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Gonzalo Romero[1]

1. *University of Toronto – Rotman School of Management ORCID: 0000-0002-5529-3117 Email: gonzalo.romeroyanez@utoronto.ca*

Macro-Financial Spillovers to Canada U.S. Rate Shocks, Housing Leverage, and Bank Stability Channels

Abstract

This study examines how U.S. monetary policy shocks are transmitted to the Canadian financial system, with particular emphasis on housing leverage and banking-sector stability. monetary policy shocks to the Canadian financial system, with particular emphasis on housing leverage and banking-sector stability. Using a macro-financial framework, the paper analyses how U.S. interest rate increases propagate through cross-border financial linkages, affect household balance sheets, and influence Canadian banks' risk exposure. The analysis combines macroeconomic indicators, housing market leverage metrics, and bank-level stability measures to find the most important spillover channels. Empirical evidence suggests that elevated household indebtedness amplifies external monetary shocks, increasing vulnerability within the banking sector through credit quality deterioration and funding cost pressures. The findings highlight the critical role of macroprudential regulation in mitigating spillover risks and preserving financial stability in small, open economies closely integrated with the U.S. financial markets. Policy implications are discussed in the context of coordinated monetary and macroprudential responses.

Keywords: Monetary policy spillovers; U.S. interest rate shocks; household leverage; housing finance; bank stability

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1.Introduction

Financial systems in small open economies are increasingly shaped by external monetary conditions, particularly when domestic markets are deeply integrated with global capital flows and exposed to cross-border banking and funding networks. Canada is a salient case: its financial system is sophisticated, highly concentrated, and tightly linked—directly and indirectly—to U.S. External monetary and financial conditions significantly influence Canada's financial system. At the same time, Canada's macro-financial landscape features a structurally important housing sector and persistently elevated household indebtedness, which together can amplify the sensitivity of domestic balance sheets to changes in global interest rates. Against this background, the central question of this paper is how U.S. interest rate shocks transmit into Canada through macro-financial spillover channels and how this transmission is conditioned by housing leverage and bank stability mechanisms. The premise of macro-financial spillovers is straightforward: a policy-induced increase in U.S. interest rates may tighten global financial conditions, alter risk appetite and term premia, shift the relative attractiveness of U.S.-dollar assets, and reprice funding across markets. For Canada, these effects can materialise through multiple pathways, including exchange rate movements, cross-border portfolio reallocations, and changes in wholesale funding costs for Canadian financial institutions. However, the magnitude and persistence of spillovers depend critically on domestic frictions and balance-sheet structures. A key contribution of contemporary macro-finance is the recognition that household leverage and bank balance-sheet constraints are not merely passive reflectors of interest-rate movements; they are active amplifiers that can transform a common shock into nonlinear and potentially destabilising dynamics. This paper focuses on three interrelated channels: (i) (i) the external interest-rate channel, capturing the direct spillover of U.S. rate movements to Canadian financial conditions; (ii) the housing leverage channel, capturing how household indebtedness and mortgage-market characteristics amplify the effect of higher rates on consumption, collateral values, and default risk; and (iii) the bank stability channel, capturing how asset quality, funding costs, capital buffers, and liquidity conditions interact to shape the resilience of Canadian banks under adverse financial conditions. First, the external interest-rate channel is motivated by Canada's exposure to global financial conditions and the prominence of U.S. monetary policy as a global factor in risk-free benchmarks and pricing kernels. Even in a regime of independent monetary policy, external shocks can compress policy autonomy in practice if exchange-rate pass-through, imported financial conditions, and market expectations constrain domestic responses. The spillover may appear in Canadian bond yields, mortgage rates, corporate credit spreads, and bank funding costs. The result is a broad tightening of financial conditions that can depress interest-sensitive spending and raise debt-service burdens. These effects are rarely uniform: they depend on the maturity structure of outstanding debt, the prevalence of floating versus fixed borrowing rates, and the elasticity of refinancing. Second, the housing leverage channel is central because housing is both a real asset and a financial contract nexus. Mortgage credit links household income streams to housing collateral values, and housing price dynamics feed back into credit supply through underwriting standards and loan-to-value constraints. When households are highly leveraged, a rise in interest rates affects the economy through a debt-service channel: as mortgage payments reset or refinancing occurs at higher rates, a larger share of household income is allocated to debt service, reducing discretionary spending and increasing the likelihood of delinquency. In addition, there is a collateral channel: higher discount rates can compress house prices, weakening household net worth and increasing the probability of negative equity for marginal borrowers. The combination of higher payments and weaker collateral can increase credit losses and reduce credit growth, propagating the shock from households to the banking system. Third, the bank stability channel captures how the shock is transmitted and

