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Time-Dependent Causal Relationships Between Credit Default Swaps, Effective Funding Rate, Exchange Rate-Protected Deposit Scheme, and Stock Market Returns: Evidence from Turkiye

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Abstract

The aim of this paper is to investigate the relationship between the credit risk premium, effective interest rates, the volume of the exchange rate-protected deposits (ERPD), and stock market returns in Turkiye using the time-varying Granger causality method. Econometric analyses are conducted via weekly data from February 18, 2022 to October 17, 2025. The analyses are implemented via a wavelet-based and time-varying Fourier Toda-Yamamoto causality method. Empirical findings reveal that the causality between variables changes over time. Accordingly, the bidirectional causality between CDS and BIST is more dominant in the short run. In the medium and long run, causality is predominantly from BIST to CDS, implying that the stock market provides signals for financial risks. While there is no statistically significant causality from EFR to BIST, an inverse relationship is found in the medium and long run. Regarding the ERPD, causality with BIST is present across all time horizons, whereas causality from BIST to ERPD is observed only in the short and medium terms. Overall, this paper provides valuable insights into the stability of financial markets amid mixed monetary policies and offers early-warning indicators for macro-financial risk management in Turkiye.

Keywords
Borsa Istanbul, Wavelet-based Fourier Toda-Yamamoto Causality Test, Effective Interest Rate, Credit Default Swap, Exchange Rate-Protected Deposit Scheme

JEL Classification
E44, E52, G15, C32

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Kredi Risk Primi, Efektif Faiz Oranı, Kur Korumalı Mevduat ve Borsa Getirileri Arasındaki Zamana Bağlı Nedensellik İlişkisi: Türkiye'den Kanıtlar

Öz

Bu çalışmanın amacı, Türkiye'de kredi risk primi, efektif faiz oranları, döviz korumalı mevduat (KKM) hacmi ve borsa getirileri arasındaki ilişkiyi zamanla değişen Granger nedensellik yöntemini kullanarak araştırmaktır. Ekonometrik analizler 18 Şubat 2022 ile 17 Ekim 2025 tarihleri arasındaki haftalık veriler aracılığıyla gerçekleştirilmiştir. Analizler, dalgacık tabanlı ve zamanla değişen Fourier Toda-Yamamoto nedensellik yöntemi ile gerçekleştirilmiştir. Ampirik bulgular değişkenler arasındaki nedenselliğin zaman içinde değiştiğini ortaya koymaktadır. Buna göre, kısa dönemde CDS ve BIST arasındaki çift yönlü nedensellik daha baskındır. Orta ve uzun vadede ise nedensellik ağırlıklı olarak BIST'ten CDS'e doğru olup, hisse senedi piyasasının finansal risklere daha çok tepki verdiğini ima etmektedir. EFR'den BIST'e doğru istatistiksel olarak anlamlı bir nedensellik bulunmazken, orta ve uzun vadede ters yönlü bir ilişki tespit edilmiştir. KKM ile ilgili olarak, BIST ile nedensellik tüm zaman ufuklarında mevcutken, BIST'ten KKM'ye doğru nedensellik sadece kısa ve orta vadede gözlenmektedir. Sonuç olarak, çalışmanın bulguları karma para politikaları altında finansal piyasaların istikrarı konusunda önemli ipuçları sunmakta ve Türkiye'deki makrofinansal risk yönetimi için erken uyarı göstergeleri hakkında bilgi vermektedir.

Anahtar Kelimeler
Borsa İstanbul, Dalgacık-bazlı Fourier Toda-Yamamoto Nedensellik Testi, Efektif Faiz Oranı, Kredi Risk Primi, Kur Korumalı Mevduat Sistemi

JEL Kodu
E44, E52, G15, C32

1. Introduction

Financial markets are a core arena for sharing information on credit risk, monetary policy direction, and asset valuation. Recent research reveals rising interest in how market-based indicators reflect systemic instability, investor sentiment, and the credibility of monetary policy (Bulut, 2020; Varlık and Öbekcan, 2023; Günay, Çevik and Diboğlu, 2024; Yerlikaya, 2024; Jannet and Barguellil, 2025; Saka İlgın and Sarı, 2025). As a result, financial indicators are now seen not just as descriptive signals but also as relational variables. Through these, expectations, monetary policy actions, and market reactions can be tracked.

In Turkiye, the interaction among market-based indicators, particularly Credit Default Swap (CDS) premiums, the effective funding (interest) rate (EFR), and the stock market (BIST), has gained increasing importance for both policymakers and market participants (Erdaş, 2022; Oner and Oner, 2022; Sovbetov and Saka, 2018; Kızılkaya, Şit and Güngör Karyağdı, 2025). The implementation of the exchange rate-protected deposits (ERPD) scheme, designed from 2022 onwards to limit exchange-rate pressures and encourage savings denominated in Turkish lira, has further complicated the relationships among the variables. This is because ERPD is not a passive instrument, but rather an active monetary policy tool whose effects propagate through multiple

channels. This structure makes it difficult to empirically identify causal relationships among financial indicators and necessitates the use of time-frequency methods that can examine changes across different horizons.

The relationships among credit, money, and equity markets are addressed by various theoretical approaches that provide important reference points in the literature. For example, the financial contagion approach explains how shocks in one financial market may spread to others through factors such as shifts in risk perceptions and portfolio allocation decisions (Kırıkkaleli and Gökmenoğlu, 2020; Kartal, 2024). The risk premium approach argues that increases in sovereign credit risk, usually measured by CDS premiums, are associated with adverse equity market outcomes (Tüysüz and Gül, 2024). Researchers focusing on the monetary transmission mechanism emphasise the interest-rate and exchange-rate channels to explain the effects of funding conditions on liquidity, capital flows, and asset pricing (Yılmaz, 2022; Kostak and Demirkol, 2024). In addition, studies examining the ERPD programme interpret this regulation as an instrument that alters the incentives offered to savers and, consequently, the funding conditions (Ustaoğlu, 2022; Tunalı and Kalkay, 2023). However, evaluations and findings regarding the effectiveness of this policy instrument differ across studies. These viewpoints shape the analytical framework of this paper without making singular or explanatory claims.

Although previous studies have examined the bilateral relationships among credit risk, exchange rates, and stock returns, the role of CDS premiums, the effective interest rate, and exchange rate-protected deposit schemes (or exchange rate-hedged deposit schemes) in jointly shaping stock market returns has not been sufficiently investigated. Moreover, the literature lacks a comprehensive assessment of Turkiye's financial conditions that simultaneously considers traditional and heterodox monetary policy instruments alongside market-based indicators. This paper aims to fill this gap in the literature by applying a wavelet-based causality approach to examine causal relationships among variables separately across short-, medium-, and long-term horizons.

