Heterogeneous Bank-Level Transmission of Monetary Policy in Guatemala

Victor H. Ramirez Hunter*

July 22, 2026

Abstract

This paper investigates how bank-specific balance-sheet characteristics affect the transmission of monetary policy in Guatemala. We combine a monthly bank-level panel of 12 commercial banks from January 2008 to June 2024 with an aggregate monetary policy shock identified via a VARX model from a previous paper. Using local projections with full date fixed effects, the cross-bank response differentials are isolated by interacting the common macro shock with lagged bank characteristics. Our point estimates suggest that a bank's response to policy tightening depends heavily on its credit intensity, reliance on borrowed funds, asset size, and liquidity. These patterns remain robust when controlling for bank-specific seasonality and broader macroeconomic states. However, accounting for first stage estimation uncertainty via bootstrap sampling yields wide confidence intervals that span zero. Consequently, we interpret these findings as providing valuable, suggestive evidence on the cross-sectional channels of Guatemalan monetary transmission rather than definitive causal proof.

JEL codes: E52, E58, G21, C33.
Keywords: monetary policy transmission; bank lending channel; heterogeneous banks; local projections; Guatemala; generated regressor.

*Economic Research Department, Banco de Guatemala. Email: vhrh@banguat.gob.gt. The views expressed in this paper are those of the author and do not necessarily represent the views of Banco de Guatemala or its authorities.

Contents

1 Introduction **3**

2 Literature Review and Contribution **5**

2.1 Monetary policy transmission in small open economies 5

2.2 Evidence for Guatemala and Central America 6

2.3 Shock identification and contribution 6

3 Institutional and Policy Background **7**

3.1 Monetary policy framework 7

3.2 Banking system and liquidity environment 7

3.3 Small open economy features 8

4 Data **8**

4.1 Bank panel and estimation sample 8

4.2 Estimation outcomes and bank traits 9

4.3 Policy shock and macro-state variables 11

5 Empirical Strategy **11**

5.1 Identification 11

5.2 Baseline interacted local projection 12

5.3 Pre-trends and robustness checks 12

5.4 First stage shock uncertainty 13

6 Results **13**

6.1 Relative strength of the results 13

6.2 Main conditional results 14

6.3 Qualified results: liquidity 17

6.4 First stage shock uncertainty 19

6.5 Discussion and policy relevance 20

7 Conclusion **22**

1 Introduction

Monetary policy is often summarized as an aggregate impulse: a policy decision changes short term rates, financial market prices adjust, credit conditions respond, and aggregate demand and inflation eventually move. In small open economies, the sequence is rarely so clean. External shocks, exchange rate management, partial dollarization, banking system liquidity, limited market depth and bank concentration can all weaken, delay, or redistribute the effects of monetary policy. These conditions make it useful to ask not only whether there is an actual transmission of monetary policy, but how it is shaped by the banking system's characteristics and where it is strongest.

Guatemala is a natural setting for these questions. Since 2005, monetary policy has operated under an inflation-targeting framework, with the leading policy rate serving as the main signal of the monetary policy stance (Banco de Guatemala, 2024, 2026). At the same time, transmission takes place through a bank-based financial system in a small open economy. Exchange rate smoothing, international-reserve management, remittance inflows, funding composition and system wide liquidity may therefore interact with the policy rate channel. A moderate aggregate response can still hide large differences across banks if institutions differ in their liquidity positions, funding structures, credit intensity or repricing capacity.

This paper studies the cross-sectional dimension of monetary policy transmission. We take the baseline monetary policy shock identified and estimated in previous work by (Blanco, Catalán-Herrera, and Ramirez, 2026) and embed it into a monthly bank-level panel. The shock is normalized so that a positive value represents an unexpected tightening; a one standard deviation innovation corresponds to an unexpected increase in the policy rate of approximately 12 basis points. As such, we do not identify the monetary policy shock, and our analysis focuses on whether banks with different pre-shock balance-sheet characteristics respond differently to the same common policy innovation.