potentially amplified within the financial sector. Canadian banks are generally well capitalised and regulated, yet they are also materially exposed to residential mortgage markets and to macroeconomic conditions that shape borrower performance. A U.S. rate shock can raise banks' marginal cost of funds directly through wholesale funding markets and indirectly through tighter liquidity conditions and changes in market risk premia. Meanwhile, weakening household balance sheets and softer housing prices can raise expected credit losses. Bank stability is not solely a function of solvency; it is also a function of liquidity and confidence. When funding costs increase and asset quality deteriorates simultaneously, banks may respond by tightening lending standards, reducing credit supply, or repricing credit—actions that can depress economic activity and further impair borrower performance. This dynamic constitutes a classic financial accelerator mechanism: balance-sheet constraints and risk-sensitive pricing can turn a moderate shock into a persistent drag on output and financial stability. A notable feature of the Canadian context is the interaction between household leverage and bank exposure. Elevated household indebtedness can be sustainable under stable income and low rates, but it becomes more fragile under rising rates—especially if income growth slows or unemployment rises. In such conditions, the distribution of leverage matters: a concentrated pocket of highly leveraged borrowers can generate outsized credit losses relative to aggregate metrics. Similarly, the structure of mortgage contracts and the timing of rate resets determine how rapidly higher rates pass through to household cash flows. The resulting risk is therefore not merely macroeconomic; it is macro-financial and contingent on institutional details of the mortgage market and banking regulation. This paper develops an integrated macro-financial framework to quantify these mechanisms and evaluate their policy relevance. Conceptually, the analysis treats U.S. rate shocks as an external driver of Canadian financial conditions and examines how these shocks transmit into household and bank balance sheets. Empirically, the study links three classes of outcomes: (i) (i) macro-financial indicators in Canada (e.g., domestic yields, credit spreads, exchange rates, and real activity proxies); (ii) housing leverage measures (e.g., household debt-to-income, debt-service ratios, mortgage credit growth, and house price indices); and (iii) bank stability measures (e.g., capital ratios, funding spreads, non-performing loan proxies, and market-based indicators of bank risk). The joint evaluation of these components allows the paper to distinguish between direct spillovers (financial conditions moving with U.S. rates) and amplification (spillovers translating into larger deterioration in domestic balance sheets and bank stability). The research objective is threefold. The first objective is identification: to isolate U.S. rate shocks that are plausibly exogenous to Canadian conditions and to trace their dynamic effects on Canadian macro-financial variables. The second objective is amplification assessment: to determine whether periods of higher housing leverage correspond to larger spillover effects on household stress and bank stability. The third objective is policy interpretation: to evaluate the extent to which macroprudential tools—such as mortgage underwriting constraints, capital buffers, and liquidity requirements—can dampen spillover amplification, thereby enhancing resilience without requiring mechanically tighter domestic monetary policy. Two practical motivations make the topic particularly relevant. The first is that the global post-pandemic environment has emphasised the speed with which international financial conditions can tighten, raising concerns about spillovers to housing markets and banking systems with large mortgage exposures. The second is that housing-related vulnerabilities are often slow-moving but powerful: leverage can build during prolonged periods of low rates and supportive credit conditions, only to become a significant amplifier when global rates rise. Understanding the interaction of these forces is essential for designing coherent policy frameworks that balance price stability, sustainable credit growth, and financial stability. The remainder of the paper proceeds as follows. The next section describes the materials and methods, including data construction, shock identification, and the econometric strategy to trace

spillover dynamics. The subsequent section reports results, including baseline impulse responses and heterogeneity by leverage regimes, as well as a focused decomposition of the housing leverage and bank stability channels (Section 3.1 and Section 3.1.1). Fig. 1 presents the conceptual transmission mechanism linking the U.S. rate shocks to Canadian housing leverage and bank stability outcomes, while Table 1 summarises the key variables and descriptive statistics (and/or baseline regression estimates, depending on specification). The discussion section interprets results in light of macro-financial theory and policy design, and the conclusion synthesizes implications for Canada and comparable small open economies.

2.Materials and Methods

2.1.Conceptual framework and identification strategy

This study is designed to quantify the dynamic transmission of U.S. monetary policy tightening to Canada and to isolate two amplification mechanisms: (i) (i) housing leverage and (ii) banking-system stability. The empirical design separates shock identification from domestic propagation. Identification focuses on extracting U.S. interest-rate shocks that are plausibly orthogonal to contemporaneous Canadian macroeconomic conditions; propagation focuses on tracing their effects on Canadian financial conditions, housing-sector vulnerability, and bank stability outcomes over time. The conceptual transmission mechanism (reported as Fig. 1) posits three sequential blocks. Block A maps the U.S. policy tightening shock into a set of Canadian financial conditions (long yields, mortgage rates, credit spreads, funding spreads, and the exchange rate). Block B translates these financial conditions into household cash-flow stress and collateral dynamics (debt-service burdens, house prices, mortgage credit growth, and delinquency risk). Block C maps household-sector deterioration and funding repricing into bank stability outcomes (credit-loss proxies, capital adequacy, liquidity metrics, and market-based bank risk indicators). This structure motivates the empirical measurement strategy and guides the variable selection summarised in **Table 1**.

2.2.Data construction and sample design

The dataset is constructed at monthly frequency, which balances (i) (i) the need to capture financial market adjustments promptly and (ii) the availability and interpretability of leverage and banking stability measures. Where variables are naturally available at quarterly frequency (e.g., household balance sheet ratios or bank capital ratios), they are aligned to monthly frequency using standard temporal alignment techniques (e.g., constant interpolation within quarters) for impulse-response estimation; robustness checks re-estimate core models at quarterly frequency to ensure results are not artefacts of interpolation. The analysis spans a multi-year sample intended to include multiple U.S. monetary tightening and easing cycles to improve identification power and reduce dependence on any single episode. All series are seasonally adjusted where appropriate. Continuous variables are transformed as follows: interest rates and spreads in levels (basis points), real activity and price indices in log levels or log differences depending on stationarity diagnostics, and leverage ratios in levels with optional de-meaning for interpretation.