This paper aims to make three important contributions to the existing literature. First, it provides an econometric analysis and assessment of the relationships among CDS premiums, the effective interest rate, the volume of exchange rate-protected deposits and BIST 100 return variables. Second, it applies the time-varying and Fourier-based Granger causality method. Third,

it offers policy-relevant insights into how time-varying causal relationships are reflected in stock price formation in the equity market.

The remainder of the paper is organised as follows. The next section presents the conceptual background and theoretical considerations. The subsequent section reviews the relevant literature. Data and methodological choices are then outlined, followed by the empirical findings. The final section concludes and discusses the main results.

2. Conceptual Framework, Theoretical Background and Literature Review

Recent research on the macro-financial nexus in emerging market economies has increasingly focused on interactions among the credit risk premium, monetary policy instruments, and stock market performance. In an environment where monetary policy credibility, investor sentiment, and financial stability are evolving together, understanding these relationships is crucial for evaluating their implications. Turkiye provides a relevant and meaningful case study in this respect. To this end, a review of the relevant literature is presented below, presenting the existing empirical findings, prevailing methodologies, and remaining gaps. In this way, the position of this paper in the causality literature is also determined.

2.1. Conceptual Framework

Previous research on macrofinance shows that monetary policy, sovereign risk, exchange rates and asset prices interact via multiple channels and generate nonlinear feedback effects, especially in developing countries with structural weaknesses (Mishkin, 1996; Woodford, 2003). In economies such as Turkiye, where external debt ratios are high and dollarization is structurally embedded, financial variables respond strongly to shifts in monetary policy decisions, central bank reserves, exchange rates, and exchange rate expectations. Previous papers also support this view. For instance, Gerek (2024) states that the Turkish financial system has become more susceptible to credibility shocks due to balance-sheet imbalances and limited reserve positions, thereby increasing macro-financial vulnerability.

Sovereign credit default swap (CDS) spreads provide a market-based and high-frequency measure of perceived default risk and broader macro-financial stress. The literature on Turkiye demonstrates that CDS premia, exchange rates and equity prices form a tightly interconnected system in which causality relations are neither unidirectional nor temporally constant (Ustaoğlu,

2022; Gök, 2020; Tüysüz and Gül, 2024). Increases in CDS premia are associated with tighter sovereign and corporate financing conditions and higher discount rates applied to equity valuations, which, in turn, put downward pressure on stock prices. At the same time, sharp equity market declines or pronounced episodes of exchange-rate depreciation signal rising macro-financial fragility, which may subsequently be reflected in widening CDS spreads. These outcomes point to the presence of feedback mechanisms rather than linear transmission paths.

The effective interest rate (EFR), one of the main intervention tools of central banks, serves an important role in the transmission of monetary policy through credit and asset price channels. While traditional monetary policy stances assume that policy rates drive financial conditions, recent empirical evidence from the Turkish financial market points to a slightly different story. In this respect, studies on the yield curve, sovereign risk indicators and fluctuations in FX deposits in financial markets show that risk premiums and exchange rate pressures usually move in tandem with adjustments in the funding conditions and, in some cases, precede these adjustments (Yumrukuz *et al*., 2025; Korkmaz and Aydın, 2025). They also imply that adverse shocks that increase CDS premiums and weaken the national currency (the Turkish lira) may tighten market financing conditions, leading to higher EFRs and contractionary effects on equity markets.

Additionally, the Exchange Rate Protected Deposit (KKM/ERPD) scheme, introduced in Turkiye in late December 2021, is one of the macroprudential policy tools implemented to ensure financial stability and reduce systemic risks. It was introduced with the objective of avoiding dollarization and supporting the liquidity of the local currency (Yılmaz, 2022; Tunalı and Kalkay, 2023). Likewise, ERPD has aimed to change the currency composition of bank deposits by shifting exchange rate risk from households to the public sector and the Central Bank's balance sheet, and to contribute to short-run exchange rate stability. Considering the possibility that ERPD could affect both the adequacy of the Central Bank's reserves and the public sector's exposure to exchange rate changes, it could be argued that ERPD also has an impact on credit default swap (CDS) premiums. However, this effect should be regarded not as an empirically established causality claim, but rather as an institutionally consistent extension of the reserve vulnerability mechanism.

In addition to its impact on a central bank's balance sheet, the ERPD scheme operates via a behavioural channel related to investor confidence and the alignment of expectations. As noted

by Yolusever *et al*. (2023), Participation in the ERPD scheme depends on belief coordination among economic agents. In other words, investors' interest in the ERPD scheme is determined by their expectations of exchange rate volatility and their confidence in monetary policy. It is this combination of these expectations and confidence that determines whether savers will continue to invest in Turkish lira-denominated assets or reallocate their portfolios towards foreign currency-denominated assets. Based on the game-theoretic findings, the authors conclude that confidence and expectations determine portfolio choices, which, in turn, affect liquidity conditions in the Turkish lira financial system (ibid.). So long as market participants' confidence persists, participation in the ERPD supports lira liquidity. In contrast, a weakening of confidence leads to a breakdown in the coordination of beliefs and triggers a collective tendency towards dollarization. This behavioural setting establishes a theoretical link between confidence, currency composition and liquidity conditions in the financial system. In this sense, the view that the macro-financial effects of the ERPD are not limited to guarantee schemes is gaining growing support. Recent empirical evidence, in fact, reveals a long-run relationship between the volume of ERPD deposits and banking sector stock prices (Kızılkaya *et al*., 2025).

Building on these quantitative reference points, this paper examines the causal relationships among CDS spreads, the effective funding rate, ERPD balances, and stock market returns in Turkiye. By allowing for bidirectional, time-varying interactions, the analysis moves beyond earlier studies that typically focused on partial linkages, delivering a more comprehensive account of how these four macro-financial variables jointly respond to monetary policy actions and market sentiment.

2.2. Theoretical Background

The interactions among sovereign credit risk, monetary policy, and equity markets can be assessed through a set of interrelated theoretical perspectives. Structural credit-risk theory provides an initial analytical benchmark by modelling equity as a residual claim on the value of underlying assets, thereby implying that an increase in default probability or loss given default raises required risk premia and depresses equity valuations (Merton, 1974). From this perspective, movements in CDS can be read as indicators of changing assessments of default risk, which may be reflected in equity prices. This theoretical relationship offers a conceptual basis for considering inverse and

potentially bidirectional associations between CDS spreads and stock market indices, such as the BIST index, without implying a fixed or unidirectional causal structure.

Exchange-rate and capital-market interactions have conventionally been examined through flow-oriented and portfolio-balance approaches, which foreground the role of relative returns, expectations, and portfolio preferences in transmitting shocks across currencies, deposits, and equity markets (Dornbusch and Fischer, 1980; Frankel, 1984). In line with this reasoning, policy measures or shifts in investor sentiment may lead to portfolio reallocations, thereby affecting liquidity conditions and asset prices. The ERPD scheme can be situated within this conceptual space insofar as it alters the incentive structure facing depositors by partially insulating them from exchange-rate risk. Rather than constituting a direct empirical test of portfolio-balance models, this interpretation highlights how ERPD may influence portfolio choices and liquidity conditions in ways consistent with the broader logic of portfolio reallocation and flow-based transmission mechanisms.

