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Domestic Public Borrowing and Private Credit Dynamics in Türkiye: Evidence from an ARDL Approach

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ABSTRACT

Purpose: This study examines whether domestic public borrowing is associated with the displacement of private credit in Türkiye and distinguishes a conventional quantity-based crowding-out mechanism from public-borrowing flows, bank sovereign exposure, and broader macro-financial conditions.

Design/Methodology/Approach: Monthly data from January 2010 to November 2023 are analysed using an ARDL/UECM reference specification, short-run OLS models with HAC standard errors, alternative credit outcomes and monetary controls, structural-break diagnostics, and Toda-Yamamoto directionality tests. The commercial-credit series is constructed consistently for all 167 months as total loans minus consumer loans and credit-card balances.

Findings: The bounds test supports a long-run level relationship, but adjustment is very slow. The normalized long-run coefficient on real domestic debt is negative and statistically insignificant, while borrowing cost and exchange-rate depreciation are negatively associated with credit and real activity is positively associated with credit. Official net domestic borrowing does not display a negative short-run association with commercial-credit growth. By contrast, increases in banks' government-securities exposure are associated with weaker commercial-credit growth, and this result remains significant under alternative financing-condition controls. Directionality tests do not establish a one-way causal relationship, and break analysis indicates regime sensitivity.

Discussion: The evidence does not support a stable, mechanical full-sample crowding-out relationship based on the quantity of domestic public debt. It instead points to a narrower portfolio-allocation association within the sovereign-bank nexus and to a debt-credit relationship that depends on financing conditions and macro-financial regimes. The results are therefore interpreted as associations rather than structural causal effects.

1. INTRODUCTION

Whether public borrowing displaces private credit remains a longstanding question in fiscal and financial economics. The issue is particularly important in economies where banks occupy a central role in financial intermediation and domestic debt markets remain closely connected to public finance. In such settings, an increase in government borrowing may affect funding costs, bank balance sheets, portfolio allocation, and the availability of credit to the private sector. The empirical evidence is mixed: some studies associate larger fiscal imbalances with tighter financing conditions, whereas others show that the transmission depends on financial structure, banking behaviour, and the wider macroeconomic environment (Laubach, 2009; Ağca & Celasun, 2012; Thia, 2020; de Mendonça & Brito, 2021).

The banking channel makes the question more complex. Banks hold government securities directly and may adjust the composition of their assets when sovereign financing conditions change. The sovereign-bank nexus therefore provides a distinct mechanism from the traditional loanable-funds argument: public borrowing need not displace private credit simply because the debt stock rises, but a larger or changing sovereign position on bank balance sheets may coincide with weaker private lending, particularly under stress (Gennaioli et al., 2014,

ETHICAL APPROVAL: This study used secondary data (Republic of Türkiye Ministry of Treasury and Finance, Banking Regulation and Supervision Agency (BDDK), Central Bank of the Republic of Türkiye Electronic Data Delivery System (EVDS), TÜİK official statistics infrastructure) and does not require ethical committee approval

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2018; Demirci et al., 2019; Afonso et al., 2024). In emerging markets, exchange-rate pressure, global liquidity, and changing risk appetite can further blur the distinction between fiscal and financial transmission (Ağca & Celasun, 2012; Bruno & Shin, 2015).

Türkiye is a useful setting in which to separate these mechanisms. The financial system is predominantly bank-based, while the post-2010 period includes rapid credit expansion, exchange-rate stress, changes in monetary policy, rising inflation, and substantial changes in sovereign financing conditions. Under such circumstances, public debt and private credit may move in the same direction because both respond to common macro-financial conditions, while portfolio reallocation may become visible only in particular regimes. A single debt-stock coefficient is therefore unlikely to capture the full fiscal-financial relationship.

The empirical question is consequently not limited to whether the domestic debt stock carries a negative coefficient. Three explanations must be distinguished. The traditional quantity-based view predicts that greater government financing demand is associated with weaker private credit. The sovereign-bank view predicts that greater bank exposure to government securities is associated with weaker allocation toward commercial lending. A common-cycle explanation allows debt and credit to co-expand when both respond to broader monetary, exchange-rate, and real-activity conditions. These mechanisms imply different empirical measures and different policy interpretations.

Against this background, the study examines monthly Turkish data from January 2010 to November 2023. The stock-based ARDL specification serves as the long-run reference model, while its conclusions are evaluated against the official flow of net domestic borrowing, direct measures of bank sovereign exposure, alternative financing-condition controls, structural-break evidence, and directionality tests. This architecture permits the debt stock, current financing demand, bank portfolio allocation, and common macro-financial conditions to be evaluated separately rather than treating the debt stock as a catch-all proxy.

This study contributes to the literature in three related ways. First, it distinguishes the stock of domestic public debt from the actual flow of net domestic borrowing, allowing the conventional crowding-out proposition to be evaluated using alternative fiscal measures. Second, it directly introduces banks' holdings of domestic government securities into the analysis, moving the sovereign-bank nexus from a theoretical interpretation to an observable balance-sheet channel. Third, it combines long-run ARDL evidence with short-run HAC specifications, endogenous structural-break analysis, and Toda-Yamamoto directionality tests. The design is deliberately associative: it seeks to distinguish empirical mechanisms without imposing a causal interpretation that the data cannot support.

The findings are correspondingly differentiated. The baseline ARDL supports a long-run level relationship, but the normalized long-run debt coefficient is negative and statistically insignificant and the estimated adjustment speed is slow. The official net domestic borrowing flow is not negatively associated with short-run commercial-credit growth. A different result emerges for the bank portfolio channel: increases in government securities relative to bank assets are negatively associated with commercial-credit growth, with similar estimates under alternative financing-condition controls. These associations are not supported as one-way causal effects by Toda-Yamamoto tests, and endogenous break analysis shows that coefficient patterns change across regimes.

The remainder of the paper reviews the theoretical mechanisms and develops testable hypotheses, describes the data and econometric design, reports the baseline and mechanism-specific results, and concludes with implications and limitations.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The traditional crowding-out argument begins with competition for domestic financial resources. Larger fiscal deficits or debt-financing needs may place upward pressure on interest rates and weaken private borrowing or investment. Laubach (2009) documents interest-rate effects of fiscal imbalances, while Ağca and Celasun (2012) show that sovereign debt is associated with higher corporate borrowing costs in emerging markets. This literature implies a negative quantity relationship between public financing and private credit, but it also indicates that financing conditions are an important transmission mechanism.

A second strand treats banks as active portfolio managers. Banks hold government securities, use them in liquidity management, and alter asset composition in response to sovereign conditions. Gennaioli, Martin, and Rossi (2018), for example, show that banks with greater sovereign exposure experience weaker loan growth during sovereign default episodes. This mechanism is conceptually different from a simple debt-stock effect because the identity of debt holders and the composition of bank assets matter for whether public financing is associated with private-credit allocation.

A third strand emphasises common macro-financial conditions. In emerging economies, domestic lending responds to exchange-rate pressure, monetary conditions, global liquidity, and risk appetite as well as to fiscal variables. Bruno and Shin (2015) highlight the role of global liquidity in international bank lending. In Türkiye, credit composition and lending behaviour have also been linked to economic activity and bank-level conditions (Tunç & Yavaş, 2016; Çepni et al., 2020; Özgür et al., 2021; Shahzad et al., 2019). A positive short-run correlation between debt and credit may therefore reflect common shocks rather than a direct borrowing-to-credit transmission.