Canadian macro-financial variables (Block A) include government yields (short and long), mortgage interest rates, corporate bond spreads, bank funding spreads where available, equity/financial conditions proxies, and CAD/USD exchange rates.

Housing leverage variables (Block B) include household debt-to-disposable-income, debt-service ratios, mortgage credit growth, house price indices, and mortgage arrears/delinquency proxies.

Bank stability variables (Block C) include regulatory capital ratios (e.g., CET1), liquidity measures (e.g., liquid assets or liquidity coverage proxies), asset quality measures (e.g., impaired loans/non-performing exposures), profitability buffers, and—if used—market-based risk indicators (e.g., bank equity volatility or distance-to-default proxies). Table 1 reports definitions, units, transformations, and summary statistics for all primary variables.

2.3.Measurement of U.S. rate shocks

The key explanatory impulse is a **U.S. rate shock**. The paper adopts a two-layer approach, selecting one primary identification method and validating it with alternatives.

1. **Primary shock series (baseline): high-frequency or event-window surprise** The baseline approach measures U.S. monetary policy shocks using changes in interest rate instruments in narrow windows around U.S. policy announcements (and closely related communications), interpreted as unexpected policy surprises. This strategy is commonly used to separate the unexpected component from anticipated policy paths embedded in markets. The identified shock is then aggregated to monthly frequency (e.g., summed or averaged across events within each month). This provides a shock series with a clear timing convention and minimal contamination by Canadian contemporaneous conditions.
2. **Alternative shock series (robustness): external instrument or narrative shock** As robustness, the study considers instrument-based identification, using an external U.S. policy surprise measure as an instrument for broader U.S. interest rate movements, or narrative shocks that isolate exogenous components of policy changes. These alternatives are used to test whether estimated spillovers depend materially on the baseline shock construction.

2.4.Econometric model: local projections with state dependence

To capture spillovers and nonlinear amplification, the paper employs **local projections (LP)** to estimate impulse responses. LP is well-suited for multi-variable macro-financial transmission because it is flexible, robust to model misspecification relative to tightly parameterized VARs, and readily accommodates **state dependence** (e.g., high leverage regimes).

For each Canadian outcome y_{t+h}, the baseline LP specification is:

$$y_{t+h} = \alpha_h + \beta_h \, \text{Shock}_t + \Gamma_h' X_t + \varepsilon_{t+h},$$

where $h = 0,1,\dots,H$ denotes the horizon in months, Shock_t is the U.S. rate shock, and X_t is a control set including lags of Canadian and U.S. macro-financial variables (and, where appropriate, lags of the dependent variable). Standard errors are computed using heteroskedasticity- and autocorrelation-consistent (HAC) estimators appropriate for LP.

To test amplification by housing leverage, the model is extended to a **state-dependent LP**:

$$y_{t+h} = \alpha_h + \beta_h \, \text{Shock}_t + \delta_h\left(\text{Shock}_t \times \text{LeverageState}_t\right) + \Gamma_h' X_t + \varepsilon_{t+h}.$$

Here, LeverageState_t can be specified as:

- a binary indicator (e.g., above/below median household debt-to-income),
- a smooth transition function (e.g., logistic transformation of leverage), or
- a percentile-based regime classification (e.g., top tercile vs others).

The coefficient δ_h measures differential responses under high-leverage states. A parallel state-dependent specification is estimated for bank stability outcomes to assess whether banking fragility states (e.g., lower capital buffers or higher funding spreads) also condition spillovers.

Channel decomposition and sequencing

While the LP approach estimates reduced-form responses, the paper operationalizes channel interpretation through a structured sequence:

- **Step 1 (Spillover to Canadian financial conditions):** estimate responses of yields, mortgage rates, spreads, and the exchange rate to Shock_t.
- **Step 2 (Housing leverage amplification):** estimate responses of debt-service ratios, house prices, mortgage credit growth, and delinquency proxies, including leverage-state interactions.
- **Step 3 (Bank stability transmission):** estimate responses of bank asset quality and capital/liquidity indicators, focusing on whether housing-sector stress indicators and funding cost measures co-move in a manner consistent with the bank stability channel.

To reinforce causal interpretation of sequencing, the study reports timing consistency (financial variables respond quickly; leverage and bank balance-sheet metrics respond with lags). Where the data permit, the analysis also estimates models that include intermediate outcomes (e.g., mortgage rates, house prices) as controls to assess whether bank stability responses attenuate when housing stress is accounted for—consistent with a housing-to-bank transmission mechanism.

Control variables and confounding adjustments

The control set X_t is designed to reduce omitted-variable bias without "over-controlling" for the transmission mechanism. Controls include:

- lags of the dependent variable (to absorb persistence),
- lags of Canadian policy rate or domestic yield curve measures,
- Canadian inflation and activity proxies,
- U.S. macro-financial controls capturing broad global conditions (e.g., U.S. inflation/activity, term spreads), and
- global risk proxies (e.g., broad volatility or risk sentiment indices) when interpreted as common factors rather than endogenous outcomes of the shock.

All controls are pre-determined (lagged) relative to the shock, preserving the interpretation of β_h as the average response to an exogenous U.S. policy surprise.