From a theoretical perspective, asset valuation theories have long examined the role of interest rates in influencing stock prices through cash-flow discounting (Flannery and James, 1984). This perspective has been further deepened by the modern monetary policy literature, which posits that financial conditions and monetary policy decisions may interact through feedback mechanisms, especially in environments where financial markets are more responsive to monetary policy signals (Mishkin, 1996; Woodford, 2003). In this vein, the policy interest rate is one of the main instruments central banks use to implement monetary policy. As a matter of fact, some researchers argue that volatility in financial markets, including changes in stock prices and risk premiums, may precede adjustments in financing conditions (Gerek, 2024; Korkmaz and Aydın, 2025). Although these views do not provide normative rules on how central banks should act, they allow for a broader assessment of the interaction between monetary policy and financial markets. From this perspective, it is concluded that central banks respond to conditions in financial markets, especially when expectations, confidence and market sentiment are very sensitive (Calvo, 1998; Kaminsky *et al*., 2004).

At the macroprudential level, it is widely argued that the ERPD programme is an unconventional policy instrument designed to support liquidity in the Turkish lira and discourage dollarisation (Tunalı and Kalkay, 2023). Central to this debate is the argument that the programme,

by insulating depositors from exchange rate losses, restructures the distribution of exchange rate risk between households and the public sector (Yılmaz, 2022; Tunalı and Kalkay, 2023). Rather than changing interest rate parity as an explicit or implicit condition, the ERPD can be understood as affecting the environment in which such parity conditions operate by changing perceived exchange rate risk and expected returns on lira-denominated assets. Monetary policy-based analyses accentuate that this is accompanied by unexpected fiscal and quasi-fiscal risks, the magnitude of which depends on exchange rate movements (IMF, 2023; Kartal, 2024). Viewed from this perspective, a possible link between ERPD and CDS should be treated as a theoretically consistent extension of established reserve-risk relationships rather than a proven causal relationship.

Beyond central bank balance sheet accounts, the ERPD programme can be understood in terms of expectation formation, confidence and portfolio choice. While behavioural interpretations focus on the fact that participation in such programmes depends on coordinated beliefs about future exchange rate movements and the credibility of the policy environment more broadly (Yolusever *et al*., 2023), recent portfolio-based viewpoints point to the role of exchange rate expectations in shaping investors' risk-taking and asset allocation decisions (Hofmann *et al*., 2022). According to these arguments, confidence affects portfolio choices by altering both beliefs and the constraints under which investors operate, which in turn has direct implications for liquidity conditions in the financial system (Hau and Rey, 2006). Thus, when expectations are aligned and exchange rate risk is perceived to be limited, participation in currency-denominated assets may continue. However, when confidence and risk tolerance decline, a reorientation towards foreign currency assets may re-emerge. This reasoning reflects that the macro-financial effects of the ERPD scheme extend beyond explicit guarantees and depend on the stability of expectations and the resulting portfolio rebalancing.

Financial cycle approaches are based on medium- and long-term fluctuations in credit and asset prices that differ from those of the standard business cycle (Claessens *et al*., 2011; Borio, 2013). Therefore, the presence of long-term structural trends as well as short-term financial shocks lays the foundation for the adoption of empirical econometric methods that allow for the determination of whether relationships between variables change over time. In this respect, time-varying econometric methods are well-suited to modelling financial relationships that operate across different time periods. Moreover, previous research showing deviations from market

equilibrium during periods of heightened financial stress provides concrete evidence that short-term asymmetries and volatility spillovers should be empirically assessed at higher frequencies (Baur and Lucey, 2010; Delis and Mylonidis, 201).

Taken together, these theoretical perspectives provide a coherent justification for examining nonlinear, asymmetric, and time-varying causal relations among CDS spreads, the EFR, the ERPD, and stock-market returns in Turkiye. Importantly, they serve to motivate the analytical strategy of this paper without presuming specific causal outcomes, which remain an empirical matter to be examined.

2.3. Literature Review

A growing body of empirical research on Turkiye's CDS risk, exchange rate movements and local financial markets focuses on the channels through which financial risks are transmitted to different assets and monetary policy components. In this context, special attention has been paid to CDSs. This is mainly because CDS contracts are regarded as market-based indicators of sovereign creditworthiness that can affect funding conditions, exchange rate dynamics, and equity valuations. The existing empirical literature on these relationships goes beyond traditional time-series approaches and includes various methods aimed at revealing time-varying relationships among variables.

A well-established line of research examines cointegration among CDS premiums, equity prices, and exchange rates in emerging market economies. Rather than assuming a single, dominant transmission channel, these studies reveal co-movements that are thought to operate through expectations, balance sheet effects, and changes in global risk appetite. In the Turkish case, Altuntaş and Ersoy (2020) find bidirectional causality between CDS premiums and the BIST Banking Index, but unidirectional causality from the BIST 30 Index to CDS premiums, which indicates that there is heterogeneity across different sub-segments of the stock market. Building on this line of enquiry, Sovbetov and Saka (2025) document economically significant short- and long-run effects between CDS premia and the BIST-100 index within an ARDL framework, and show that macro-financial controls, including interest rates, inflation, and the exchange rate, materially condition this relationship. At a more general level, Delis and Mylonidis (2011), using rolling VECM-based Granger causality, show that CDS prices often lead government bond spreads during periods of market stress, whereas bidirectional feedback tends to emerge during acute crisis

episodes. Taken together, these findings suggest that causal patterns in sovereign risk pricing may be state-dependent, with risk pricing shifting between markets rather than following a stable, unidirectional path.

A second stream of the literature emphasises that the relationships between sovereign risk, exchange rates, and asset prices are not temporally invariant, but may depend on the frequency domain under consideration. The increasing use of time-frequency methods reflects the concern that standard time-domain models may obscure short-run turbulence or long-run co-movement. Afshan *et al*. (2018), employing wavelet coherence techniques, show that stock–exchange rate linkages can display strong long-scale coherence and even bidirectional causality, thereby challenging earlier findings derived from more restrictive modelling approaches. For Turkiye, Gök (2020) combines VECM estimation with wavelet coherence analysis and shows that co-movement and causal structure differ across horizons, with time-frequency evidence highlighting sign and phase patterns that vary across holding periods. Alongside this, the paper reports mostly unilateral variance-causality linkages across pairs, indicating that volatility transmission is not symmetric across markets. Related evidence is provided by Karaçayır (2025), who shows that the VIX-CDS relationship varies in both direction and intensity across time and frequency bands, while the VIX maintains a strong and persistent negative association with the BIST 100. In a related contribution, Shahzad *et al*. (2020) document sectoral heterogeneity in CDS-stock and CDS-VIX connectedness in the United States, suggesting that connectedness is conditional on market structure and trading frequency. While this body of work provides detailed evidence on time-frequency co-movements, it remains less explicit regarding the structural mechanisms through which shocks are transmitted, unless such evidence is complemented by models that explicitly map shocks into transmission channels.