The Turkish case also has a fiscal-financial dimension. Debt sustainability and debt governance remain important policy concerns, while a bank-based financial structure creates a direct balance-sheet connection between sovereign instruments and private lending (Togan Eğrican et al., 2022). The relevant empirical gap is therefore not simply the absence of another Turkish debt-credit regression, but the need to distinguish the quantity of accumulated public debt, the current borrowing flow, bank sovereign exposure, and the broader financing environment within the same empirical setting.

The hypotheses are stated in terms of association rather than causal effect because neither ARDL nor the short-run reduced-form specifications provide structural identification.

H1. Higher real domestic public debt is negatively associated with real commercial credit in the long run.

H2. Higher financing and borrowing costs are associated with weaker private-credit dynamics.

H3. Exchange-rate depreciation is associated with weaker private-credit dynamics.

H4. Stronger real economic activity is associated with stronger private credit.

H5. Greater banking-sector exposure to domestic government securities is associated with weaker commercial-credit growth.

H1 captures the conventional quantity-based proposition. H2-H4 represent the broader financing and macro-financial environment, while H5 directly tests the portfolio-allocation implication of the sovereign-bank nexus. The empirical strategy below maps separate variables and specifications to these mechanisms.

3. METHOD

3.1. Research Model and Data

The analysis uses monthly observations from January 2010 to November 2023 (N = 167). The dataset combines the Republic of Türkiye Ministry of Treasury and Finance (HMB), the Banking Regulation and Supervision Agency (BDDK), the Central Bank of the Republic of Türkiye Electronic Data Delivery System (EVDS), and OECD Main Economic Indicators accessed through FRED. Monetary values are retained in the source unit during construction and are converted to billion Turkish lira only for descriptive presentation where indicated.

Commercial and other loans are constructed consistently for every month as total loans minus consumer loans minus credit-card balances using BDDK Monthly Bulletin data. All three components are available for 167/167 months, so no definition switch or statistical splicing is required. An audit against the narrower sum of working-capital and installment commercial loans over their common 2019-03 to 2023-11 window produces a level correlation of 0.998, but the narrower measure averages only 44.4% of the consistent residual series and its monthly growth correlation is 0.879. The narrower series is therefore not spliced into the baseline. Nominal loan values are reported by BDDK in million TL and are deflated by CPI (2015=100).

The main fiscal stock variable is the CPI-deflated central-government domestic debt stock. Current financing demand is measured separately by HMB monthly net domestic borrowing. The sovereign-bank channel is measured by domestic government securities held by the banking sector relative to total banking assets. The baseline financing-cost variable is HMB's average annual compound cost of domestic borrowing. Commercial lending rates and the CBRT policy rate are used in separate short-run specifications, while an ex-post real Treasury borrowing-cost measure provides an additional robustness check. Real activity is represented by the seasonally adjusted industrial production index.

The exchange-rate variable in the baseline is the OECD/FRED monthly spot end-of-period USD exchange-rate series (CCUSSP01TRM650N). The source series is expressed historically as USD per unit of national currency and is reciprocated where necessary so that the empirical variable is consistently expressed as TRY per USD; its natural logarithm is used. The term "corrected USD/TRY" is therefore not used. The newly estimated short-run extensions use the official TCMB EVDS USD/TRY buying rate (TP.DK.USD.A.YTL) aggregated to monthly frequency; the different timing convention is treated as an additional robustness dimension rather than silently mixed with the baseline definition.

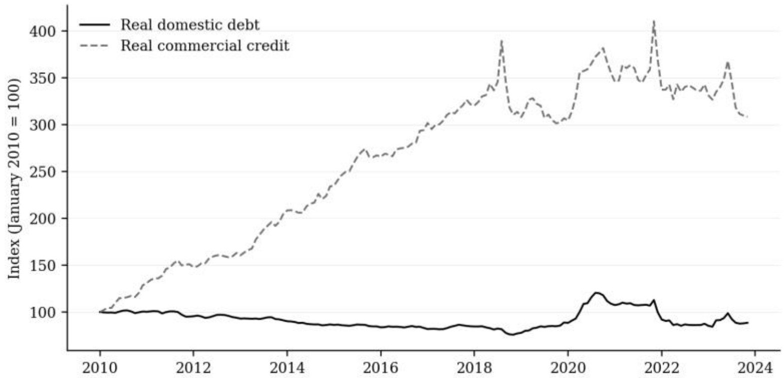
Table 1. Variable Definitions, Sources, Units, and Transformations

Variable	Definition	Source / code	Original unit	Transformation	Coverage	Use
Real commercial credit	Total loans - consumer loans - credit cards	BDDK Table 3	Million TL	CPI-deflated; ln	2010-01–2023-11	Main outcome
Real domestic debt stock	Central-government domestic debt stock	HMB debt-stock statistics	Million TL	CPI-deflated; ln	2010-01–2023-11	H1 / baseline
Treasury borrowing cost	Average annual compound cost of domestic borrowing	HMB	%	Level	2010-01–2023-11	H2 / baseline
Industrial production	Industry except construction, SA	OECD/FRED TURPROINDMISMEI	2015=100	ln	2010-01–2023-11	H4
USD/TRY	Spot, end of period, expressed as TRY per USD	OECD/FRED CCUSSP01TRM650N	TRY/USD	Reciprocal if needed; ln	2010-01–2023-11	H3 / baseline
Net domestic borrowing	Monthly "İÇ BORÇLANMA (NET)"	HMB financing statistics	Million TL	CPI-deflated; level and /assets	2010-01–2023-11	Flow mechanism
Government securities / assets	Banking-sector domestic government securities / total assets	BDDK Tables 8 and balance sheet	Ratio	Level; monthly change	2010-01–2023-11	H5
Commercial lending rate	TRY commercial loan rate	TCMB EVDS TP.KTF17	%	Level / monthly change	2010-01–2023-11	Short-run control
Policy rate	CBRT policy rate	TCMB EVDS TP.BISPOLFAIZ.TUR	%	Level / monthly change	2010-01–2023-11	Alternative control
Real SME loans	SME loans deflated by CPI	BDDK Table 6	Million TL	CPI-deflated; ln	2010-01–2023-11	Alternative outcome

Note: CPI denotes the consumer price index and SA denotes seasonally adjusted. BDDK monetary source data are in million TL; values shown in billion TL elsewhere are divided by 1,000. The full data audit also includes HMB debt-holder shares used in auxiliary robustness checks.

Figure 1 presents the two principal stock variables in indexed form. Both increase over the sample, but their relative movements vary substantially across subperiods. The figure is descriptive and does not imply directionality.

Figure 1. Real Domestic Public Debt and Consistently Defined Real Commercial Credit (January 2010 = 100)



Note: Both series are CPI-deflated and rebased to January 2010 = 100. Commercial credit is defined consistently as total loans minus consumer loans minus credit-card balances for all 167 months.

