Y	2015m8	+0.129***
	5Y	2016m1	+0.120***
Covariance	10Y	2022m11	+3.937***
	5Y	2022m11	+5.293***
DCC	10Y	2011m7	+0.090***
	5Y	2022m4	+0.102***

Notes: All rolling measures use a 1,250-day rolling window. Δ indicates the change between post- and pre-break means, where significance is based on two-sample t-tests. DCC refers to the Gaussian DCC-GARCH baseline specification. All structural breaks are significant at the 1% level according to the supremum Wald test (Andrews 1993). *** $p < 0.01$.

changes in synchronization measures before and after each break. All structural breaks are statistically significant at the 1% level according to the supremum Wald test and the corresponding pre- versus post-break mean comparisons.

The level-based measures suggest different timing patterns across maturities. Particularly, the rolling correlation measure identifies an earlier structural break for the 10-year yield than for the 5-year yield. Conversely, the covariance measure identifies simultaneous breaks for both maturities.

The difference-based measures exhibit a narrower gap in break timing between maturities. Rolling correlation and DCC indicate earlier synchronization in the 10-year maturity, although the difference is substantially smaller than in the level-based specification. As in the level-based measures, covariance again identifies simultaneous structural breaks across maturities.

Across all measures, the post-break means are significantly larger than the pre-break means, indicating stronger Korea–U.S. bond market synchronization following the identified regime shifts. Although the exact break dates vary across alternative rolling-window specifications, the broader synchronization patterns remain qualitatively similar. Particularly, the alternative-window results continue to indicate earlier synchronization in the 10-year maturity than in the 5-year maturity, whereas covariance measures consistently identify a simultaneous increase in shared volatility across maturities. These results are reported in Appendix Table A2.

B. Global and Domestic Drivers of Yield Synchronization

Although the structural break results reveal clear differences in synchronization timing across maturities, they do not directly explain the underlying economic forces driving this maturity-dependent synchronization pattern. To investigate the sources of these differences, we next examine the relative importance of global and domestic factors using the SUR framework.

Table 4 reports the SUR estimates for the Korean 10- and 5-year government bond yields. Across both maturities, the U.S. term premium, expected-rate component, and VIX all exhibit positive and statistically significant effects, indicating that Korean bond yields are closely associated with global interest rate conditions and global risk

TABLE 4
GLOBAL AND DOMESTIC CHANNEL DECOMPOSITION

	KR 3Y Residual		KR 1Y Residual	
	KR 10Y	KR 5Y	KR 10Y	KR 5Y
U.S. Term Premium	0.468***	0.554***	0.468***	0.552***
	(0.020)	(0.018)	(0.024)	(0.029)
Cross-Equation test	$\chi^2(1)$ = 20.87***		$\chi^2(1)$ = 16.12***	
U.S. Expected-Rate Component	0.073***	0.072***	0.072***	0.072***
	(0.012)	(0.008)	(0.013)	(0.012)
Cross-Equation test	$\chi^2(1)$ = 0.00		$\chi^2(1)$ = 0.00	
VIX	1.097***	1.085***	1.782***	1.902***
	(0.426)	(0.339)	(0.601)	(0.622)
Cross-Equation test	$\chi^2(1)$ = 0.00		$\chi^2(1)$ = 0.12	
Domestic Component	0.832***	0.990***	1.022***	1.196***
	(0.006)	(0.005)	(0.013)	(0.013)
Cross-Equation test	$\chi^2(1)$ = 1133.49***		$\chi^2(1)$ = 572.99***	
Constant	–0.065**	–0.059**	–0.065	–0.059
	(0.031)	(0.024)	(0.043)	(0.045)
Observations	5,954	5,954	5,954	5,954

Notes: Dependent variables are daily changes in Korean yields (basis points). Global factors are maturity-matched U.S. ACM term premium (TP), expected-rate component (ERC = yield − TP), and log-differenced VIX. Columns (1) and (2) construct the domestic factor as the residual from regressing ΔKR3Y on U.S. TP3Y and ERC3Y, respectively. Columns (3) and(4) use the residual from ΔKR1Y on U.S. TP1Y and ERC1Y, respectively. All domestic factors are orthogonal to U.S. rate factors by construction. All U.S. variables are lagged one trading day. Cross-equation tests evaluate equality of coefficients across maturities. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$.

sentiment.