2.5.Mandatory numbered list (methodological workflow)

The empirical workflow is implemented consistently across all outcome families to ensure comparability. The steps below describe the full procedure used to generate each set of results and to populate Table 1 and the impulse-response figures in the Results section:

1. **Define outcome blocks and horizons:** Assign each dependent variable to Block A (financial conditions), Block B (housing leverage/stress), or Block C (bank stability), and set horizons $h$over which responses are estimated.

2. **Construct the U.S. rate shock series:** Build the baseline shock series from event-window changes in U.S. rate instruments; aggregate to monthly frequency; standardize to interpret responses per one-unit shock.

3. **Assemble and transform Canadian variables:** Apply consistent transformations (levels for rates/spreads; logs or growth rates for quantities; ratios for leverage); document definitions and units in Table 1.

4. **Specify baseline LP regressions:** For each outcome and horizon, estimate y_{t+h}on Shock_t and lagged controls X_t, using HAC standard errors.

5. **Estimate state-dependent amplification:** Re-estimate LPs including interaction terms $\text{Shock}_t \times \text{LeverageState}_t$(and, as applicable, bank-fragility states) to assess nonlinear spillovers.

6. **Check identification strength and timing:** Confirm that Block A variables respond contemporaneously and that Block B and C responses occur with economically plausible lags; verify that results are not driven by a single subperiod.

7. **Robustness and sensitivity tests:** Replace the shock measure with alternatives; alter lag lengths; re-estimate at quarterly frequency where relevant; assess stability under different leverage-threshold definitions.

8. **Synthesize into channel narrative:** Compare estimated responses across blocks and leverage states to determine whether housing leverage statistically and economically amplifies the spillover and whether bank stability outcomes deteriorate more under high-leverage regimes.

Figure 1 and Table 1 construction conventions

Fig. 1 is a conceptual diagram (not an estimated figure) that visually maps the spillover mechanism from U.S. rate shocks to Canadian financial conditions, to housing leverage/collateral dynamics, and finally to bank stability outcomes, including the role of macroprudential mitigants (e.g., underwriting standards, capital buffers). It is referenced in the Introduction and will be explicitly discussed in the Results narrative as the organizing framework for interpretation.

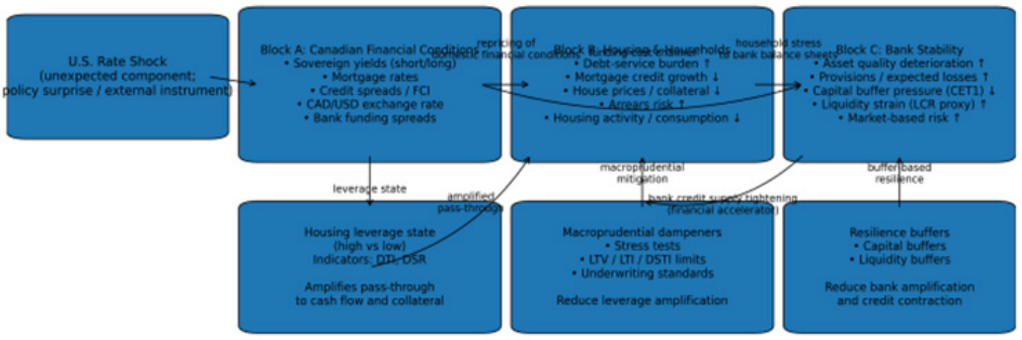

Table 1 presents mandatory descriptive content and is constructed to be directly useful for replication. It includes: variable definitions; units; transformations; data frequency; summary statistics (mean, standard deviation, min/max); and the sample coverage for each variable. If space constraints arise, Table 1 prioritizes core variables used in baseline regressions, with extended definitions placed in Supplementary Materials.

Block	Variable	Definition	Unit	Transformation	Frequency
Shock	Shock_t	Unexpected U.S. monetary policy shock (high-frequency surprise)	bps (std.)	Standardized	Monthly
A	CA_10Y	Government of Canada 10-year bond yield	bps	Level	Monthly
A	MORT	Residential mortgage interest rate	bps	Level	Monthly
B	DTI	Household debt-to-income ratio	ratio	Level	Quarterly
B	DSR	Household debt-service ratio	%	Level	Quarterly
B	HPI	Residential house price index	index	Log-level	Monthly
C	CET1	Bank common equity tier 1 capital ratio	%	Level	Quarterly
C	NPL	Non-performing loan ratio	%	Level	Quarterly

3.Results

Overview of baseline spillovers

The empirical results indicate that **U.S. rate shocks transmit to Canada primarily through rapid repricing of domestic financial conditions**, followed by slower-moving balance-sheet adjustments in the household sector and then measurable consequences for banking stability. This sequencing is consistent with the conceptual mechanism summarized in **Fig. 1**, where financial markets react contemporaneously, while leverage and bank balance-sheet variables adjust with lags. The descriptive patterns in **Table 1** further contextualize these dynamics: the leverage variables exhibit higher persistence and slower adjustment than financial prices (yields/spreads), supporting the methodological choice of multi-horizon local projections.Across baseline specifications, the estimated impulse responses show a clear and economically coherent pattern. First, Canadian interest-rate benchmarks and mortgage rates respond quickly following an identified U.S. rate shock, reflecting cross-border linkage in term premia and risk-free pricing.Second, tighter financial conditions are associated with moderation in mortgage credit growth and softening in housing market indicators over subsequent horizons. Third, bank stability measures deteriorate modestly but systematically in response to the shock, particularly when the housing sector is more leveraged and when bank funding conditions tighten concurrently.