Our empirical object of interest is therefore the relative response across banks instead of the average response of the banking system. In the bank-level panel, full date fixed effects absorb all common monthly shocks, including the level effect of the monetary policy shock. Heterogeneous transmission is identified thus from interactions between the common shock and lagged bank variables, which do vary across banks within a given month.

The estimation sample contains 12 banks with monthly data from January 2008 through June 2024, yielding 2,376 bank-month observations before local projection lead and lag restrictions. The main outcomes are GTQ loan rates, GTQ deposit rates, GTQ credit growth, and the non-performing loan ratio. The main heterogeneity dimensions are bank size, capital adequacy, medium-term liquidity, deposits-to-assets, borrowed funds-to-assets,

credit-to-assets, FX loan share, and FX deposit share. Effects are reported as p75–p25 response differentials, i.e., the response of a bank at the 75th percentile of a characteristic relative to a bank at the 25th percentile after a one standard deviation tightening shock.

Conditional on the estimated monetary policy shock, the results suggest meaningful heterogeneity. More credit-intensive banks show relatively stronger GTQ credit growth at medium horizons. Banks with greater borrowed funds exposure show weaker GTQ deposit rate pass-through. Larger banks show stronger short run GTQ loan rate pass-through. Banks with higher medium-term liquidity show a more negative GTQ credit growth differential, although this result is sensitive to pretrend diagnostics and is treated with some caution.

The first stage shock uncertainty exercise tempers the interpretation. Since the monetary policy shock is estimated in a first stage aggregate model, treating it as observed can understate uncertainty. We therefore use bootstrap shock draws from the aggregate VARX model and recenter them around the baseline shock series used in the bank panel. This exercise preserves some qualitative signs, but the resulting intervals are wide and include zero. The main conclusion is cautious: the bank-level evidence is economically coherent conditional on the estimated shock, but it is not statistically significant once first stage shock uncertainty is propagated.

The contribution of this paper is to connect aggregate shock identification with bank-level heterogeneity in a transparent way. The paper uses an explicitly identified policy shock, estimates heterogeneous local projections with full date fixed effects, reports economically interpretable p75–p25 differentials, checks results with negative horizon diagnostics, and separates conditional robustness from first stage shock uncertainty. We find that the results do not support a simple story in which monetary tightening uniformly constrains smaller, less-capitalized, or less-liquid banks. The results point instead to a more nuanced pattern, which seems to be linked to business model, funding structure, bank size, and liquidity related portfolio adjustment.

The remainder of the paper is organized as follows. Section 2 reviews the related literature and contribution. Section 3 describes the institutional and policy background. Section 4 presents the data. Section 5 explains the empirical strategy. Section 6 presents the results. Section 7 concludes.

2 Literature Review and Contribution

2.1 Monetary policy transmission in small open economies

This paper is situated in the broader literature on monetary policy transmission in small open and emerging-market economies. In these settings, the pass-through from policy rates to market rates, credit, aggregate demand, and inflation is often incomplete or delayed. Financial frictions, shallow markets, concentrated banking systems, exchange rate management, external shocks and foreign-currency balance-sheet positions can all shape the strength of transmission (Mishkin, 1996; Boivin, Kiley, and Mishkin, 2010).

The bank lending channel gives bank heterogeneity a direct role in the transmission mechanism. If monetary tightening raises the cost or reduces the availability of bank funding, banks that rely more heavily on fragile funding, hold less liquidity or face stronger balance-sheet constraints may reduce credit more sharply (Bernanke and Blinder, 1988; Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Kishan and Opiela, 2000). Later work shows that liquidity, capitalization, funding structure and international funding networks can materially affect how banks respond to monetary policy shocks (Jiménez et al., 2012; Gambacorta, 2005; Cetorelli and Goldberg, 2012).

These mechanisms are especially relevant in a bank-based financial system: a common monetary policy shock may have different effects depending on banks' balance-sheet characteristics and business models. Thus, the aggregate response can reflect the composition of the banking system in addition to the stance of monetary policy.