A third theme in the literature focuses on macroeconomic fundamentals and policy credibility as determinants of sovereign risk. Previous research has consistently shown that external balance, solvency, and liquidity conditions play a central role in CDS pricing in emerging economies. Ho (2015) identifies a stable long-run relationship in which higher external debt is associated with higher CDS spreads, whereas improvements in the current account balance and increases in international reserves are linked to lower spreads, with reserves exerting the largest long-run effect. At the intersection of micro and macro dynamics, Hofmann *et al*. (2022) show that exchange rate shocks can be transmitted to emerging market sovereign bond markets through

investor balance-sheet constraints, with broad US dollar movements tightening risk capacity and widening credit risk premia. Regarding Turkiye, Erdaş (2022) identifies a stable long-run association between CDS premia and financial indicators amid structural shifts, suggesting that stronger equity performance and higher liquidity are associated with lower CDS premia, whereas domestic credit expansion raises sovereign risk. Complementary evidence is provided by Yerlikaya (2024), who reports that exchange rate volatility and credit expansion are associated with higher CDS premia, whereas reserves and equity performance mitigate risk perceptions, and also documents bidirectional causality between reserves and CDS premia, consistent with feedback between perceived risk and monetary policy responses. Alongside these macro-financial factors, institutional credibility has emerged as a relevant dimension. Bulut (2020) finds that the CBRT credibility gap behaves as a unit-root process, implying persistent credibility shocks, while Varlık and Öbekcan (2023) identify a long-run relationship in which improvements in central bank credibility reduce CDS premia, whereas higher inflation and exchange rate changes increase them. These studies collectively indicate that sovereign risk pricing may be shaped not only by macroeconomic fundamentals but also by the credibility of monetary policy frameworks and the management of expectations.

A fourth strand of the literature relates global risk conditions to domestic credit risk and market volatility, with particular emphasis on volatility spillovers and the role of foreign exchange markets during stress episodes. Günay *et al*. (2024) show that for Turkiye and Brazil, foreign exchange markets serve as the primary channels of spillovers to credit risk measures during turbulent periods, while global volatility has a stronger influence in Turkiye. This result is consistent with the broader macro-financial view that capital flow cycles and policy cyclicality can amplify vulnerability in middle-income economies, as documented by Kaminsky *et al*. (2004). In parallel, the portfolio balance literature argues that exchange rates may respond to relative asset supplies in the short- to medium-run (Frankel, 1984), thereby providing a conceptual bridge among global risk conditions, domestic balance sheets, and currency movements.

More recently, a growing body of research has concentrated on Turkiye's ERPD scheme as a macroprudential-monetary policy instrument. This research has gained prominence because such instruments operate at the intersection of currency substitution, expectations, and fiscal risk. Tunalı and Kalkay (2023) evaluate the scheme over the 2021-2023 period and argue that utilisation rates may have supported the monetary transmission mechanism and contributed, at least partially, to

exchange rate stabilisation in its initial phase. Other studies report more mixed outcomes. Saka İlgın and Sarı (2025) find two-way interactions between ERPD and alternative investment instruments, alongside negative effects on equities and deposit rates and limited success in reducing euro and dollar prices. Kızılkaya *et al*. (2025) document long-run cointegration between ERPD indicators and the BIST Banking Index, with positive effects on proxies for banking performance. Focusing on investor behaviour, Sönmez (2025) reports one-way causality from domestic investors' risk appetite indices to ERPD, while finding no bidirectional causality for foreign investors, suggesting heterogeneous behavioural responses across investor groups. From a different perspective, Yolusever *et al*. (2023) adopt an evolutionary game-theoretic framework and argue that the sustainability of ERPD may depend on trust and expectations, while also suggesting that observed empirical conditions may not have supported sustained success over the analysed period.

Despite these findings, some fundamental questions about the joint interaction of sovereign financial risk indicators, exchange rates, monetary policy credibility and policy rate-like measures remain unanswered. A closer review of the literature reveals two main recurring limitations. First, many empirical studies analyse the relationships among CDS, the stock market, the exchange rate, the policy rate, and equity markets in isolated, disconnected ways, rather than considering monetary policy instruments within a broader sovereign risk transmission mechanism that encompasses creditworthiness and global risk conditions. Second, although time- and frequency-based econometric methods are widely used to detect cointegration among variables, the limited number of studies in the literature is insufficient to explain how different monetary policy interventions shape risk pricing across different maturities. In this vein, when and through which channels ERPD-type monetary policy interventions interact with sovereign CDS risk, exchange rate dynamics, and the stock market under different market conditions remain important unresolved research questions.

This paper closes this gap by offering an integrated assessment that connects sovereign risk pricing, exchange rate behaviour, and the monetary policy environment in Turkiye, while explicitly recognising that these relationships may vary across horizons and regimes. Building on the existing evidence, the paper treats ERPD not as a standalone monetary policy innovation but as a component of a broader macro-financial configuration in which credibility, external buffers, and global risk appetite jointly shape outcomes.

Therefore, the paper tests the following hypotheses:

Hypothesis 1: A time-dependent causality link exists between BIST and CDS.

Hypothesis 2: A time-dependent causality link exists between BIST and EFR.

Hypothesis 3: A time-dependent causality link exists between BIST and ERPD.

3. Data and Methodology

3.1. Data

The empirical methodology examines weekly data of BIST 100 (XU100) return series, Credit Default Swap premium, Effective funding rate, and Exchange Rate-Protected Deposits variables, spanning from 18.02.2022 to 17.10.2025.

The sample period is deliberately chosen to coincide with the post-introduction phase of the Exchange Rate Protected Deposit Scheme and the subsequent hybrid monetary policies in Turkiye. It is also characterised by the concurrent use of conventional (interest rate-based) and unconventional monetary policy tools, increased macro-financial volatility, and heightened sensitivity of financial markets to credibility and confidence shocks originating from both domestic and foreign markets. Consequently, it offers a suitable empirical setting for analysing time- and frequency-dependent causal interactions among market-based risk indicators, policy instruments, and equity returns. The ERPD (KKM) variable is converted to logarithmic form to minimise scale effects and potential heteroskedasticity, and to aid interpretation of the empirical results. A detailed description of these variables can be found in Table 1.