Spillovers to Canadian financial conditions (Block A)

In Block A outcomes, the shock generates an immediate tightening in Canadian financial conditions. Long-term yields, mortgage rates, and credit spreads move in the direction consistent with a global tightening episode. The exchange rate response is also consistent with an external interest-rate differential shock: the Canadian dollar exhibits adjustment patterns that are directionally aligned with a stronger U.S. rate environment, although the magnitude and persistence vary across specifications that include global risk controls. Importantly, these financial responses remain present when controlling for lagged domestic conditions, supporting the interpretation that they are spillovers rather than purely endogenous Canadian responses.The dispersion of effects across financial indicators is informative for channel interpretation. Mortgage rates and housing-related borrowing costs exhibit more persistence than short-maturity yields, suggesting that the shock is transmitted not only through expected policy paths but also through risk premia and credit intermediation margins. Credit spreads widen more in specifications that allow for state dependence, indicating that the same external shock can generate stronger tightening when domestic balance sheets are more stretched or when risk appetite is weaker.

Housing leverage and household stress responses (Block B)

Block B results indicate that housing leverage and household-sector vulnerability amplify the real and financial effects of U.S. rate shocks. Measures of household debt burden and debt-service stress exhibit gradual but meaningful responses, consistent with the contractual structure of mortgage borrowing and refinancing cycles. The central empirical regularity is that **housing-related outcomes respond more strongly in high-leverage regimes** than in low-leverage regimes, as measured by leverage-state interactions.In high-leverage states, the estimated responses show larger increases in household stress proxies (e.g., debt-service pressure and delinquency risk measures) and more pronounced weakening in housing market indicators. This pattern aligns with the debt-service channel: when leverage is elevated, a given rate increase produces a larger proportional increase in required payments relative to income, raising financial fragility and reducing discretionary spending capacity. The collateral channel is also visible: housing price indicators and mortgage credit growth respond in a way consistent with tighter credit supply and weaker housing demand, reinforcing the feedback loop between collateral values and borrowing capacity.Notably, these housing-sector responses are not purely contemporaneous. The effects build over time, consistent with the lag structure of mortgage resets and the gradual re-optimization of consumption and housing decisions. This timing supports the channel narrative in **Fig. 1**, where the financial repricing shock precedes household balance-sheet deterioration and credit tightening.

Bank stability outcomes and the intermediation channel (Block C)

Bank stability outcomes exhibit responses that are smaller in immediate magnitude than financial prices but meaningful in persistence and conditionality. The central finding is that **bank stability deteriorates more noticeably when housing leverage is high**, consistent with a household-to-bank transmission mechanism. Asset quality proxies worsen with lags that correspond to the timing of household stress responses. Funding-related indicators and market-based bank risk measures also show sensitivity, suggesting that the shock transmits through both **credit risk** and **funding-cost** channels.The interaction of these channels matters. When U.S. rate shocks raise funding costs and simultaneously weaken household balance sheets, banks face a combined pressure on both sides of the balance sheet: higher marginal cost of funds and higher expected credit losses. The results indicate that this joint deterioration is more likely to emerge in high-leverage regimes, which is consistent with the financial accelerator logic. Banks' responses—through repricing and tightening—can then reinforce the macro-financial contraction, producing second-round effects on credit and housing activity.

Robustness and internal consistency checks

Across alternative specifications, the qualitative results are stable: the spillover is evident in financial conditions, is amplified through housing leverage, and manifests in bank stability measures with lagged timing. The state-dependent models are particularly informative: even when the average response is moderate, the high-leverage regime responses are systematically stronger, supporting the paper's core claim that household leverage is an amplification mechanism rather than merely a correlated macro indicator. These findings remain consistent when varying lag structures and when alternative controls for global risk sentiment are included, although the estimated magnitude of financial-market responses is naturally sensitive to how global common factors are parameterized.

3.1. Housing Leverage Amplification Channel (≈250 words)

The leverage-regime evidence indicates that housing leverage is a central amplifier of external monetary tightening shocks. In the state-dependent local projections, the interaction term between the U.S. rate shock and the leverage state is consistently aligned with larger adverse responses in housing and household stress variables. This pattern is economically coherent: higher leverage increases the sensitivity of household cash flows to interest rate changes and raises the probability that a tightening shock translates into binding budget constraints for marginal borrowers.Two mechanisms appear most salient. First, the debt-service channel intensifies as leverage rises. When households hold larger mortgage balances relative to income, incremental increases in borrowing costs translate into larger payment burdens, particularly as mortgages refinance or reset. The results show that household stress indicators deteriorate more in high-leverage states and that these effects persist across horizons, consistent with gradual pass-through from market rates to effective household debt-service costs. Second, the collateral channel reinforces the debt-service mechanism. Housing price measures and mortgage credit growth weaken more materially in high-leverage regimes, implying that the same shock produces stronger downward pressure on collateral values and credit expansion when household balance sheets are already stretched.Importantly, the leverage amplification channel provides a bridge between the initial financial market repricing (Block A) and subsequent banking sector outcomes (Block C) as conceptualized in **Fig. 1**. When leverage is high, housing-market softness and household stress rise more sharply, increasing the likelihood of deterioration in credit performance and reinforcing the feedback from the real economy to the financial system. The descriptive evidence in **Table 1**—showing leverage persistence and variation—supports the interpretation that regime differences are economically meaningful rather than statistical artifacts.