Recent evidence for emerging and developing economies also cautions against assuming that policy rates pass mechanically into the borrowing costs faced by firms and households. Anagol and Wang (2026), using harmonized household and SME loan data across a large set of countries, find weaker pass-through from policy rates to borrower rates in poorer economies. De Leo, Gopinath, and Kalemli-Özcan (2024) document a related short-rate disconnect in emerging economies: policy rates often move countercyclically, but short-term market rates do not necessarily follow, particularly where domestic financial intermediaries are exposed to external funding conditions. These findings motivate a bank-level approach in which monetary-policy transmission depends on the balance-sheet structure of intermediaries and not on the policy rate alone.

2.2 Evidence for Guatemala and Central America

The empirical literature on monetary policy transmission in Guatemala and Central America generally finds that transmission does exist, but is weaker or less uniform than in more financially developed economies. Common explanations include limited financial-market development, banking system concentration, partial dollarization, excess liquidity, exchange rate management and institutional features that weaken pass-through from policy to market rates.

Montiel (2015) studies monetary policy transmission in Guatemala using VAR models and finds that the central bank can influence short term rates, while the effects on aggregate demand and inflation are less precise. Blanco, Valle, and Delgado (2017) and Medina, Carrion-Menendez, and Frantischek (2011) study policy rate pass-through in Central America and the Dominican Republic and find slower and weaker pass-through than in more financially developed Latin American economies. Blanco, Valle, and Delgado (2017) examine inflation-targeting experiences in Central America and emphasize that progress in policy frameworks has not always translated into strong and uniform pass-through.

Bank-level evidence points in a similar direction. Blanco and Valle (2018) study the credit channel in Guatemala using bank-level data and find that transmission depends on bank characteristics such as size, liquidity, and capitalization. Valle et al. (2022) also find evidence of an operational but heterogeneous credit channel, with particularly relevant differences across bank types and credit categories.

The present paper builds on this literature but differs in its empirical view and strategy. Rather than replacing the aggregate shock with a different policy indicator, we use the same identified aggregate policy shock in the bank-level panel. This is crucial, in our view, since it aligns the macroeconomic and bank-level structural shocks. Consequently, we are able to study whether the response to an identified aggregate monetary policy innovation differs across institutions, according to their characteristics.

2.3 Shock identification and contribution

A central issue in this literature pertains to the definition of the monetary policy shock. Observed policy rate changes may reflect endogenous responses to inflation, activity, external conditions or exchange rate pressures. Innovations in short term market rates may also capture liquidity or risk conditions rather than policy innovations. Our VARX model from previous work addresses this issue by estimating a monetary policy shock conditional on external and domestic macroeconomic information, using short run restrictions implemented

with the Rubio-Ramirez, Waggoner, and Zha algorithm (Rubio-Ramirez, Waggoner, and Zha, 2010; Blanco, Catalán-Herrera, and Ramirez, 2026). In this way, we are able to separate in the data the unexpected component from the expected (endogenous) one in the movements of the policy rate.

Our contribution in this paper is to use the identified shock as the common policy innovation in a bank-level panel. We then estimate whether responses differ across banks with different lagged balance-sheet characteristics. The design combines full date fixed effects, p75–p25 response differentials, negative horizon diagnostics, bank-specific seasonality controls, macro-state interaction robustness and a first stage shock uncertainty bootstrap.

This last component in the analysis is very important because the policy shock is estimated, rather than observed, and so there is a generated-variable issue in the estimated local projections. We therefore distinguish between conditional bank-level robustness and robustness to first stage shock uncertainty.

3 Institutional and Policy Background

3.1 Monetary policy framework

Guatemala has operated under an explicit inflation-targeting framework since 2005. The framework followed legal reforms in the early 2000s which assigned price stability as the central bank's main objective and granted the central bank autonomy to choose the instruments needed to pursue said objective. The current inflation target is set at 4 percent, with a tolerance interval of ± 1 percentage point (Banco de Guatemala, 2024).

The main policy instrument is the leading monetary policy interest rate, set by the Monetary Board. Policy rate decisions are scheduled several times per year; the 2026 calendar, for example, lists eight meetings for decisions on the leading policy rate (Banco de Guatemala, 2026). The policy rate serves as the reference for short term central-bank deposit operations and is intended to influence broader monetary and financial conditions.