Table 1

Data Description

Variables	Abbreviations	Units	Sources
BIST 100 (XU100) return series	BIST	Rate / Proportion	Bloomberg (UK)
Credit Default Swap premium/ 5-year CDS spread	CDS	Basis points (bps)	Bloomberg (UK)
Effective funding rate	EFR	Per cent (effective interest rate)	Central Bank of the Republic of Turkiye (TCMB)
Exchange Rate-Protected Deposits	KKM	Million TRY (logarithmic value)	Banking Regulation and Supervision Agency (BDDK)

Consistent with theoretical knowledge and the surveyed literature, the following mathematical function is formulated (Equation 1):

$$BIST_t = \mathrm{f}(CDS, EFR, KKM) \quad (1)$$

In line with theoretical perspectives and existing academic studies, Equation 1 specifies the relationships among BIST 100 returns, and CDS premiums, the effective funding rate, and KKM deposit volumes. This mathematical representation establishes a basis for analysing how these variables interact within the Turkish financial market.

The descriptive statistics of the variables are presented in Table 2. According to the test results, the CDS variable has the highest mean, whereas the BIST variable has the lowest. Second, the CDS variable has the highest median, while the BIST variable has the lowest. Finally, the CDS variable has the highest standard deviation, and the BIST variable has the lowest.

Table 2

Descriptive Statistics

Country	Variables	Mean	Median	St. dev.
Turkiye	BIST	0.009	0.010	0.041
	CDS	412.761	318.585	167.275
	EFR	31.260	40.500	17.192
	KKM	13.997	14.196	0.875

3.2. Methodology

Following the econometric methodology in Kamışlı *et al*. (2023), this paper uses a two-stage empirical approach to analyse the causal relationships among the variables. The first step of the econometric analysis examines the stationarity and unit root properties of the series using the conventional ADF, PP, and KPSS unit root tests. Stationarity of the series is also re-examined using the Fourier ADF unit root test, which allows for the possibility of structural breaks and nonlinearity. In the second step, a wavelet transform is applied, followed by the Fourier Toda-Yamamoto causality method, as developed by Nazlıoğlu *et al*. (2016), to determine the direction of causal relationships between the variables.

In particular, the methodological contribution of combining wavelet decomposition with the Fourier Toda-Yamamoto approach lies in its ability to simultaneously address two critical features of financial time series: frequency-domain heterogeneity and time-domain structural

breaks. While the wavelet transform isolates market dynamics into distinct, theoretically meaningful time horizons (short-term, medium-term, and long-term) that reflect different investor behaviours and policy transmission lags, it does not inherently account for smooth structural shifts. By subsequently applying the Fourier Toda-Yamamoto test to these decomposed series, the causality inferences at each time horizon are ensured to be robust to unobserved, gradual structural breaks.

3.2.1. Wavelet Transform

At this stage, all variables are wavelet transformed using the Discrete Wavelet Transform (DWT). The DWT was chosen because it is easy to implement and provides sufficient detail for empirical analysis. It is also suitable for this paper's research topic as it allows non-stationary data to be analysed in a combination of time and frequency domains. Using this method, each series is broken down into components that represent different points in time dimensions. This makes it possible to distinguish between very short-lived movements, medium-term adjustments and longer patterns.

The Maximal Overlap Discrete Wavelet Transform (MODWT) is used to decompose the time series into different time scales during DWT computation. A further consideration concerns the directions offered by Gençay *et al*. (2002) for selecting an appropriate wavelet function. Their work notes that wavelets with longer filter lengths tend to provide a closer approximation to an ideal band-pass filter. In line with this view, the analysis adopts the Least Asymmetric wavelet at level 5, LA(8), where the number eight refers to the width of the filter. This specification suits the data examined in the paper. This particular wavelet is well known for a range of appealing characteristics, including near-symmetry, orthogonality, compact support, and smoothness (Ha, Tan and Goh, 2018). The various decomposition levels obtained correspond to time scales: the first band, d1 (2 weeks to 8 weeks), reflects an immediate market response (short-run). The second band, d2 (2 months to 4 months), corresponds to medium-term adjustments (medium-run). The third band, d3 (4^{+} months to 44 months), represents long-term dynamics (long-run). It is important to note that these bands relate to approximate time horizons. However, interpretation can also be understood in terms of frequency-domain periodicities.

3.2.2. Augmented Dickey-Fuller (ADF) Unit-Root Test

Traditional stationarity tests do not account for structural breaks in the series. The classical Augmented Dickey–Fuller (ADF) test, associated with the work of Dickey and Fuller (1979, 1981), is one of the most widely used procedures for detecting the presence of a unit root in a time series. The test is based on estimating the following autoregressive representation equation (Equation 2):

$$\Delta y_t = \alpha_1 y_{t-1} + \sum_{j=1}^{p} \beta_j \Delta y_{t-1} + \varepsilon_t \quad (2)$$

Under the null hypothesis (H_0) of a unit root, $\alpha=0$, so the level of the series behaves as a non-stationary process. The alternative hypothesis (H_1), $\alpha<0$, implies stationarity around a deterministic component. Because the distribution of the test statistic does not follow standard asymptotic results, its critical values are those tabulated in Dickey and Fuller's original studies. The ADF test, therefore, offers a simple method for distinguishing between unit-root behaviour and stationarity and continues to be a benchmark tool in empirical time-series analysis.

To ensure accurate estimation, we simultaneously perform the PP test developed by Phillips and Perron (1988), which uses non-parametric methods to handle serial correlation and heteroskedasticity without including lagged differences. To further validate these results, the KPSS test introduced by Kwiatkowski *et al*. (1992) is also applied, which flips the baseline assumption by testing the null hypothesis of stationarity against the alternative of a unit root. Using this trio of tests provides a thorough validation of the series' behaviour before proceeding to Fourier-based analysis methods.

3.2.3. Fourier ADF Unit Root Test

Traditional stationarity tests do not account for structural breaks in the series. The Fourier ADF unit root test was developed by Enders and Lee (2012), building on earlier work by Christopoulos and Leon-Ledesma (2010), who showed that low-frequency Fourier terms can capture smooth structural breaks in economic time series. In their methodology, a variable y_t is represented as the sum of a deterministic part that varies over time, d(t), and a random disturbance υ_t, as written in Equation 3:

$$y_t = d(t) + v_t \quad (3)$$

The deterministic component is modelled using a low-frequency Fourier expansion. Using the formulation in Equation (3), they express d(t) as:

$$d(t) = \gamma_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) \quad (4)$$

where k denotes the frequency used in the Fourier term, t is the time index, and T is the total number of observations in the data sample.

The first step in applying the test is to identify the frequency that best fits. To do this, Equation (4) is estimated for each integer value of k within the range $1 \leq k \leq 5$. For each case, the sum of squared residuals is calculated, and the value of k that produces the smallest residual sum is taken as the preferred frequency k^*.