Among the U.S. interest rate components, the term premium shows the largest and most economically significant effect. The estimated coefficients imply that increases in U.S. term premium shocks are transmitted strongly to Korean yields at both maturities. Moreover, the cross-equation tests reject equality of coefficients across maturities under both domestic-factor specifications, indicating that the 5-year

Korean yield responds more strongly to U.S. term premium shocks than the 10-year yield. By contrast, the expected-rate component and VIX exhibit nearly identical coefficients across maturities, and the corresponding cross-equation tests fail to reject equality.

The domestic component is also positive and highly significant across all specifications. Importantly, the coefficient is consistently larger for the 5-year yield than for the 10-year yield under the 3- and 1-year domestic-factor constructions. The corresponding cross-equation statistics are substantially larger than those associated with the U.S. term premium component under both domestic-factor specifications, indicating that differences in domestic-yield sensitivity constitute the dominant source of maturity heterogeneity in the Korean yield curve.

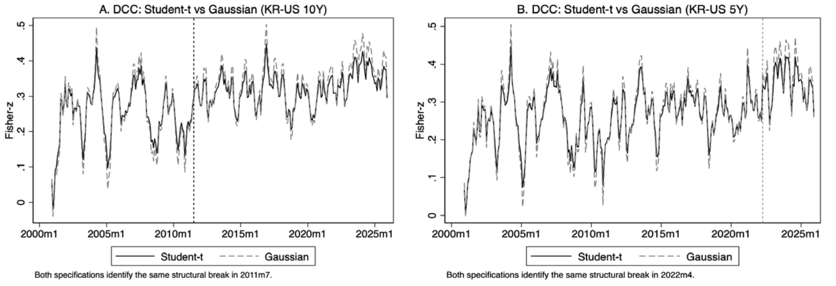
Taken together, the results suggest that both maturities are strongly associated with global interest rate factors and global risk conditions. At the same time, however, the domestic component displays substantially greater cross-maturity variation than any of the global factors. This pattern remains robust when the domestic factor is alternatively constructed using the Korean 1-year yield. The evidence therefore suggests that maturity-dependent synchronization is primarily associated with differences in domestic-yield sensitivity rather than differences in exposure to global policy-rate expectations or global risk sentiment.

C. Robustness

a) DCC: Student's t-Distribution Robustness

Because daily bond–yield changes may exhibit excess kurtosis and fat-tailed innovations, the Gaussian assumption in the baseline DCC specification may underestimate extreme co-movements during periods of market stress. To assess whether the results are sensitive to this distributional assumption, we re-estimate the DCC model using a Student's t-distribution and compare it with the Gaussian baseline.

Figure 6 shows that the two specifications generate highly similar DCC dynamics for both maturities. Importantly, the identified structural break dates remain unchanged, indicating that the main DCC results are robust to allowing for fat-tailed innovations.



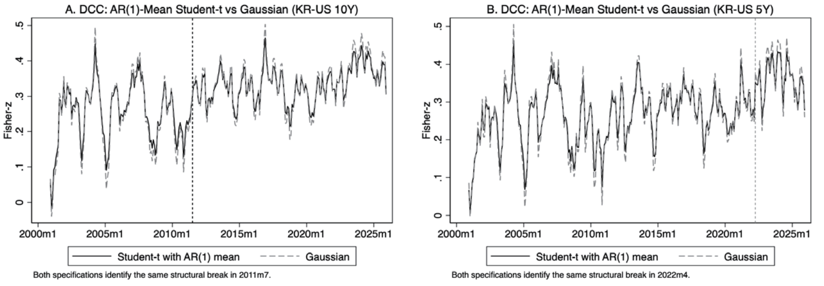
Notes: Panels A and B compare DCC estimates under the Gaussian baseline and the student's t-specification for the 10- and 5-year maturities, respectively. Fisher z-transformation is applied to all DCC correlations. Dashed vertical lines indicate structural break dates identified by the supremum Wald test. Both specifications identify the same break dates: 2011m7 for the 10-year maturity and 2022m4 for the 5-year maturity. Sample: 2005m3–2025m12.