3.2 Banking system and liquidity environment

The Guatemalan financial system is strongly bank-centered. Banks play a central role in credit provision, deposit mobilization, and financial intermediation. As such, bank-level heterogeneity is most relevant for monetary policy transmission. Institutions differ in size, funding structure, credit intensity, liquidity position and currency composition, as well as in their business model.

Liquidity conditions are particularly important for the transmission. The central bank conducts operations through instruments such as term deposits and liquidity facilities. Banks have historically held reserves above required levels, so the transmission from the policy rate to bank behavior may depend not only on the policy rate decision, but also on how liquidity is distributed among the public, banks, and the central bank balance sheet.

Our analysis in previous work emphasizes liquidity management as part of the transmission mechanism. Monetary stabilization operations can absorb liquidity and slow secondary money creation, while changes in international reserves can have monetizing effects. Fiscal operations can also affect liquidity through Treasury placements, taxes, spending, loans, bonds and treasury bills. As such, these institutional features help motivate our bank-level analysis: banks with different liquidity and funding positions may react differently to a common policy innovation.

3.3 Small open economy features

As a small open economy, Guatemala is exposed to external shocks that affect inflation, activity, capital flows, exchange rate dynamics and liquidity conditions, with the exchange rate behavior being especially relevant. Guatemala moved away from the fixed parity of the quetzal to the U.S. dollar after reforms from the 1980s through the early 2000s. The central bank participates in the foreign exchange market under a rule-based mechanism designed to moderate excessive nominal exchange rate volatility without changing its trend (Banco de Guatemala, 2024, 2022).

Currency composition is also relevant for bank-level transmission, with regards to both loans and deposits denominated in foreign currency. These differences may affect how policy shocks interact with exchange rate movements, borrower currency mismatch, funding composition, and balance-sheet valuation. Significant remittance inflows are another relevant feature of Guatemala's macro financial environment, since they affect household income, deposit growth, foreign exchange supply, and liquidity.

4 Data

4.1 Bank panel and estimation sample

The empirical analysis combines three data blocks: a bank-level monthly panel, the baseline monetary policy shock from the aggregate VARX analysis and macro financial variables used in robustness exercises. The unit of observation is a bank-month and the bank-level data

is constructed from publicly available supervisory/accounting information published by the *Superintendencia de Bancos* and related public bank disclosures.

The estimation sample is balanced and runs from January 2008 through June 2024. It contains 12 banks, 198 monthly observations, and 2,376 bank-month observations before local projections lead and lag restrictions.

Table 1: Panel summary

Number of banks	12
Estimation period	2008m1–2024m6
Number of months	198
Bank-month observations	2,376
Panel type	Balanced

Table 2: Data sources and role in the analysis

Data block	Main variables	Role
Bank-level panel	Loan and deposit rates, credit, NPLs, balance-sheet ratios, currency composition	Outcomes and lagged heterogeneity dimensions
Monetary policy shock	Baseline shock from previous VARX analysis	Common policy innovation interacted with bank variables
Macro-state variables	WTI oil price, US CPI, effective federal funds rate, domestic inflation, IMAE growth, FX depreciation	Lagged macro-state interactions used in robustness checks

Notes: The bank panel is based on public supervisory/accounting information. Macro-state variables are included as interactions with bank traits rather than as common level controls because the preferred specifications include full date fixed effects.

4.2 Estimation outcomes and bank traits

The analysis focuses on four outcomes: GTQ loan rates, GTQ deposit rates, GTQ credit growth, and the nonperforming loan ratio. Loan and deposit rates capture interest rate pass-through. GTQ credit growth captures the quantity margin of transmission. The nonperforming loan ratio captures asset-quality deterioration.

Rate outcomes are modeled as forward changes and reported in basis points. GTQ credit growth is measured year-on-year and reported in percentage points. Because the year-on-year

transformation requires 12 lagged months, the first 12 months for each bank are missing by construction, which accounts for 144 missing observations in GTQ credit growth in the estimation panel.