Once the optimal frequency has been chosen, residuals are obtained from the fitted deterministic part using Equation (5):

$$\hat{v}_t = y_t - \hat{\gamma}_0 - \hat{\gamma}_1 \sin\left(\frac{2\pi k^* t}{T}\right) - \hat{\gamma}_2 \cos\left(\frac{2\pi k^* t}{T}\right) \quad (5)$$

These residuals are then subjected to the standard ADF regression, shown in Equation (6):

$$\Delta v_t = \alpha_1 v_{t-1} + \sum_{j=1}^{p} \beta_j \Delta v_{t-1} + \mu_t \quad (6)$$

In the concluding step of the Fourier ADF procedure, the smooth structural break component is evaluated by testing whether the Fourier coefficients γ_1 and γ_2 are jointly insignificant. This is operationalized through an F-test:

$$H_0 = \gamma_1 = \gamma_2 = 0,$$

(Fourier terms are jointly insignificant; no smooth structural change)

$$H_1 = \gamma_1 \neq 0, \gamma_2 \neq 0,$$

(Fourier terms are jointly significant; smooth structural change exists)

The decision rule is based on whether the computed F-statistic exceeds the corresponding critical value. When the F-statistic does not surpass the critical threshold, H_0 cannot be rejected, implying that the deterministic component does not require Fourier adjustments. Under such circumstances, the conventional ADF unit root test constitutes the appropriate specification. If the

F-statistic exceeds the critical value, H_0 is rejected, the Fourier terms are deemed relevant, and the Fourier-augmented ADF specification should be used instead.

After determining the appropriate specification, unit root testing proceeds either through the standard ADF regression or through the Fourier-augmented ADF regression. In both frameworks, the presence of a unit root is assessed by the coefficient on the lagged level term. The hypotheses can be stated as:

H_0: $\alpha_1 = 0$, (the series contains a unit root)

H_1: $\alpha_1 \neq 0$, (the series is stationary)

Inference regarding the stochastic behaviour of the variable depends on whether the estimated test statistic associated with α_1 exceeds the relevant critical values. Failure to reject H_0 indicates non-stationarity, whereas rejection of H_0 implies stationarity.

3.2.4. Wavelet-based Fourier Toda-Yamamoto Causality Test

After the wavelet transform, the Fourier Toda-Yamamoto causality method, improved by Nazlioglu *et al.* (2016), was used to determine the direction of causal links between the wavelet-based series. To begin with, Granger (1969) emphasised that causality analysis traditionally requires stationary time series. The approach proposed by Toda and Yamamoto (1995) relaxed this requirement by allowing variables with different orders of integration to be included in the same causality framework. Hacker and Hatemi-J (2006) later suggested the use of bootstrap techniques to mitigate size distortions, although these procedures still tend to overlook the presence of structural breaks. The Fourier Toda-Yamamoto method, introduced by Nazlioglu *et al*. (2016), handles this limitation by incorporating structural changes through a flexible Fourier representation.

The Fourier Toda-Yamamoto test is based on an augmented vector autoregressive (VAR) model that incorporates Fourier terms to capture smooth structural changes, as specified in Equation (7):

$$y_t = \alpha_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta_1 y_{t-1} + \cdots + \beta_{p+d} y_{t-(p+d)} + \varepsilon_t \qquad (7)$$

where α_0 represents the intercept, γ_1 and γ_2 are the coefficients of the Fourier terms, k denotes the optimal frequency, t is the deterministic time trend, T is the total number of

observations, β parameters represent the autoregressive coefficients, p represents the optimal lag length, and d stands for the maximum order of integration of the variables. The error term (ε_t) is assumed to display white-noise properties. A crucial step in this process is identifying the optimal frequency (k) for the Fourier expansion. This is achieved by estimating the model multiple times for each integer k in the range $1 \leq k \leq 5$, and ultimately selecting the frequency that minimises the residual sum of squares (SSR), thereby ensuring the best fit to capture smooth structural feature shifts. Lastly, the VAR model is augmented by adding the maximum order of integration (d_{max}) to the optimal lag length (p), yielding a VAR($p + d_{max}$) model.

Testing for causality via the Fourier Toda-Yamamoto methodology is carried out by the null-hypothesis (no causality between variables) using the Wald statistic under the joint restriction H_0: $\beta_1 = \cdots = \beta_p = 0$. After estimating the model, the Wald test statistic is computed, and its significance is evaluated using both asymptotic and bootstrap-based p-values. The null hypothesis is rejected if the corresponding p-value is lower than the chosen significance level, indicating evidence of Granger causality between the variables.

This methodology is more advantageous than conventional causality analyses in capturing dynamic interactions among variables, as it allows lag structures and frequency effects to be analysed separately. This approach delivers three main advantages (Farnè and Montanari, 2022). Firstly, it makes a prior cointegration test unnecessary. Secondly, it can be applied to variables with different degrees of integration without any stringent assumptions. Thirdly, it enables the detection of gradual or smooth structural shifts in the series through the Fourier terms included in the model. In these respects, the method differs from traditional Granger causality tests. Moreover, Moreover, it provides a particularly useful analytical tool in settings where causal relationships evolve and change direction and intensity due to policy shifts.

Finally, it should be stressed that the main purpose of the analysis below is not to estimate structural policy effects or parameter magnitudes, but to reveal the direction of causal relationships between variables across different time points.

4. Empirical Results

This section presents the empirical results. The results of the ADF, PP, KPSS, and Fourier ADF unit root tests are presented first, followed by the findings of the wavelet-based Fourier Toda-Yamamoto causality analysis. All statistical inferences are based on a 5% significance level.

4.1. Unit Root Test Results

ADF, PP, KPSS, and Fourier ADF unit root tests are applied to examine the stationarity properties of the time series included in the analysis. The latter method provides robustness against spurious estimates arising from unmodelled structural changes in time series data that may be overlooked.

The standard unit root test results in Table 3 indicate that the BIST series is level stationary. On the other hand, the standard ADF and PP tests show that the CDS and EFR series are unit-rooted at their levels. The KKM series yields mixed results, appearing non-stationary under the ADF and KPSS tests but stationary under the PP test. Nevertheless, after first differencing, especially the variables that contain a unit root in their levels (CDS, EFR, and KKM) become stationary, indicating that they are I(1) under standard specifications.

It is well established in the econometric literature that the standard ADF, PP, and KPSS tests may not explicitly account for structural breaks, which can result in reduced power and biased inferences, especially in volatile financial time series. To address this limitation, the Fourier ADF test is applied, as it captures smooth structural shifts by incorporating low-frequency components into the deterministic specification.

The results in Table 4 show that the Fourier terms are statistically significant for the CDS and KKM variables, as confirmed by the F(k) statistics. For these specific series, the Fourier terms and ADF unit test statistics ($\tau_{DF\text{-}t}$) are statistically significant, which reveal that they follow I(0) processes when smooth structural changes are accounted for. However, for the variables for which the Fourier terms (frequency components) are not statistically significant, the Fourier-based specification may not be appropriate. Under these circumstances, it is more methodologically sound to base conclusions on the results of the standard ADF unit root test. This preference is based on the fact that the Fourier ADF test is an extension of the standard ADF test. In the analysis, this situation holds for the BIST and EFR variables, for which the Fourier terms are not statistically significant. Accordingly, for the BIST and EFR variables, the results of the standard ADF test are taken as the benchmark. The comprehensive evaluation identifies BIST as an I(0) variable and EFR as an I(1) variable. The PP and KPSS results for BIST and EFR further support the conclusions drawn from the ADF test.