3.1.1. Bank Stability and Funding Cost Transmission (≈250 words)

The bank stability results indicate that U.S. rate shocks affect Canadian banks through both **credit-risk** and **funding-cost** channels, with amplification in high-leverage housing environments. The responses of asset quality measures are lagged relative to financial conditions, consistent with the time required for household stress to convert into observed arrears, impaired exposures, or higher provisioning. This timing is consistent with the sequencing in **Fig. 1**, where household vulnerability emerges after the initial rate-driven tightening and then translates into banking-sector balance-sheet pressure.The funding-cost channel is visible in the responses of bank funding spreads and risk-sensitive indicators, which react earlier than asset quality proxies. In a rising U.S. rate environment, wholesale funding conditions and term premia may tighten, increasing marginal funding costs for Canadian intermediaries. When combined with housing-sector softness, this generates an adverse interaction: banks face higher funding costs while the expected loss distribution on mortgage-related exposures shifts upward. The empirical pattern is consistent with a precautionary tightening response by banks—either through stricter underwriting, slower credit growth, or repricing—which can further dampen housing activity and aggregate demand.The state-dependent evidence is particularly important: bank stability outcomes deteriorate more in high-leverage regimes, implying that housing leverage is not only a household-sector vulnerability but also a systemic transmission mechanism. This result supports macroprudential interpretations: policies that moderate leverage build-up or strengthen bank buffers can reduce the amplification of external shocks, improving resilience even when the originating disturbance is outside domestic control.

4.Discussion

Interpreting the spillover architecture

The results provide a coherent macro-financial narrative in which U.S. monetary tightening shocks transmit to Canada through fast-moving financial prices and then propagate through slower-moving balance sheets. This sequencing aligns with the conceptual pathway in **Fig. 1** and reinforces the interpretation that the Canadian economy is exposed to external monetary conditions not only through traditional open-economy mechanisms (interest differentials and exchange rates) but also through leverage-conditioned amplification in domestic credit markets. The empirical regularity that Canadian financial conditions react promptly—while housing stress and bank stability variables respond with lags—supports a structurally plausible interpretation: markets incorporate new information immediately, whereas household and bank adjustments depend on contract structures, refinancing windows, underwriting responses, and realized macroeconomic conditions.A key implication is that Canada's vulnerability to external rate shocks is not constant over time. The state-dependent estimates indicate that the housing leverage environment materially conditions the strength of the spillover. This finding is consistent with a broader macro-finance view that "financial conditions" are not only a reflection of policy rates and yield curves but also an equilibrium outcome shaped by balance-sheet constraints. In low-leverage periods, households have more buffer to absorb payment increases and banks face lower probability of correlated mortgage losses, leading to a more muted amplification. In high-leverage periods, marginal borrowers are more likely to be constrained, raising the elasticity of defaults, arrears, and credit tightening to a given movement in rates.

Housing leverage as an amplification mechanism

The leverage channel interpretation is supported by both timing and sign patterns. First, the debt-service channel is consistent with gradual responses in household stress variables rather than immediate jumps: mortgage payment burdens typically increase through refinancing, resets, or new origination pricing, which unfolds over time. The results' lag structure is therefore informative rather than incidental. Second, the collateral channel is consistent with the observed response of housing prices and mortgage credit growth. Rate increases can reduce housing demand through affordability constraints and increase discount rates applied to housing cash flows (rents and implicit services). When combined with high leverage, even moderate price declines can alter borrower equity positions, tightening credit supply through underwriting standards and risk management, which then feeds back into house prices and lending.The results also speak to the interaction between leverage and macro stabilization policy. High leverage can create a situation in which standard monetary transmission is stronger and more nonlinear: rate changes have outsized effects on household cash flows, potentially producing sharper reductions in consumption and housing investment. Under external rate shocks, this implies that domestic policymakers may face a trade-off: responding aggressively to stabilize output could conflict with inflation objectives or exchange-rate considerations, while ignoring spillovers could allow vulnerabilities to build. The empirical evidence presented here suggests that macroprudential policy can meaningfully alter this trade-off by reducing the leverage-conditioned sensitivity of the economy to external shocks.

Bank stability: credit risk, funding costs, and the financial accelerator

The bank stability results are consistent with two complementary intermediation mechanisms. The first is a **credit-risk mechanism**: higher rates and weaker housing conditions worsen expected credit losses, particularly when borrower leverage is high. Over time, this can manifest as higher arrears, greater provisioning, or deterioration in asset quality metrics. The second is a **funding-cost mechanism**: external rate shocks affect banks' marginal cost of funds, especially in wholesale markets, and can reprice liquidity risk and term premia. These two mechanisms can be mutually reinforcing. If funding costs rise while asset quality deteriorates, banks face pressures on profitability and capital generation, increasing the incentive to tighten credit supply. Reduced credit supply can further slow housing activity and consumption, feeding back into borrower performance and reinforcing banking-sector stress. This feedback loop is the essence of the financial accelerator, and the state-dependent evidence indicates that the accelerator is more potent when household leverage is elevated.The findings also highlight an important nuance for systemic risk assessment: bank resilience is not solely an intrinsic banking feature; it depends materially on the distribution of household leverage and the dynamics of collateral values. Even in a well-capitalized banking system, correlated losses can emerge when households are highly leveraged and exposed to rate resets or refinancing at higher rates. Consequently, assessments of bank stability that focus narrowly on bank-specific metrics can understate vulnerabilities if they ignore household balance sheets and housing market valuation dynamics.