Table 2. Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Median	Max
Real commercial credit (billion TL, 2015 prices)	167	1029.718	327.887	391.789	1152.476	1607.589
Real domestic debt stock (billion TL, 2015 prices)	167	461.943	46.612	381.369	445.357	605.662
Treasury borrowing average cost (%)	167	11.961	4.554	5.770	10.344	30.198
Industrial production (2015=100, SA)	167	105.959	22.388	63.115	104.113	146.325
USD/TRY (end-of-period)	167	6.014	6.304	1.434	3.444	28.886
Real net domestic borrowing (billion TL, 2015 prices)	167	4.404	5.886	-8.191	3.477	36.066
Government securities / bank assets (%)	167	11.572	5.480	5.525	9.284	27.186
Commercial lending rate (%)	167	16.372	6.861	8.415	14.865	51.575

Note: Real monetary aggregates are expressed at 2015 prices. Commercial credit is displayed in billion TL after dividing the BDDK million-TL source values by 1,000.

3.2. Econometric Strategy

The time-series properties of the variables are examined using Augmented Dickey-Fuller (ADF) and KPSS tests. The two tests are reported jointly because their null hypotheses differ. Test statistics, p-values, lag or bandwidth choices, deterministic components, and critical values are reported rather than relying on a single integration label. Zivot-Andrews tests with an endogenously selected break are added as complementary evidence because the sample includes major macro-financial regime changes. The combined evidence does not indicate that any baseline variable is integrated of order two, which is the critical condition for the ARDL bounds framework.

Table 3. ADF and KPSS Stationarity Tests for Baseline Variables

Variable	Form	ADF statistic (lag)	ADF p	KPSS statistic (bw)	KPSS p
ln(real commercial credit)	Level	-2.996 (6)	0.035	1.751 (8)	0.010
ln(real commercial credit)	First difference	-4.533 (5)	<0.001	0.784 (1)	0.010
ln(real domestic debt)	Level	-2.043 (1)	0.268	0.251 (8)	0.100
ln(real domestic debt)	First difference	-9.820 (0)	<0.001	0.077 (5)	0.100
Treasury borrowing cost (%)	Level	-0.173 (14)	0.942	1.284 (8)	0.010
Treasury borrowing cost (%)	First difference	-4.358 (13)	<0.001	0.156 (3)	0.100
ln(industrial production)	Level	-1.518 (5)	0.524	1.863 (8)	0.010
ln(industrial production)	First difference	-7.977 (4)	<0.001	0.204 (26)	0.100
ln(USD/TRY)	Level	2.352 (0)	0.999	1.850 (8)	0.010
ln(USD/TRY)	First difference	-11.407 (0)	<0.001	0.604 (2)	0.022

Note: ADF specifications include a constant and select lags by AIC. KPSS specifications include a constant and use automatic bandwidth selection. Exact 1%, 5%, and 10% critical values and the Zivot-Andrews results are reported in Appendix Tables A1-A2. Mixed ADF/KPSS outcomes are treated conservatively; the ARDL requirement is assessed as the absence of an I(2) process.

The baseline long-run relationship can be written as follows:

$$\ln(Credit\_t) = \alpha_0 + \alpha_1 \ln(Debt\_t) + \alpha_2\, Cost\_t + \alpha_3 \ln(IPI\_t) + \alpha_4 \ln(FX\_t) + u\_t$$

Here, Credit_t denotes real commercial credit, Debt_t real central-government domestic debt, Cost_t the average annual compound cost of domestic borrowing, IPI_t the industrial production index, and FX_t the end-of-period TRY-per-USD exchange rate. The baseline specification provides the long-run reference against which the additional mechanism and robustness analyses are evaluated.

The dynamic ARDL representation is:

$$\ln(Credit_t) = c + \sum_{i=1}^{p} \varphi_i \ln(Credit_{t-i}) + \sum_{j=0}^{q_1} \beta_j \ln(Debt_{t-j}) + \sum_{k=0}^{q_2} \gamma_k Cost_{t-k} + \sum_{m=0}^{q_3} \delta_m \ln(IPI_{t-m}) + \sum_{n=0}^{q_4} \theta_n \ln(FX_{t-n}) + \varepsilon_t \tag{1}$$

The model is rewritten in unrestricted error-correction form:

$$\Delta\ln(Credit_t) = c + \sum_{i=1}^{p-1} \rho_i \Delta\ln(Credit_{t-i}) + \sum_{j=0}^{q_1-1} \lambda_j \Delta\ln(Debt_{t-j}) + \sum_{k=0}^{q_2-1} \mu_k \Delta Cost_{t-k} + \sum_{m=0}^{q_3-1} \nu_m \Delta\ln(IPI_{t-m}) + \sum_{n=0}^{q_4-1} \xi_n \Delta\ln(FX_{t-n}) + \psi_1 \ln(Credit_{t-1}) + \psi_2 \ln(Debt_{t-1}) + \psi_3 Cost_{t-1} + \psi_4 \ln(IPI_{t-1}) + \psi_5 \ln(FX_{t-1}) + \varepsilon_t \tag{2}$$

The differenced terms represent short-run movements, while the lagged levels are jointly evaluated through the bounds test. The baseline test corresponds to Pesaran et al. Case III, with an unrestricted intercept and no deterministic trend. In addition to the conventional asymptotic bounds, 20,000 finite-sample simulations are used to report sample-specific critical values. Normalized long-run multipliers are calculated separately from UECM level terms, and their standard errors and confidence intervals are obtained from the estimated parameter covariance matrix using the delta method.

The associated error-correction representation is:

$$\Delta\ln(Credit_t) = c + \sum_i a_i \Delta Z_{t-i} + \eta ECT_{t-1} + \varepsilon_t \tag{3}$$

A negative and statistically significant error-correction coefficient indicates adjustment following a deviation from the estimated long-run relation. Because the magnitude of the coefficient can be economically small even when statistically significant, the adjustment half-life and the time required to eliminate 90% of a disequilibrium shock are also reported.

The reference specification is ARDL(3,1,1,1,1). Lag sensitivity is assessed with a BIC search that allows up to three autoregressive lags and one distributed lag for each of the four baseline regressors. The search evaluates 324 admissible candidate structures. The preferred comparison model is ARDL(3,1,1,1): three autoregressive lags of commercial credit and one distributed lag each for real domestic debt, Treasury borrowing cost, and USD/TRY, with industrial production excluded by BIC. The newly added flow specifications use a forced-variable BIC grid with autoregressive lags of 1-3 and distributed lags of 1-2. This modular design avoids placing all controls and mechanisms in one highly parameterized monthly ARDL.

Robustness analysis is organized around three distinct concerns. First, the stock measure is complemented by official monthly net domestic borrowing. Second, the sovereign-bank mechanism is examined directly through government securities relative to banking-sector assets. Third, financing conditions are varied across separate specifications using the commercial lending rate, the CBRT policy rate, and an ex-post real Treasury borrowing-cost measure. Total loans and SME loans provide alternative outcomes. In the core short-run specifications, the dependent variable is monthly real credit growth, measured as the first difference of the logarithm of the relevant real credit aggregate. The mechanism regressor is either net domestic borrowing relative to banking-sector assets or the monthly change in government securities relative to banking-sector assets. Controls comprise the monthly changes in seasonally adjusted industrial production, USD/TRY, and the commercial lending rate, together with one lag of credit growth and calendar-month indicators; the indicated alternative-rate specifications replace the commercial lending-rate control. Newey-West HAC covariance estimates use a maximum lag of 12 months. The industrial-production series is seasonally adjusted at source, while calendar-month indicators address residual monthly seasonality in the financial series. Flow-based ARDL models are treated as sensitivity evidence rather than replacements for the baseline when their error-correction and residual diagnostics are weak.