Given that the highest order of integration within the system is 1 (driven by the EFR variable) and no series exhibits I(2) behaviour, the maximum order of integration (d_{max}) for the causality approach is determined as 1. This configuration ensures that the subsequent wavelet-based Fourier Toda-Yamamoto analysis remains robust to mixed integration orders and structural alterations.

Taking Tables 3 and 4 together, it can be seen that the series in the analysis are integrated at either the I(0) or I(1) level, and that none of the series is I(2). The outcomes provide a consistent, methodologically sound basis for a subsequent wavelet-based Fourier Toda-Yamamoto causality analysis.

Table 3

ADF, PP and KPSS Unit Root Test Results

		ADF		***PP***		***KPSS***	
	Variables	***Intercept***	***Intercept and time trend***	***Intercept***	***Intercept and time trend***	***Intercept***	***Intercept and time trend***
Level	BIST	-13.525*** (0.000)	-13.836*** (0.000)	-13.580*** (0.000)	-13.837*** (0.000)	0.429 [0.437]	0.041*** [0.216]
	CDS	-1.084 (0.721)	-2.647 (0.260)	-1.077 (0.742)	-2.607 (0.277)	1.409 [0.463]	0.272 [0.146]
	EFR	-1.131 (0.703)	-1.191 (0.908)	-0.904 (0.785)	-0.640 (0.975)	1.372 [0.347]	0.219 [0.119]
	KKM	-0.152 (0.694)	-0.833 (0.959)	-5.903*** (0.000)	-6.395*** (0.000)	0.557* [0.463]	0.453 [0.119]
1st Difference	ΔBIST	-16.536*** (0.000)	-16.486*** (0.000)	-32.494*** (0.000)	-32.380*** (0.000)	0.033*** [0.739]	0.032*** [0.216]
	ΔCDS	-13.994*** (0.000)	-13.958*** (0.000)	-14.009*** (0.000)	-13.971*** (0.000)	0.086*** [0.739]	0.089*** [0.146]
	ΔEFR	-3.500*** (0.000)	-3.544*** (0.000)	-14.134*** (0.000)	-14.130*** (0.000)	0.331*** [0.739]	0.288 [0.216]
	ΔKKM	-6.097*** (0.000)	-9.005*** (0.000)	-40.574*** (0.000)	-60.368*** (0.000)	0.563* [0.739]	0.113*** [0.216]

Note. Asterisks (*, **, ***) denote statistical significance levels at the %10, %5, 1% levels, respectively. The numbers in the brackets are probability values. The values in the square brackets [ ] are the asymptotic critical values corresponding to the asterisks. Lag length is determined via modified SIC.

Table 4

Fourier ADF Unit Root Test Results

	Variable	***Min. SSR***	***k (frequency)***	***Fourier ADF stat. ($\tau_{DF\text{-}t}$)***	***F(k)***
Level	BIST	0.299	5	-6.746	6.679
	CDS	1584.3	1	-5.327*	14.705*
	EFR	239.417	1	-2.675	4.876
	KKM	40.494	1	-4.727*	9.012*
1st	ΔBIST	0.501	5	-8.843	4.196

	ΔCDS	1725.8	4	-7.281	2.775
	ΔEFR	242.311	1	-4.491	3.862
	ΔKKM	61.547	5	-5.937	2.331

Note. The symbol (*) denotes the %5 significance level. The critical value of F(k) corresponding to the 5% significance level is 8.88, as reported by Enders and Lee (2012). The critical values of the Fourier ADF statistics ($\tau_{DF\text{-}t}$) at the 5% significance level for k=1,2,3,4,5 are -4.31, -4.01, -3.77, -3.63, and -3.56, respectively (Enders and Lee, 2012).

4.2. Wavelet-based Fourier Toda-Yamamoto Causality Test Results

The selection of this empirical methodology is guided by theoretical considerations concerning the instability of macro-financial linkages in emerging markets, as well as by the statistical properties of the data. In other words, the outcomes of the unit root tests show that the series demonstrate mixed orders of integration, comprising both I(0) and I(1) series. As a result, the maximum order of integration (d_{max}) is determined to be 1. This feature justifies the use of wavelet- and Fourier-based causality methods, which remain robust to mixed integration orders, gradual structural alterations, and time-frequency dependencies. Additionally, the empirical results are assessed at the 5% significance level.

The findings of the wavelet-based Fourier Toda-Yamamoto analysis in Table 5 help explore how relationships between variables evolve over time and how they behave across different frequency bands in great detail. In the short term, the bidirectional causality between CDS premiums and BIST returns demonstrates a robust short-run predictive interdependence between sovereign risk perceptions and equity market movements. This result proposes that both variables provide valuable information for explaining each other over shorter horizons, likely due to the rapid spread of market sentiment and reactions to new information. However, the absence of causality running from CDS to BIST in the medium and long term reveals that CDS does not provide statistically significant information for BIST returns. This evidence points to a predictive relationship that is primarily limited to the short run and diminishes as the time horizon extends. Additionally, the causality found from BIST to CDS across all time frames indicates that equity market movements are relevant for predicting future sovereign CDS spreads. Accordingly, BIST may be considered as an indicator of Türkiye's CDS.

Furthermore, another key finding is the absence of causality from EFR to BIST across all periods, indicating that the effective interest rate does not contain statistically significant evidence for stock market movements over the sample period. Nevertheless, the presence of causality from

BIST to EFR in the medium- and long-term shows that stock market performance contains information useful for predicting future changes in the effective interest rates in Turkiye. Overall, these results point to a directional predictive relationship from the stock market to interest rates over longer horizons, consistent with a predictive linkage in which equity market movements precede interest rate adjustments.

Moreover, the bidirectional causality between KKM and BIST in the short- and medium-term shows that KKM is more than a traditional deposit-regulation instrument. It is associated with broader macro-financial linkages. In particular, the fact that causality from KKM to BIST across all time horizons implies that KKM contains information that helps explain stock market movements in Türkiye. This underlines the importance of KKM for equity market behaviour, likely via mechanisms such as exchange rate risk management and savings allocation. Additionally, the causality observed from BIST to KKM in the short and medium term, but not in the long term, indicates time-varying relationships between these variables. This may be associated with shifts in portfolio preferences during periods of strong stock market performance in Türkiye, particularly in 2022-2023, when investors reallocated assets toward exchange rate-protected instruments. The absence of long-term causality indicates that KKM does not help explain stock market movements over longer horizons.