Figure 6
Distributional Robustness of DCC

B. DCC: AR(1)-Mean Robustness

Daily bond yields may also exhibit serial correlation in their conditional mean dynamics. Therefore, we further re-estimate the DCC model using an *AR*(1)-mean Student's *t*-specification. Figure 7 shows that incorporating autoregressive mean dynamics produces DCC estimates that are highly similar to those obtained under the Gaussian baseline.

The identified structural break dates also remain unchanged across specifications, indicating that the main DCC results are robust to alternative assumptions regarding the conditional distribution and the conditional mean process. Overall, the synchronization dynamics and structural break timing remain highly consistent across all three specifications, indicating that the main DCC results are not sensitive to assumptions regarding the conditional distribution or the mean process.



Notes: Panels A and B compare DCC estimates under the Gaussian baseline and the AR(1)-mean Student's t-specification for the 10- and 5-year maturities, respectively. Fisher z-transformation is applied to all DCC correlations. Dashed vertical lines indicate structural break dates identified by the supremum Wald test. Both specifications identify the same break dates: 2011m7 for the 10-year maturity and 2022m4 for the 5-year maturity. Sample: 2005m3–2025m12.

FIGURE 7
ROBUSTNESS OF DCC UNDER AR(1)-MEAN SPECIFICATION

V. Conclusion

This paper empirically investigates the evolution of yield synchronization between Korea and the U.S. by analyzing daily government bond yields for 5- and 10-year maturities from December 2000 to December 2025. We examine the evolution of Korea–U.S. yield synchronization through a multidimensional framework consisting of rolling correlation, rolling covariance, and DCC measures. By utilizing structural break tests, we identify the timing and nature of regime shifts in Korea–U.S. yield synchronization. The analysis distinguishes between long-run co-movement in yield levels and short-run synchronization in yield changes, while controlling for idiosyncratic noise through monthly averaging of daily synchronization measures.

The empirical results show that synchronization evolved differently across maturities. Across multiple synchronization measures, the 10-year yield generally exhibited earlier structural breaks than the 5-year yield, indicating a maturity-dependent synchronization pattern. This pattern appears in the level-based measures, which capture long-run alignment in yield levels, and the difference-based measures, which capture synchronization in daily yield innovations. At the same time, covariance measures identify a simultaneous increase in shared yield volatility across maturities beginning in late 2022, coinciding with the global inflation and monetary tightening cycle.

To further examine the sources of these maturity-dependent synchronization patterns, this study decomposes Korean yield movements into global and domestic components using an SUR framework. The results show that the 10- and 5-year Korean yields are significantly associated with U.S. interest rate factors and global risk conditions, indicating the importance of external financial conditions across the entire Korean yield curve. However, the domestic component exhibits a substantially larger effect on the 5-year maturity than on the 10-year maturity under the 3- and 1-year domestic-factor specifications. Although the 5-year yield also responds more strongly to U.S. term premium shocks than the 10-year yield, cross-equation tests indicate that differences in domestic-yield sensitivity constitute the dominant source of maturity heterogeneity across maturities. This finding suggests that the medium-term segment of the Korean yield curve remained more closely associated with domestic yield dynamics during much of the sample period.

Overall, the findings suggest that Korea–U.S. yield synchronization did not evolve uniformly across maturities. Although long-term Korean yields became synchronized with global benchmarks relatively early, synchronization in the medium-term sector emerged more gradually and remained more closely associated with domestic yield dynamics. The robustness analyses further confirm that the main DCC results remain stable under alternative distributional and conditional mean specifications.