Toda-Yamamoto tests are used as a directionality check for the flow and sovereign-exposure relationships. BIC selects p=1 in both bivariate systems, the maximum integration order is dmax=1, and the augmented VAR is therefore estimated with p+dmax=2 lags; Wald restrictions are imposed only on the original p lag. The procedure is not interpreted as structural causal identification (Toda & Yamamoto, 1995). Structural instability is examined through Zivot-Andrews unit-root tests, a global sum-of-squared-residuals break search over zero to three breaks with a minimum segment length of 24 months following Bai-Perron logic, break-specific HAC estimates, CUSUM, CUSUM of squares, and Ramsey RESET diagnostics (Brown et al., 1975; Zivot & Andrews, 1992; Bai & Perron, 2003).

4. EMPIRICAL FINDINGS

The empirical evidence distinguishes three patterns. First, the stock-based ARDL does not provide statistically persuasive evidence of a stable long-run crowding-out coefficient on domestic debt. Second, replacing the stock perspective with the official monthly flow of net domestic borrowing does not reveal a negative short-run association with commercial-credit growth. Third, bank sovereign exposure displays a different pattern: increases in government securities relative to banking assets are associated with weaker commercial-credit growth. The latter relationship remains visible under alternative financing-condition controls, although directionality tests do not support a verified one-way causal interpretation.

4.1. Baseline ARDL Results

The baseline ARDL(3,1,1,1,1) bounds statistic is 31.430. Under Case III, this value is far above both the asymptotic and simulated finite-sample upper bounds. With 20,000 finite-sample simulations, the I(0)/I(1) critical values are 2.502/3.579 at 10%, 2.928/4.122 at 5%, and 3.918/5.315 at 1%. The error-correction coefficient is -0.0222 (p=0.009), indicating statistically detectable but slow adjustment.

Table 4. Baseline ARDL/UECM and Normalized Long-Run Results

Panel A. Bounds, adjustment, and selected short-run coefficients

Statistic / term	Estimate	p	5% I(0)	5% I(1)	Interpretation
Bounds F-statistic	31.430	-	2.928	4.122	Cointegration supported
ECT(t-1)	-0.0222	0.009	-	-	Slow adjustment
Δ ln(real domestic debt)	0.6407	<0.001	-	-	Positive short-run co-movement
Δ Treasury borrowing cost	0.0004	0.517	-	-	Not significant
Δ ln(industrial production)	0.0036	0.898	-	-	Not significant
Δ ln(USD/TRY)	0.3700	<0.001	-	-	Positive contemporaneous association

Panel B. Normalized long-run multipliers (delta-method inference)

Variable	Coefficient	SE	t	p	95% CI
Real domestic debt	-0.3306	0.5448	-0.607	0.544	[-1.398, 0.737]
Treasury borrowing cost	-0.0637	0.0309	-2.063	0.039	[-0.124, -0.003]
Industrial production	2.0700	0.6600	3.136	0.002	[0.776, 3.364]
USD/TRY	-0.5755	0.2404	-2.394	0.017	[-1.047, -0.104]

Note: The reference model is ARDL(3,1,1,1,1), Case III. Finite-sample critical values are based on 20,000 simulations: I(0)/I(1) = 2.502/3.579 at 10%, 2.928/4.122 at 5%, and 3.918/5.315 at 1%. Panel B reports normalized long-run multipliers and their own covariance-based inference; UECM level-term p-values are not used as substitutes for long-run inference.

The long-run results provide no statistical support for H1 in the full-sample reference specification. The real domestic debt multiplier is -0.331 with p=0.544 and a confidence interval that spans both negative and positive values. Because both debt and credit enter in logarithms, the point estimate corresponds to approximately 0.33% lower real commercial credit for a 1% higher level of real domestic debt, but the wide confidence interval means that this economic magnitude is not statistically pinned down. By contrast, the normalized borrowing-cost coefficient is negative (β=-0.0637, p=0.039), industrial production is positive (β=2.070, p=0.002), and USD/TRY is negative (β=-0.575, p=0.017). Correct inference on the normalized multipliers therefore strengthens the evidence for H2-H4 while leaving H1 unsupported.

The error-correction coefficient implies that only about 2.2% of disequilibrium is corrected per month. The implied half-life is approximately 30.9 months, and approximately 102.7 months are required for 90% of an initial deviation to dissipate. The long-run adjustment should therefore be described as very slow rather than simply stable.

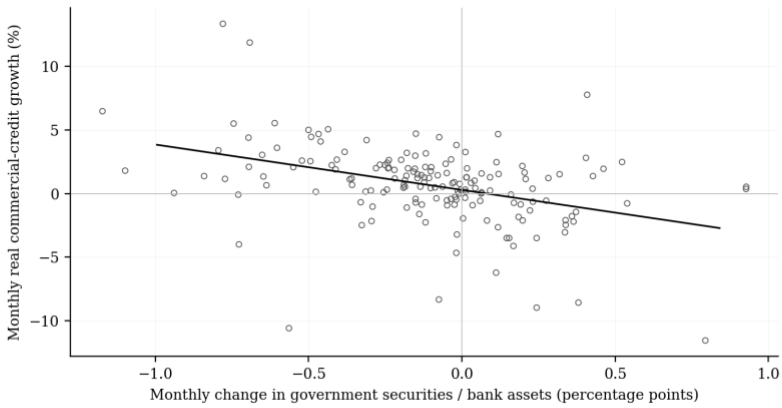
The positive short-run debt-stock coefficient (0.641, $p<0.001$) should not be interpreted as evidence that government borrowing stimulates lending. A BIC comparison model selects ARDL(3, 1, 1, 1) after dropping industrial production and retains the same qualitative pattern; the total-loan robustness model also produces a high bounds statistic (30.254), a negative significant ECT (-0.0380), and an insignificant debt level term ($p=0.780$). These results motivate a direct test of current borrowing flows rather than attributing the stock-change coefficient to a financing-demand mechanism.

4.2. Borrowing Flows and the Sovereign-Bank Portfolio Channel

When public financing demand is measured directly by HMB net domestic borrowing scaled by banking-sector assets, the short-run association with real commercial-credit growth is small and statistically insignificant ($\beta=0.0039$, $p=0.682$). This result does not support an immediate flow-based displacement mechanism. The contrast with the positive debt-stock change coefficient is consistent with interpreting the latter as common macro-financial co-movement rather than a direct borrowing-to-credit transmission effect.

A more distinct pattern emerges when the fiscal-financial link is measured through bank portfolio exposure. A one-percentage-point increase in the government-securities-to-assets ratio is associated with approximately -0.0298 log points lower monthly real commercial-credit growth ($p=0.0026$). A one-standard-deviation monthly increase in sovereign exposure, approximately 0.349 percentage points, corresponds to about 1.04% lower monthly real commercial-credit growth. This is an economically meaningful association but is not interpreted as a causal effect.