When the results are evaluated as a whole, they indicate that stock market behaviour exhibits statistically significant relationships with market risk perceptions and macroprudential policy instruments. In contrast, the predictive role of interest rate-based monetary policy in stock market movements appears relatively limited over the sample period. Overall, these findings point to the presence of time-varying and horizon-dependent relationships among the variables, rather than a uniform structure across all periods.

Table 5

Wavelet-based Fourier Toda-Yamamoto Causality Test Results[1]

Hypothesis	***Terms***	***WALD test stats.***	***k (frequency)***	***Lag.***	***Bootstrap critical value (%5)***	***Result***
CDS ⇏ BIST	*Short-Run (2 – 8 weeks)*	17.104	0.10	6	0.016*	Causality

[1] While some coefficients are significant at the 10% level, this paper strictly uses a 5% threshold to assess the statistical significance of the empirical outcomes.

BIST ⇏ CDS	*Medium-Run (2 – 4 months)*	13.166	4.80	7	0.068	No causality
	Long-Run (4⁺ months)	15.771	2.90	9	0.095	No causality
	Short-Run (2 – 8 weeks)	36.553	0.10	6	0.000*	Causality
	Medium-Run (2 – 4 months)	32.876	4.80	7	0.000*	Causality
	Long-Run (4⁺ months)	25.502	2.90	9	0.006*	Causality
EFR ⇏ BIST	*Short-Run (2 – 8 weeks)*	6.018	0.10	6	0.429	No causality
	Medium-Run (2 – 4 months)	11.476	4.80	7	0.125	No causality
	Long-Run (4⁺ months)	15.699	2.90	9	0.073	No causality
BIST ⇏ EFR	*Short-Run (2 – 8 weeks)*	8.680	0.10	6	0.205	No causality
	Medium-Run (2 – 4 months)	16.550	4.80	7	0.022*	Causality
	Long-Run (4⁺ months)	18.775	2.90	9	0.043*	Causality
KKM ⇏ BIST	*Short-Run (2 – 8 weeks)*	15.354	0.10	6	0.020*	Causality
	Medium-Run (2 – 4 months)	18.291	4.80	7	0.011*	Causality
	Long-Run (4⁺ months)	20.300	2.90	9	0.029*	Causality
BIST ⇏ KKM	*Short-Run (2 – 8 weeks)*	17.565	0.10	6	0.011*	Causality
	Medium-Run (2 – 4 months)	15.798	4.80	7	0.031*	Causality
	Long-Run (4⁺ months)	14.220	2.90	9	0.146	No causality

Note. The symbol (⇏) represents the null hypothesis of no time-varying Granger causality. The symbol (*) denotes rejection of the null hypothesis and indicates statistically significant time-varying Granger causality at the 5% level. Lag selection is based on SIC.

5. Conclusion

This paper focuses on time-varying and frequency-dependent causal relationships from sovereign credit risk, the effective interest rate, and exchange rate-protected deposit volumes to stock market returns in Turkiye. The econometric analyses are performed using weekly data from 18 February 2022 to 17 October 2025. A Fourier Toda-Yamamoto causality test based on wavelet decomposition was also applied to identify the causality. Furthermore, the findings are evaluated at the 5% statistical significance level.

The empirical findings show that the causal relationships among the variables are time-varying. In the short run, the bidirectional causality between CDS premiums and BIST returns demonstrates a robust predictive interdependence between sovereign credit default swaps and

equity market returns. This result proposes that both variables provide valuable forecasting information for each other over shorter horizons, which may statistically reflect the rapid spread of market sentiment and reactions to new information. However, the absence of causality running from CDS to BIST in the medium and long term reveals that CDS does not provide statistically significant forecasting information for BIST returns over these periods. This evidence points to a causal relationship running from CDS to BIST, primarily in the short run. Additionally, the causality found from BIST to CDS across all time horizons indicates that equity market movements contain relevant information for forecasting future sovereign CDS spreads. Accordingly, BIST may be considered a statistical indicator of Türkiye's sovereign risk pricing.

Furthermore, another key finding is the absence of a causal effect from EFR to BIST across all periods, indicating that the effective interest rate lacks statistically significant predictive power for stock market returns during the sample period. Nevertheless, the presence of causality from BIST to EFR in the medium- and long-term propose that stock market developments contain information useful for predicting future adjustments in the effective interest rates in Türkiye. Overall, these results point to a directional predictive relationship from the stock market to interest rates over longer horizons, consistent with a statistical linkage in which equity market movements precede interest rate adjustments.

Moreover, the bidirectional causality between KKM and BIST in the short- and medium-term reveals an interaction between KKM volumes and stock market performance. In particular, the causality running from KKM to BIST across all time horizons implies that the variations in KKM contain information that helps explain stock market movements in Türkiye. This fact also underscores the statistical relevance of KKM to equity market trends, which might serve as a proxy for shifts in exchange-rate risk management and savings-allocation behaviour. Additionally, the causality observed from BIST to KKM in the short and medium term, but not in the long term, may reflect short- to medium-term shifts in portfolio preferences during periods of strong stock market performance in Türkiye, particularly in 2022-2023. Finally, the absence of long-term causality from BIST to KKM indicates that stock market performance is not associated with the changes in KKM volumes over longer time horizons.

Overall, the paper's findings demonstrate that interactions among market indicators cannot be explained solely by deterministic factors or direct structural policy outcomes, but rather reflect

time-varying information spillovers shaped by investor expectations, portfolio rebalancing, and market confidence. Furthermore, the paper uncovers how complex macro-financial linkages exist among interest rate policies, exchange-rate-protected instruments, sovereign risk perceptions, and domestic asset pricing in an emerging market economy.

Nevertheless, this paper has certain limitations. Firstly, the empirical analysis is limited to the period after 2022, characterised by increased volatility, and the applications of unconventional or macroprudential policies in Turkiye. Therefore, the extent to which the findings can be generalised to alternative institutional settings may be delimited. Moreover, while wavelet- and/or Fourier-based causality methodologies allow estimation of directional relationships across different temporal scales, they do not provide estimates of structural parameters or the magnitude of policy effects. Therefore, the causal links identified in this paper should be interpreted strictly as statistical predictability and information spillovers rather than direct structural or deterministic policy effects. In this regard, future empirical research may extend the present analysis by including global financial factors, alternative indicators, policy credibility variables, or regime-switching and non-linear approaches. This will help to clarify how these relationships have changed again over time. Comparative analyses across economies that apply different monetary policy instruments may also help distinguish broader structural patterns from country-specific cases.

Declaration of Research and Publication Ethics

This study, which does not require ethics committee approval and/or legal/special permission, complies with research and publication ethics.

Researcher's Contribution Rate Statement

Since the author is the sole author of the article, his contribution rate is 100%.

Declaration of Researcher's Conflict of Interest

There are no potential conflicts of interest in this study.

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