The heterogeneity variables are lagged bank traits: bank size, capital adequacy, medium-term liquidity, deposits-to-assets, borrowed funds-to-assets, credit-to-assets, FX loan share, and FX deposit share. These are standardized for estimation and reported as p75–p25 differentials.

Table 3: Main estimation outcomes and heterogeneity dimensions

Type	Variable	Interpretation
Outcome	GTQ loan rate	Domestic currency lending rate pass-through; modeled as a forward change and reported in basis points
Outcome	GTQ deposit rate	Domestic currency deposit rate pass-through; modeled as a forward change and reported in basis points
Outcome	GTQ credit growth	Year-on-year domestic currency credit growth; reported in percentage points
Outcome	NPL ratio	Past-due loans relative to gross loans; asset quality margin
Heterogeneity dimension	Bank size	Log total assets
Heterogeneity dimension	Capital adequacy	Capital available relative to risk-weighted assets and contingencies
Heterogeneity dimension	Medium term liquidity	Liquid resources and investments relative to deposit, financial, borrowed fund, and payable obligations
Heterogeneity dimension	Borrowed funds-to-assets	Reliance on non-deposit borrowed funding
Heterogeneity dimension	Credit-to-assets	Lending intensity of the bank balance sheet
Heterogeneity dimension	FX loan and deposit shares	Currency composition of assets and liabilities

Notes: Bank traits enter the local projections lagged one month and standardized. Effects are reported as p75–p25 response differentials.

The official indicator of capital adequacy is defined as

$$AC = \frac{\text{Regulatory capital} - \text{Deferred expenses} - \text{Investments in subordinate debt}}{\text{Total risk-weighted assets and contingencies}}. \quad (4.1)$$

The official liquidity indicator closest to medium-term liquidity is *liquidez mediata*:

$$LM = \frac{\text{Cash and due from banks} + \text{Investments}}{\begin{array}{c}\text{Deposit liabilities} + \text{Financial liabilities} \\ + \text{Borrowings} + \text{Accounts payable}\end{array}}. \quad (4.2)$$

The official asset-quality indicator closest to the non performing loan ratio is the ratio of past-due loans to gross loans:

$$CVC = \frac{\text{Past-due loan portfolio}}{\text{Gross loan portfolio}}. \quad (4.3)$$

4.3 Policy shock and macro-state variables

The monetary policy shock is the baseline shock estimated in the companion aggregate VARX analysis. The shock is standardized so that one unit corresponds to a one standard deviation unexpected tightening, approximately a 12 basis-point increase in the policy rate.

The macro-state variables used in robustness exercises are selected to align with the first stage aggregate model. These include WTI oil prices, US CPI inflation, the effective federal funds rate, domestic CPI inflation, the Monthly Economic Activity Index's (IMAE) growth, and nominal exchange rate depreciation. In the bank-level regressions, these enter as lagged standardized interactions with bank variables, instead of as common level controls, since the preferred specification includes full date fixed effects.

5 Empirical Strategy

5.1 Identification

Let MPShock_t denote the baseline monetary policy shock in month t. Since the shock is common to all banks in a given month, it is collinear with date fixed effects. The average response specification

$$Y_{i,t+h} = \alpha_h + \beta_h \text{MPShock}_t + \mu_i + \tau_t + \varepsilon_{i,t+h} \quad (5.1)$$

cannot identify β_h when τ_t is a full set of monthly date fixed effects.

Our empirical interest is instead the interaction between the common shock and a lagged bank trait:

$$\text{MPShock}_t \times Z_{i,t-1}. \tag{5.2}$$

This interaction remains identified because $Z_{i,t-1}$ varies across banks within the same month. The coefficient on this term measures whether high-trait banks respond differently from low-trait banks after the same monetary policy shock.