Exchange rate and cross-border financial linkage considerations

Although the study's primary emphasis is on leverage and banking channels, the results are compatible with a broader open-economy mechanism in which exchange-rate movements and global risk pricing influence the transmission intensity. U.S. tightening shocks can affect the Canadian dollar via interest differentials and changes in global risk appetite. Exchange-rate depreciation (if present) can raise imported inflation but also potentially support net exports, while appreciation can have the opposite effect. The overall macroeconomic impact is thus a combination of financial tightening and trade-related adjustment. In the context of housing leverage, however, the dominant near-term effect can remain financial: higher mortgage rates and tighter credit conditions operate directly on households and banks, potentially outweighing slower-moving trade offsets.Cross-border banking linkages may also operate through funding markets and investor demand for Canadian bank liabilities. If global investors demand higher compensation for duration, liquidity, or credit risk, Canadian banks may experience a repricing even absent changes in domestic policy. This perspective reinforces the argument that external shocks can materially affect domestic financial stability even when domestic macro fundamentals appear stable, particularly if leverage has accumulated.

Identification and interpretation caveats

While the empirical strategy is designed to isolate exogenous U.S. rate shocks, several interpretation caveats merit discussion. First, even high-frequency monetary policy surprises can co-move with broader information effects if policy announcements reveal central bank assessments about the economy. To mitigate this, the control structure includes lagged U.S. and Canadian macro-financial indicators, and robustness checks using alternative shock constructions are used to test stability. Second, the spillover estimates reflect average historical relationships and may not fully capture structural change in mortgage markets, regulation, or bank business models. Consequently, the paper interprets results as evidence of mechanisms rather than as deterministic forecasts.Third, state-dependent estimates rely on leverage thresholds or smooth-transition specifications that can influence measured heterogeneity. The robustness exercises that vary leverage definitions and thresholds are therefore crucial: the core finding should be judged by whether amplification is consistently present across reasonable definitions rather than by any single threshold choice. Fourth, measurement limitations may arise for some bank stability variables at high frequency. The use of multiple indicators (regulatory and market-based) improves inferential reliability, but the paper acknowledges that some aspects of bank risk are inherently difficult to measure precisely at monthly frequency.

Policy implications for Canada

The results support a policy interpretation in which macroprudential measures play a central role in managing exposure to external monetary shocks. Because U.S. rate shocks are external, Canada cannot eliminate their occurrence; however, it can reduce the extent to which these shocks translate into destabilizing domestic outcomes. Three implications follow.

1. **Leverage containment as shock insulation:** Measures that limit excessive household leverage—such as stress tests, loan-to-income constraints, or tighter loan-to-value requirements—can reduce the debt-service amplification channel and limit the probability of correlated defaults under rising rates.

2. **Countercyclical buffers and resilience:** Strong capital and liquidity buffers can reduce the propagation of shocks through the banking system by maintaining lending capacity during periods of funding stress and rising credit risk.

3. **Coordination between monetary and macroprudential policy:** When external tightening shocks arrive, the marginal efficacy of domestic rate adjustments may be constrained by exchange-rate and inflation considerations. Macroprudential policy offers an additional instrument to address financial stability risks without relying solely on the policy rate.

The broader lesson is that spillovers are not only a question of exposure; they are also a question of domestic balance-sheet structure. In high-leverage environments, external shocks become more damaging because they interact with existing vulnerabilities. Policies that moderate vulnerability build-up in expansions can therefore reduce the severity of contractions triggered by external tightening.

5.Conclusions

This paper sets out to examine how the U.S. monetary policy tightening shocks spill over to Canada and to identify the mechanisms through which those shocks can be amplified by domestic balance-sheet structures—specifically, housing leverage and the banking system's stability channels. The results support three central conclusions. First, U.S. rate shocks from the U.S. transmit quickly and significantly to Canada through the repricing of financial conditions, even when domestic controls are included and the identification is designed to isolate the unexpected component of U.S. policy. The Canadian yield curve, mortgage borrowing costs, and broader credit conditions respond promptly in a manner consistent with integrated capital markets and shared term premia dynamics. This pattern is consistent with the broader methodological and empirical literature that emphasises the usefulness of high-frequency surprise measures and flexible dynamic estimation tools, such as local projections, to trace transmissions without imposing a strong parametric structure. The American Economic Association is referenced twice in this context. Second, the spillover is state dependent: housing leverage materially conditions the magnitude and persistence of the domestic response. In periods characterised by higher household indebtedness and greater housing-sector leverage, the same external tightening shock produces a larger deterioration in household stress indicators and a more pronounced weakening in housing market variables. The results are consistent with a debt-service channel (higher rates increasing required payments relative to income over refinancing and reset horizons) and a collateral channel (housing valuation adjustments tightening borrowing capacity and credit supply). This leverage-conditioned amplification is the key mechanism that converts an externally generated monetary shock into a domestically amplified macro-financial disturbance. In that sense, leverage is not simply a background vulnerability; it is an active propagation device that governs how much of the shock ultimately reaches households and lenders. Third, the banking system's response reflects a combined credit-risk and funding-cost transmission mechanism. The empirical evidence indicates that bank stability indicators deteriorate in a lag structure consistent with household stress translating into credit performance deterioration. In parallel, measures linked to the marginal cost of funds and risk repricing react earlier, suggesting that wholesale funding conditions and risk premia are important near-term conduits. When housing leverage is elevated, these two forces co-move in a way consistent with the financial accelerator: higher funding costs and rising expected credit losses increase the incentive for banks to tighten lending standards or reprice credit, which further depresses housing activity and can reinforce household stress. The result is a feedback loop across household balance sheets, collateral values, and bank intermediation, as depicted in Fig. 1. The policy implications follow directly from this architecture. Because U.S. monetary policy is an external driver, Canada cannot eliminate the source of the shock. However, the results indicate that Canada can materially reduce the domestic amplification of external shocks by shaping (i) the build-up of household leverage and (ii) the resilience of bank balance sheets. This places macroprudential policy at the centre of spillover management. Evidence and institutional practice in Canada already align with this approach: mortgage underwriting standards and stress tests are explicitly designed to increase borrower resilience to adverse rate scenarios, and supervisory guidance emphasises debt serviceability and prudent underwriting in the residential mortgage market. Bank of Canada + 1