Figure 2. Monthly Change in Bank Sovereign Exposure and Real Commercial-Credit Growth



Note: The scatter plot is descriptive and shows the unadjusted monthly relationship. The multivariate HAC specifications in Table 5 control separately for financing conditions and other short-run macro-financial movements.

Table 5. Short-Run Mechanism and Robustness Tests

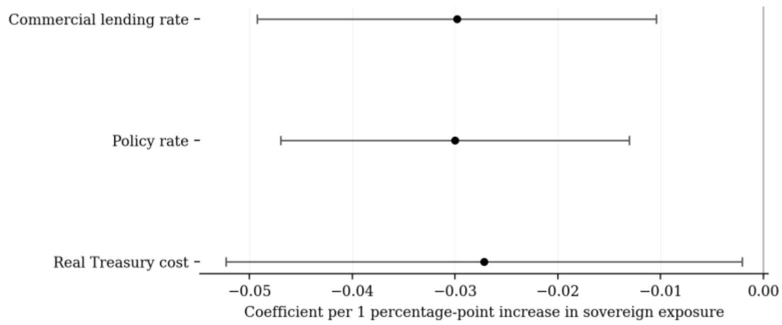
Outcome	Key mechanism	Financing control	β	p	95% CI	N
Commercial credit	Net borrowing / assets (pp)	Δ commercial lending rate	0.0039	0.682	[-0.0148, 0.0227]	165
Commercial credit	Sovereign exposure (per 1 pp)	Δ commercial lending rate	-0.0298	0.003	[-0.0493, -0.0104]	165
Total loan	Net borrowing / assets (pp)	Δ commercial lending rate	0.0092	0.176	[-0.0041, 0.0226]	165
Total loan	Sovereign exposure (per 1 pp)	Δ commercial lending rate	-0.0247	0.004	[-0.0417, -0.0078]	165
SME loan	Net borrowing / assets (pp)	Δ commercial lending rate	0.0143	0.179	[-0.0065, 0.0350]	165
SME loan	Sovereign exposure (per 1 pp)	Δ commercial lending rate	-0.0126	0.095	[-0.0273, 0.0022]	165
Commercial credit	Sovereign exposure (per 1 pp)	Δ policy rate	-0.0300	<0.001	[-0.0470, -0.0130]	165
Commercial credit	Sovereign exposure (per 1 pp)	Real Treasury cost	-0.0272	0.034	[-0.0523, -0.0021]	141

Note: Dependent variables are monthly changes in the logarithm of real credit. Core controls are Δ ln(industrial production), Δ ln(USD/TRY), Δ commercial lending rate, one lag of credit growth, and calendar-month indicators. Newey-

West HAC standard errors use maxlags=12. Alternative financing-control rows replace the commercial lending-rate change as indicated. Sovereign-exposure coefficients are rescaled to the effect of a one-percentage-point monthly increase in government securities relative to banking assets. Net-borrowing coefficients use percentage points of net domestic borrowing relative to banking assets.

The negative sovereign-exposure association survives replacement of the commercial lending rate with the CBRT policy rate and remains significant in the shorter real-Treasury-cost robustness sample. For total loans the association is also negative and significant, while the SME estimate is negative but only marginally significant. By contrast, none of the net-borrowing flow coefficients in the three credit outcomes is negative and statistically significant. The cross-model pattern therefore points more clearly toward a bank portfolio-allocation association than toward mechanical crowding-out from current net borrowing.

Figure 3. Sovereign-Exposure Coefficient under Alternative Financing-Condition Controls



Note: Points report the coefficient associated with a one-percentage-point monthly increase in government securities relative to banking-sector assets in commercial-credit-growth models. Horizontal bars are 95% confidence intervals. All estimates are associations, not causal effects.

The flow-based ARDL sensitivity model does not replace the reference ARDL. Although its bounds statistic is 7.993, the commercial-credit flow UECM has an error-correction coefficient of -0.0130 ($p=0.395$) and adverse ARCH and normality diagnostics. Its normalized long-run flow multiplier is therefore reported only as sensitivity evidence. The more parsimonious conclusion is that the official borrowing flow does not provide a robust negative crowding-out signal in the short-run HAC results, while the long-run flow specification is too weak diagnostically to serve as the headline model.

4.3. Structural Breaks, Directionality, and Hypothesis Assessment

The sample spans several policy and financial regimes, so a constant full-sample coefficient should not be assumed. Zivot-Andrews tests identify variable-specific endogenous break dates, reported in Appendix Table A2. A global SSR/BIC search applied to the short-run flow and sovereign-exposure equations selects December 2021 as the preferred single break in both systems. For the flow equation, a two-break specification identifying April 2018 and December 2021 is near-competitive in BIC. Break-specific HAC estimates reinforce the regime-sensitive interpretation. Net domestic borrowing relative to banking assets remains statistically insignificant in both one-break subsamples ($\beta=0.0088$, $p=0.266$ before December 2021; $\beta=0.0499$, $p=0.554$ thereafter), providing no negative flow-based displacement signal. Sovereign exposure remains negative in both subsamples ($\beta=-0.0292$ per one percentage point, $p=0.005$ before December 2021; $\beta=-0.0371$, $p=0.123$ thereafter), although statistical precision weakens in the 24-month post-break segment. The evidence therefore concerns endogenous regime sensitivity rather than researcher-defined crisis dummies.

The break evidence is consequently interpreted through endogenously identified dates and break-specific estimates. The detailed two-break and holder-share robustness results are reported in Appendix Table A5.

Directionality tests add a further qualification. With p=1, dmax=1, and an augmented VAR(2), the null that net domestic borrowing does not predict commercial credit cannot be rejected ($p=0.871$), and the same is true for the direction from sovereign exposure to commercial credit ($p=0.131$). Reverse-direction tests are also insignificant. The negative sovereign-exposure coefficient should therefore be described as a contemporaneous short-run association whose causal direction remains unresolved.

Table 6. Endogenous Structural-Break, Break-Specific, and Directionality Evidence

Evidence	Model / direction	Break / statistic	BIC / p	Interpretation
Zivot-Andrews	Baseline and mechanism variables	Variable-specific endogenous dates	See Appendix A2	Breaks are determined from the data rather than imposed as crisis dummies
Endogenous break search	Flow model, 1 break	2021-12	BIC=-1147.921	Preferred flow break structure
Endogenous break search	Flow model, 2 breaks	2018-04; 2021-12	BIC=-1146.666	Near-competitive flow specification
Endogenous break search	Sovereign-exposure model, 1 break	2021-12	BIC=-1172.555	Preferred nexus break structure
Break-specific HAC	Flow: 2010-03–2021-11	β=0.0088	p=0.266	No negative flow displacement
Break-specific HAC	Flow: 2021-12–2023-11	β=0.0499	p=0.554	No negative flow displacement
Break-specific HAC	Sovereign exposure: 2010-03–2021-11	β=-0.0292 per 1 pp	p=0.005	Negative association
Break-specific HAC	Sovereign exposure: 2021-12–2023-11	β=-0.0371 per 1 pp	p=0.123	Negative sign; imprecise in short segment
Toda-Yamamoto	Net borrowing/assets → commercial credit	Wald χ^2=0.026	p=0.871	No directionality at 5%
Toda-Yamamoto	Commercial credit → net borrowing/assets	Wald χ^2=0.355	p=0.551	No directionality at 5%
Toda-Yamamoto	Sovereign exposure → commercial credit	Wald χ^2=2.280	p=0.131	No directionality at 5%
Toda-Yamamoto	Commercial credit → sovereign exposure	Wald χ^2=1.349	p=0.245	No directionality at 5%

Note: The global break search compares zero to three break structures by SSR and BIC with a minimum segment length of 24 months, following Bai-Perron logic. Break-specific HAC specifications use the same short-run controls and Newey-West maxlags=12 as Table 5. Toda-Yamamoto tests use BIC-selected p=1, dmax=1, and an augmented VAR(2); Wald restrictions are applied only to the original p lag. Failure to reject is not evidence of no economic relationship.