5.2 Baseline interacted local projection

For bank i, month t, horizon h, outcome $Y_{i,t+h}$, and lagged bank trait $Z_{i,t-1}$, the baseline local projection is

$$\begin{aligned} Y_{i,t}^{(h)} = \gamma_h \left(\text{MPShock}_t \times Z_{i,t-1}\right) + \rho_{1h} Y_{i,t-1} + \rho_{2h} Y_{i,t-2} + \lambda_h Z_{i,t-1} \\ + \mu_i + \tau_t + \eta_i t + \varepsilon_{i,t+h}. \end{aligned} \tag{5.3}$$

The coefficient of interest is γ_h. This coefficient measures how the response at horizon h differs according to the value of the bank trait. The specification includes bank fixed effects, date fixed effects, bank-specific linear trends, two lags of the outcome and the lagged trait. Standard errors are clustered by bank and date.

Results are reported as p75–p25 response differentials. Let z_{75} and z_{25} denote the 75th and 25th percentiles of the lagged trait. The reported differential is

$$\Delta_h^{75-25} = \gamma_h \left(z_{75} - z_{25}\right). \tag{5.4}$$

5.3 Pre-trends and robustness checks

Negative horizon diagnostics are used to assess whether post-shock differences reflect pre-existing differential trends. For $h < 0$, the same interacted specification is estimated using pre-shock outcomes. Outcomes with repeated statistically visible negative horizon coefficients are not treated as main results, even when they show post-shock significance.

The first robustness check adds bank $\times$ calendar-month fixed effects:

$$\begin{aligned} Y_{i,t}^{(h)} = \gamma_h \left(\text{MPShock}_t \times Z_{i,t-1}\right) + \rho_{1h} Y_{i,t-1} + \rho_{2h} Y_{i,t-2} + \lambda_h Z_{i,t-1} \\ + \tau_t + \psi_{i,m(t)} + \eta_i t + \varepsilon_{i,t+h}, \end{aligned} \tag{5.5}$$

where $\psi_{i,m(t)}$ captures each bank's recurring calendar-month pattern.

The second robustness check allows banks with different traits to respond differently to macro financial states:

$$Y_{i,t}^{(h)} = \gamma_h \left(\text{MPShock}_t \times Z_{i,t-1}\right) + \sum_k \delta_{kh} \left(X_{k,t-1} \times Z_{i,t-1}\right) + \rho_{1h} Y_{i,t-1} + \rho_{2h} Y_{i,t-2} + \lambda_h Z_{i,t-1} + \tau_t + \psi_{i,m(t)} + \eta_i t + \varepsilon_{i,t+h}. \tag{5.6}$$

where the variables $X_{k,t-1}$ are lagged and standardized macro-state variables.

5.4 First stage shock uncertainty

The policy shock is estimated in a first stage aggregate model, using the exact same data, model specification, identification restrictions and estimation method as in the previous work (Blanco, Catalán-Herrera, and Ramirez, 2026). Bank-level standard errors that treat it as observed may therefore understate total uncertainty. To assess this issue here, we employ bootstrap shock draws from the first stage aggregate VARX model and recenter them around the exact baseline shock used in the bank panel. Let $\text{MPShock}_t^{baseline}$ be the baseline shock series, $\text{MPShock}_t^{point,first}$ the point shock reproduced by the first stage model, and $\text{MPShock}_t^{b,first}$ bootstrap draw b. The recentered draw is

$$\text{MPShock}_t^{b,recentered} = \text{MPShock}_t^{baseline} + \left(\text{MPShock}_t^{b,first} - \text{MPShock}_t^{point,first}\right). \tag{5.7}$$

Each draw is standardized over the estimation sample and used to re-estimate the main bank-level local projections. However, it should be emphasized that this exercise serves as a sensitivity analysis for first stage shock uncertainty and not as a claim of exact full-information inference.

6 Results

6.1 Relative strength of the results

The results are organized in three categories. Conditional results are stable across the main bank-level specifications, including bank-specific seasonality controls and macro-state interactions. Qualified conditional results are stable in sign and magnitude but have nontrivial pretrend concerns. The shock uncertainty analysis then asks whether these results remain statistically visible after propagating uncertainty from the first stage shock estimate.