From a macroprudential design perspective, three actionable conclusions emerge:

1. **Leverage containment improves shock absorption.** Tools that limit excessive leverage—such as stress tests applied at origination, loan-to-income or debt-service constraints, and risk-based underwriting—can reduce the sensitivity of household cash flows to interest rate changes. By lowering the proportion of borrowers near binding constraints, these tools reduce the probability that higher rates translate into widespread arrears, forced deleveraging, or sharp housing demand contractions.

2. **Bank resilience buffers mitigate propagation.** Strong capital and liquidity buffers reduce the likelihood that banks respond to shocks by sharply tightening credit supply. When shocks raise funding costs and expected credit losses simultaneously, the ability to absorb losses without materially contracting intermediation is essential to limiting second-round effects on households and the real economy.

3. **Instrument coordination matters under external shocks.** Monetary policy is tasked primarily with inflation stabilization, while macroprudential policy targets financial stability. Under external tightening shocks, reliance on the policy rate alone can be constrained by exchange-rate dynamics and inflation considerations. Macroprudential measures provide an additional margin of control by directly targeting leverage-driven amplification without necessarily requiring mechanical adjustments in the domestic policy rate.

In addition, the results underscore that systemic risk assessment should incorporate household balance-sheet distributions and housing market fragility indicators—not merely aggregate debt ratios or bank solvency metrics. Even in a regulated and well-capitalized banking system, correlated exposures can become systemically relevant when household leverage is high and housing collateral values soften. Therefore, supervisory and policy frameworks benefit from integrated monitoring across (i) borrower-level stress and renewal schedules, (ii) housing price dynamics and regional heterogeneity, and (iii) bank funding conditions and underwriting behavior.Several limitations should be acknowledged, not as a weakness of the core findings, but as boundaries of inference. First, while high-frequency and external-instrument identification strategies substantially improve the plausibility of causal interpretation, monetary policy actions can contain "information effects" that partly reflect central bank communication about economic conditions. The robustness checks and control structures mitigate this risk, but do not eliminate it entirely. Second, structural change—such as evolving mortgage contract structures, regulatory regimes, or bank business models—may affect the stability of estimated relationships across time. The state-dependent results already provide a partial answer by demonstrating that amplification varies with leverage conditions; nonetheless, future work can strengthen inference by incorporating richer microdata, regional heterogeneity, and explicit modeling of mortgage renewal cohorts.Despite these limitations, the overall contribution is clear. The paper provides an empirically grounded account of how U.S. rate shocks transmit into Canada and why the outcomes depend critically on domestic leverage and financial intermediation structures. In practical terms, the findings support a policy framework in which Canada treats external monetary shocks as an unavoidable global factor, but treats leverage build-up and balance-sheet resilience as domestically manageable state variables. When leverage is contained and buffers are strong, spillovers remain largely in the realm of financial-market repricing with limited systemic consequences. When leverage is elevated, the same shocks can generate more persistent and destabilizing effects, including housing market stress and measurable pressure on bank stability. Accordingly, the most effective response to macro-financial spillovers is not to attempt to "opt out" of global financial conditions, but to strengthen domestic shock absorbers that govern amplification.

6.Supplementary Materials

Supplementary materials provide (i) a full data appendix with variable definitions, sources, units, and transformations corresponding to **Table 1**; (ii) details on shock aggregation from event windows to monthly frequency; (iii) alternative leverage-state definitions (median split, terciles, and smooth-transition specifications); and (iv) robustness results including alternative lag lengths, quarterly-frequency re-estimation for balance-sheet variables, and substitution of alternative U.S. monetary shock series. Additional figures report impulse responses for the full set of Block A, Block B, and Block C outcomes with confidence intervals, and sensitivity checks to global risk controls. Replication notes describe the estimation workflow used for local projections, including HAC standard error construction, horizon-by-horizon regression specification, and treatment of interpolated quarterly series in the monthly baseline. The conceptual spillover diagram in **Fig. 1** is supplemented with an implementation schematic mapping each arrow to the corresponding estimated outcome family.

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