Table 7. Hypothesis Assessment

Hypothesis	Assessment	Evidence
H1	Not supported in the full-sample reference model	Baseline long-run debt multiplier = -0.331, p=.544, 95% CI [-1.398, 0.737]. The official net-borrowing flow separately provides no negative short-run displacement evidence.
H2	Supported	Baseline long-run Treasury borrowing-cost multiplier = -0.0637, p=.039; alternative lending/policy-rate controls are consistent with a financing-condition channel.
H3	Supported in the baseline long run	Baseline long-run USD/TRY multiplier = -0.575, p=.017; short-run exchange-rate coefficients are not interpreted as a universal effect.
H4	Supported in the baseline long run	Baseline long-run industrial-production multiplier = 2.070, p=.002.
H5	Supported as an association	Sovereign exposure is negatively associated with commercial-credit growth (about -0.0298 log points per 1 pp, p=.0026); Toda-Yamamoto does not establish one-way causality.

5. CONCLUSION AND POLICY IMPLICATIONS

This paper examines whether domestic public borrowing crowds out private credit in Türkiye and, more importantly, whether the observed debt-credit relationship is better characterised by a quantity mechanism, a sovereign-bank portfolio channel, or common macro-financial dynamics. The expanded evidence does not support a stable full-sample version of the conventional crowding-out hypothesis in which a larger domestic public-debt position mechanically displaces commercial credit. The normalized long-run debt coefficient is negative but statistically insignificant, and the official flow of net domestic borrowing is not negatively associated with short-run commercial-credit growth.

At the same time, the absence of a robust quantity-based result should not be interpreted as evidence that sovereign financing is irrelevant for private lending. A narrower banking-channel result is visible. Increases in domestic government securities relative to banking-sector assets are associated with weaker real commercial-credit growth. The association is economically non-trivial and remains significant when the financing-condition control is changed from the commercial lending rate to the CBRT policy rate and when an ex-post real Treasury borrowing-cost measure is used. Total-loan results point in the same direction, while the SME estimate is weaker.

The directionality and structural-break evidence prevents this result from being interpreted as a simple causal chain. Toda-Yamamoto tests do not establish conventional one-way predictive causality from sovereign exposure to commercial credit. The endogenous break search instead identifies December 2021 as the preferred single break in both the flow and sovereign-exposure equations, with April 2018 appearing in a near-competitive two-break flow specification. Break-specific HAC estimates show no negative net-borrowing relationship in either one-break subsample, while the sovereign-exposure coefficient remains negative on both sides of the 2021 break but becomes imprecisely estimated in the shorter post-break segment. The appropriate inference is therefore regime-sensitive association rather than a time-invariant causal effect.

The baseline long-run relation should also be interpreted cautiously. Although the bounds test strongly rejects the null of no level relationship, the estimated error-correction speed is only about 2.2% per month, implying a half-life of roughly 31 months. In addition, stability diagnostics are not uniform: the CUSUM statistic does not reject coefficient stability, but the baseline RESET test rejects at the 5% level and the CUSUM-of-squares path crosses its 95% simulated band. These results reinforce the decision to describe the full-sample ARDL as a reference relationship rather than as a time-invariant structural model.

The policy implication is therefore narrower than a mechanical crowding-out prescription. The estimates do not imply that reducing domestic borrowing would automatically increase private credit, nor that a change in interest-rate or exchange-rate policy would mechanically produce a particular lending response. They do suggest that debt management should be evaluated together with the financing environment and the way sovereign instruments interact with bank portfolios. Monitoring bank sovereign exposure alongside lending conditions may be useful when assessing potential portfolio-allocation pressures in a bank-based financial system.

Several limitations remain. The analysis is based on aggregate monthly time series and cannot identify bank-level heterogeneity or structural causal effects. The commercial-credit measure is a consistently constructed official-data residual rather than a single headline BDDK label, although the full-sample construction and alternative total-loan and SME outcomes substantially reduce measurement uncertainty. The sample also contains pronounced regime shifts, and the break evidence indicates that a single full-sample coefficient cannot summarise all periods equally well. Future work could use bank-level balance sheets, local projections or structural identification strategies, and richer measures of sovereign holdings to distinguish causal portfolio reallocation from common responses to macro-financial shocks.

For other bank-based emerging economies, the broader implication is that the public-debt stock, the current public-borrowing flow, and banks' sovereign-securities exposure should not be treated as interchangeable proxies for a single crowding-out mechanism. A weak aggregate debt-stock coefficient can coexist with a portfolio-allocation association on bank balance sheets. Empirical work in comparable systems should therefore distinguish financing demand from the identity of debt holders and the composition of bank assets before drawing conclusions about private-credit displacement.

Overall, the Turkish evidence is most consistent with a conditional fiscal-financial relationship. A stable quantity-based crowding-out effect is not established for the full sample, while a negative sovereign-exposure association is visible in the banking channel. Financing conditions, portfolio composition, and regime changes therefore provide a more defensible interpretation of the debt-credit relationship than either a mechanical crowding-out claim or an equally strong claim that public borrowing is irrelevant for private credit.

DECLARATIONS

Generative AI Statement: Generative artificial intelligence tools were used solely for language editing and improving the clarity of the text during the preparation of this study. These tools were not used to produce research data, perform statistical analysis, interpret findings, or generate scientific conclusions. The authors have critically reviewed all AI-assisted content and take full responsibility for the accuracy, integrity, and originality of the published study.

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Conflict of Interest Statement: The authors declare that they have no financial, commercial, personal, or professional conflict of interest that could have influenced the conduct, analysis, interpretation, or publication of this research.

Data Availability Statement: This study uses secondary data compiled from the Republic of Türkiye Ministry of Treasury and Finance (HMB), the Banking Regulation and Supervision Agency (BDDK), the Central Bank of the Republic of Türkiye Electronic Data Delivery System (EVDS), TÜİK official statistics, and OECD Main Economic Indicators accessed through FRED, all of which are publicly available from the respective institutions' data portals.