Future research could investigate the role of specific monetary and macroprudential policies in shaping maturity-dependent synchronization patterns, particularly during periods of heightened global inflation and financial volatility. The analysis could also be extended to other open emerging economies to assess whether similar maturity-dependent synchronization patterns represent a more general feature of global bond market co-movement.

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Appendix

Table A1
ADF Unit Root Test Results

Variable	Series	Test Statistic	p-value
Korea 10Y	Level	−2.250	0.462
	First Diff.	−15.925	0.000
U.S. 10Y	Level	−2.016	0.593
	First Diff.	−15.259	0.000
Korea 5Y	Level	−2.339	0.412
	First Diff.	−16.372	0.000
U.S. 5Y	Level	−1.819	0.695
	First Diff.	−15.663	0.000
Korea 3Y	Level	−2.239	0.468
	First Diff.	−16.255	0.000
U.S. 3Y	Level	−1.745	0.731
	First Diff.	−15.152	0.000

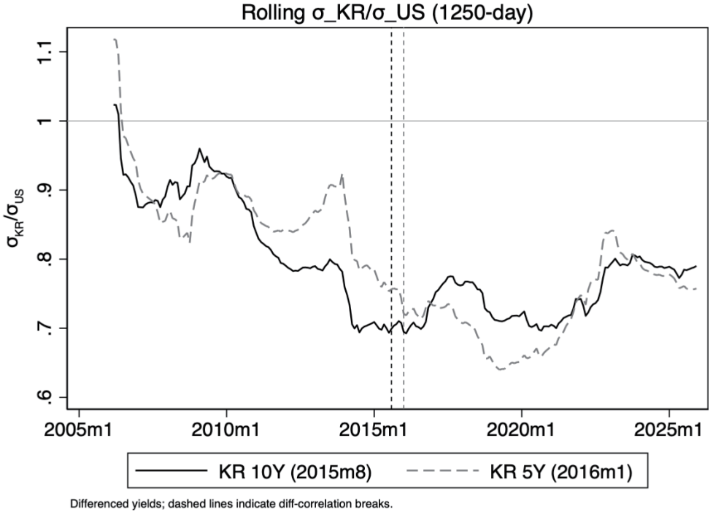
Notes: Tests for levels include a trend; first differences include a drift term. Lag length, 20, is selected by AIC.

Table A2

Window-Size Robustness: Structural Breaks in Correlation and Covariance

Measure	Maturity	Break Date	*Δ* (Post–Pre)
Panel A. 500-day window			
Correlation	10Y	2012m12	+0.143***
	5Y	2022m5	+0.189***
Covariance	10Y	2022m6	+8.593***
	5Y	2022m6	+11.119***
Panel B. 750-day window			
Correlation	10Y	2013m11	+0.136***
	5Y	2014m1	+0.120***
Covariance	10Y	2022m8	+7.321***
	5Y	2022m8	+9.752***
Panel C. 1,000-day window			
Correlation	10Y	2014m12	+0.131***
	5Y	2015m1	+0.118***
Covariance	10Y	2022m10	+5.514***
	5Y	2022m10	+7.328***

Notes: This table reports alternative-window results for rolling correlation and covariance using first-differenced yields. Δ indicates the change between post- and pre-break means; significance is based on two-sample t-tests. Baseline results using the 1,250-day window are reported in Table 3. All structural breaks are significant at the 1% level according to the supremum Wald test. *** $p < 0.01$.



Notes: The volatility ratio is computed from first-differenced yields using a 1,250-day rolling window. Since β = ρ ×(σ_{KR} / σ_{US}), stability of the volatility ratio implies that the rise in rolling beta reflects genuine co-movement (ρ) rather than relative volatility. Dashed vertical lines indicate structural break dates from differenced rolling correlation: black for 10-year (2015m8) and dashed for 5-year (2016m1). Sample: 2005m3–2025m12.

Figure A1
Rolling Volatility Ratio: σ_{KR} / σ_{US}

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