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APPENDIX

Table A1. Full ADF and KPSS Unit-Root Diagnostics

Variable	Form	ADF	p	lag	ADF CV 1/5/10%	KPSS	p	bw	KPSS CV 1/5/10%
ln(real commercial credit)	Level	-2.996	0.035	6	-3.472/-2.880/-2.576	1.751	0.010	8	0.739/0.463/0.347
ln(real commercial credit)	First difference	-4.533	<0.001	5	-3.472/-2.880/-2.576	0.784	0.010	1	0.739/0.463/0.347
ln(real domestic debt)	Level	-2.043	0.268	1	-3.471/-2.879/-2.576	0.251	0.100	8	0.739/0.463/0.347
ln(real domestic debt)	First difference	-9.820	<0.001	0	-3.471/-2.879/-2.576	0.077	0.100	5	0.739/0.463/0.347
Treasury borrowing cost (%)	Level	-0.173	0.942	14	-3.474/-2.881/-2.577	1.284	0.010	8	0.739/0.463/0.347
Treasury borrowing cost (%)	First difference	-4.358	<0.001	13	-3.474/-2.881/-2.577	0.156	0.100	3	0.739/0.463/0.347
ln(industrial production)	Level	-1.518	0.524	5	-3.472/-2.880/-2.576	1.863	0.010	8	0.739/0.463/0.347
ln(industrial production)	First difference	-7.977	<0.001	4	-3.472/-2.880/-2.576	0.204	0.100	26	0.739/0.463/0.347
ln(USD/TRY)	Level	2.352	0.999	0	-3.470/-2.879/-2.576	1.850	0.010	8	0.739/0.463/0.347
ln(USD/TRY)	First difference	-11.407	<0.001	0	-3.471/-2.879/-2.576	0.604	0.022	2	0.739/0.463/0.347

Note: ADF includes a constant and uses AIC lag selection. KPSS includes a constant and uses automatic bandwidth selection. Reported critical values are series-specific for ADF and standard KPSS critical values. The mixed results are interpreted jointly rather than converted mechanically into a single I(0)/I(1) label.

Table A2. Zivot-Andrews Unit-Root Tests with Endogenous Breaks

Variable	ZA stat	p	Break	lag	1%	5%	10%	5% decision
ln(real commercial credit)	-3.700	0.699	2018-08	6	-5.576	-5.073	-4.827	Do not reject
ln(real domestic debt)	-4.924	0.076	2020-01	1	-5.576	-5.073	-4.827	Do not reject
Treasury borrowing cost (%)	-4.444	0.238	2021-01	11	-5.576	-5.073	-4.827	Do not reject
ln(industrial production)	-6.059	0.002	2018-08	0	-5.576	-5.073	-4.827	Reject
ln(USD/TRY)	-3.697	0.701	2021-09	0	-5.576	-5.073	-4.827	Do not reject
commercial lending rate (%)	-4.215	0.364	2019-09	1	-5.576	-5.073	-4.827	Do not reject
policy rate (%)	-4.616	0.166	2018-05	3	-5.576	-5.073	-4.827	Do not reject
government securities / assets	-3.437	0.841	2012-10	0	-5.576	-5.073	-4.827	Do not reject
net domestic borrowing / banking assets (%)	-10.009	<0.001	2020-08	0	-5.576	-5.073	-4.827	Reject

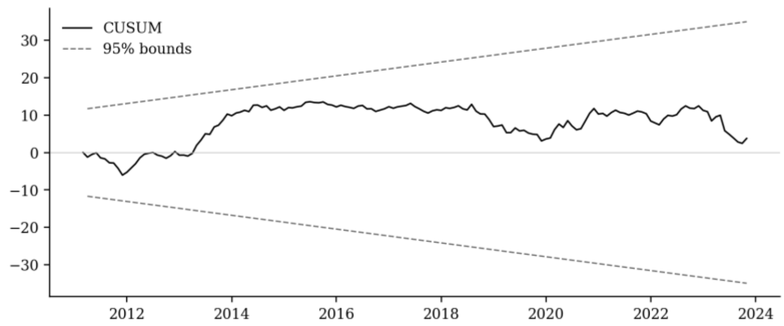
Note: Regression specification includes a constant and trend. The null is a unit root with a one-time endogenous structural break. These tests complement rather than replace the ADF/KPSS evidence.

Table A3. Residual and Stability Diagnostics

Model	LB p(6)	LB p(12)	ARCH p	JB p	RESET p	CUSUM p	CUSUMSQ
Baseline ARDL/UECM	0.530	0.493	0.857	0.079	0.018	0.910	Crosses 95% band
Commercial-credit flow UECM	0.106	0.499	<0.001	<0.001	0.188	0.975	Not reported
Total-loans flow UECM	0.010	0.086	<0.001	<0.001	0.202	0.995	Not reported
Commercial-credit policy-rate flow UECM	0.006	0.072	<0.001	<0.001	0.954	0.984	Not reported

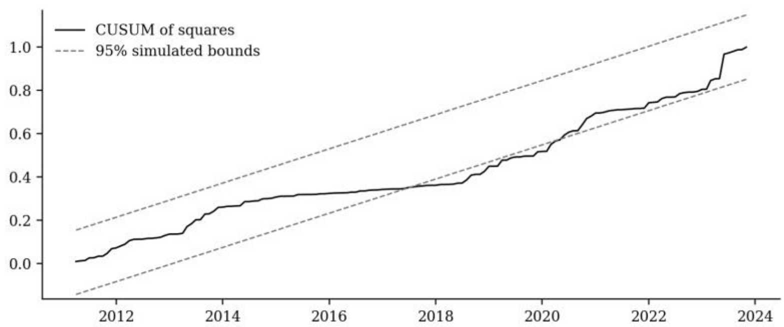
Note: Baseline CUSUMSQ uses recursive residuals and Monte Carlo 95% simultaneous bands under the stable Gaussian null (200,000 draws). The mixed baseline diagnostics motivate the regime-sensitive interpretation. Flow-based ARDL specifications are treated as sensitivity models because ARCH and normality diagnostics are adverse.

Figure A1. CUSUM Stability Plot for the Baseline UECM



Note: Dashed lines are the 95% Brown-Durbin-Evans CUSUM boundaries.

Figure A2. CUSUM of Squares for the Baseline UECM



Note: Dashed lines are Monte Carlo 95% simultaneous bands around the expected CUSUMSQ path under parameter and variance constancy. The path crosses the lower band, indicating variance/specification instability during part of the sample.

Table A4. Flow-Based ARDL Sensitivity and Long-Run Multipliers

Model	ARDL order	Bounds F	ECT	ECT p	5% I(0)	5% I(1)
Commercial credit + real net borrowing flow + commercial lending rate	(2, 1, 1, 1, 2)	7.993	-0.0130	0.395	2.943	4.097
Total loans + real net borrowing flow + commercial lending rate	(1, 2, 1, 1, 2)	8.117	-0.0298	0.064	2.943	4.097
Commercial credit + real net borrowing flow + policy rate	(1, 1, 1, 1, 2)	4.318	-0.0160	0.310	2.943	4.097

Note: Case III finite-sample critical values are based on 20,000 simulations. For these flow specifications the I(0)/I(1) values are 2.484/3.563 at 10%, 2.943/4.097 at 5%, and 3.885/5.181 at 1%. These models complement the stock-based reference specification.

Model	Variable	LR multiplier	SE	p	95% CI
Commercial-credit flow ARDL	Real net domestic borrowing	0.1134	0.1204	0.348	[-0.124, 0.351]
Commercial-credit flow ARDL	Commercial lending rate	-0.0825	0.1093	0.452	[-0.298, 0.133]
Commercial-credit flow ARDL	ln industrial production	2.3007	1.9820	0.248	[-1.615, 6.216]
Commercial-credit flow ARDL	ln USD/TRY	-1.1290	1.1347	0.321	[-3.371, 1.113]
Total-loans flow ARDL	Real net domestic borrowing	0.0636	0.0301	0.037	[0.004, 0.123]
Total-loans flow ARDL	Commercial lending rate	-0.0284	0.0211	0.180	[-0.070, 0.013]
Total-loans flow ARDL	ln industrial production	2.1263	0.7543	0.005	[0.636, 3.616]
Total-loans flow ARDL	ln USD/TRY	-0.4911	0.2494	0.051	[-0.984, 0.002]

Note: Delta-method inference is shown for the newly estimated flow specifications. The commercial-credit flow model has an insignificant ECT and is not used as the headline long-run model.

Table A5. Additional Subsample and Holder-Share Robustness

Specification	Period	β	p	95% CI	N
Flow	2010-03–2021-11	0.0088	0.266	[-0.0067, 0.0242]	141
Flow	2021-12–2023-11	0.0499	0.554	[-0.1154, 0.2152]	24
Sovereign exposure	2010-03–2021-11	-0.0292	0.005	[-0.0498, -0.0087]	141
Sovereign exposure	2021-12–2023-11	-0.0371	0.123	[-0.0843, 0.0101]	24
Δ banking-sector share of domestic debt (pp)	Full sample	0.0015	0.492	[-0.0028, 0.0059]	165
Δ public-bank share of domestic debt (pp)	Full sample	0.0101	0.092	[-0.0016, 0.0218]	165

Note: Sovereign-exposure subsample coefficients are rescaled to a one-percentage-point change. Holder-share models use monthly percentage-point changes in HMB debt-holder shares and HAC standard errors.

Table A6. Complete Data Dictionary for Baseline and Extension Variables

Variable	Institution / code	Original unit	Frequency / SA	Deflator	Transformation	Coverage / use
Commercial and other loans	BDDK Monthly Bulletin Table 3	Million TL	Monthly / NSA	CPI (2015=100)	Total loans - consumer loans - credit cards; real; ln	2010-01–2023-11 / main outcome
Total loans	BDDK Monthly Bulletin Table 3	Million TL	Monthly / NSA	CPI (2015=100)	Real; ln	2010-01–2023-11 / alternative outcome
SME loans	BDDK Monthly Bulletin Table 6	Million TL	Monthly / NSA	CPI (2015=100)	Real; ln	2010-01–2023-11 / alternative outcome
Domestic public debt stock	HMB central-government debt-stock statistics	Million TL	Monthly / NSA	CPI (2015=100)	Real; ln	2010-01–2023-11 / baseline fiscal stock
Net domestic borrowing	HMB Central Government Budget Balance and Financing: İÇ BORÇLANMA (NET)	Million TL	Monthly / NSA	CPI (2015=100)	Real level; also scaled by bank assets	2010-01–2023-11 / flow mechanism
Government securities / bank assets	BDDK Monthly Bulletin Table 8 + banking-sector balance sheet	Ratio	Monthly / NSA	None	Level; monthly change in percentage points	2010-01–2023-11 / sovereign-bank nexus
Treasury borrowing cost	HMB İç Borçlanmanın Ortalama Maliyeti	% annual compound	Monthly / NSA	None	Level; first difference where specified	2010-01–2023-11 / baseline cost
Commercial lending rate	TCMB EVDS TP.KTF17	%	Monthly / NSA	None	Level; monthly change	2010-01–2023-11 / short-run control
Policy rate	TCMB EVDS TP.BISPOLFAIZ.TUR	%	Monthly / NSA	None	Level; monthly change	2010-01–2023-11 / alternative control
CPI	TCMB EVDS TP.FG.J0	Index	Monthly / NSA	—	Rebased so 2015 average=100	2010-01–2023-11 / deflator
Inflation	Constructed from TCMB EVDS TP.FG.J0	% y/y	Monthly / NSA	—	12-month CPI change	2011-01–2023-11 / real-cost robustness
USD/TRY, baseline	OECD MEI via FRED CCUSSP01TRM650N	USD per national currency in source orientation	Monthly / end-of-period	None	Reciprocal where required to TRY/USD; ln	2010-01–2023-11 / baseline FX
USD/TRY, extensions	TCMB EVDS TP.DK.USD.A.YTL	TRY/USD	Monthly average / NSA	None	ln; monthly change where specified	2010-01–2023-11 / extension FX

Variable	Institution / code	Original unit	Frequency / SA	Deflator	Transformation	Coverage / use
Industrial production	OECD MEI via FRED TURPROINDMISMEI	Index, 2015=100	Monthly / SA	None	ln	2010-01–2023-11 / real activity
Real Treasury cash borrowing cost	HMB cash borrowing cost + TCMB CPI	Percentage points	Monthly / NSA	YoY CPI inflation	Nominal cash borrowing cost minus inflation	141 usable observations / robustness
Banking-sector share of domestic debt	HMB domestic debt by holder	%	Monthly / NSA	None	Monthly percentage-point change	2010-01–2023-11 / holder-share check
Public-bank share of domestic debt	HMB domestic debt by holder	%	Monthly / NSA	None	Monthly percentage-point change	2010-01–2023-11 / public-bank check

Note: NSA denotes not seasonally adjusted and SA denotes seasonally adjusted. Monetary series are kept in source units during construction; descriptive tables convert million TL to billion TL where stated. The baseline and extension exchange-rate series are documented separately because they use different timing conventions and are not silently spliced.

Table A7. ADF and KPSS Diagnostics for Additional Model Variables

Variable	Form	ADF statistic (lag)	ADF p	KPSS statistic (bw)	KPSS p
ln(real total loans)	Level	-3.015 (6)	0.033	1.718 (8)	0.010
ln(real total loans)	First difference	-4.375 (5)	<0.001	0.798 (2)	0.010
ln(real SME loans)	Level	-3.220 (1)	0.019	1.620 (8)	0.010
ln(real SME loans)	First difference	-9.690 (0)	<0.001	0.567 (3)	0.027
real net domestic borrowing (bn TL, 2015 prices)	Level	-4.153 (2)	<0.001	1.027 (7)	0.010
real net domestic borrowing (bn TL, 2015 prices)	First difference	-5.812 (12)	<0.001	0.067 (8)	0.100
net domestic borrowing / banking assets (%)	Level	-8.380 (0)	<0.001	0.574 (6)	0.025
net domestic borrowing / banking assets (%)	First difference	-8.730 (4)	<0.001	0.184 (12)	0.100
commercial lending rate (%)	Level	-0.965 (10)	0.766	1.169 (8)	0.010
commercial lending rate (%)	First difference	-4.429 (9)	<0.001	0.184 (6)	0.100
policy rate (%)	Level	-2.064 (3)	0.259	1.143 (8)	0.010
policy rate (%)	First difference	-2.336 (2)	0.161	0.176 (7)	0.100
government securities / assets	Level	-5.694 (0)	<0.001	1.293 (8)	0.010
government securities / assets	First difference	-5.045 (2)	<0.001	1.290 (6)	0.010

Note: Both tests include a constant. ADF lags are selected by AIC and KPSS bandwidths automatically. Full test-specific critical values are contained in the underlying diagnostics; the table reports the additional variables used in robustness and mechanism models. None of the evidence indicates an I(2) process.