Table 4: Relative strength of the results

Category	Result	Interpretation
Conditional evidence	Credit growth × credit-to-assets; deposit rate × borrowed funds; loan rate × bank size	Stable across conditional bank-level specifications, but not robust to first stage shock uncertainty.
Qualified conditional evidence	Credit growth × medium-term liquidity	Stable post-shock pattern, but pretrend-sensitive under the macro-state specification and not robust to first stage shock uncertainty.
Suggestive evidence	Capitalization, deposit funding, FX deposit share, and several NPL interactions	Economically plausible channels, but not sufficiently stable across diagnostics.

Note: Here, "Conditional" refers to "conditional on the estimated baseline monetary policy shock".

6.2 Main conditional results

Three patterns are most stable in the conditional analysis. First, banks with higher credit-to-assets ratios show relatively stronger GTQ credit growth performance after a tightening. At horizon 19, the p75–p25 differential is approximately 0.89 percentage points, with a 90 percent conditional confidence interval of $[0.19, 1.59]$.

Second, banks with higher borrowed funds exposure show weaker GTQ deposit rate pass-through. At horizon 24, the p75–p25 differential is approximately -3.91 basis points, with a 90 percent conditional confidence interval of $[-7.00, -0.82]$.

Third, larger banks show stronger short run GTQ loan rate pass-through. At horizon 2, the p75–p25 differential is approximately 16.41 basis points, with a 90 percent conditional confidence interval of $[3.35, 29.47]$.

Table 5: Main conditional estimates

Outcome × bank trait	Horizon	Unit	p75–p25 estimate	90% CI
GTQ credit growth × credit-to-assets	19	pp	0.89	[0.19, 1.59]
GTQ deposit rate × borrowed funds-to-assets	24	bp	-3.91	[-7.00, -0.82]
GTQ loan rate × bank size	2	bp	16.41	[3.35, 29.47]
GTQ credit growth × medium-term liquidity	18	pp	-1.01	[-1.89, -0.13]
GTQ credit growth × medium-term liquidity	19	pp	-1.53	[-2.56, -0.50]

Notes: Estimates are p75–p25 response differentials from the macro-state robustness check model specification. "pp" denotes percentage points and "bp" denotes basis points.

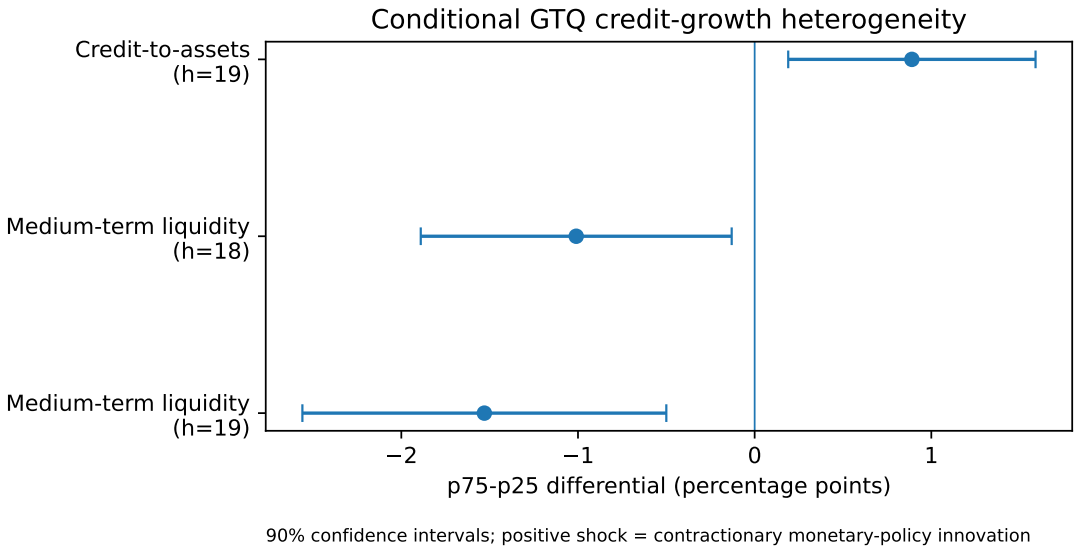

Figure 1: Conditional GTQ credit growth heterogeneity

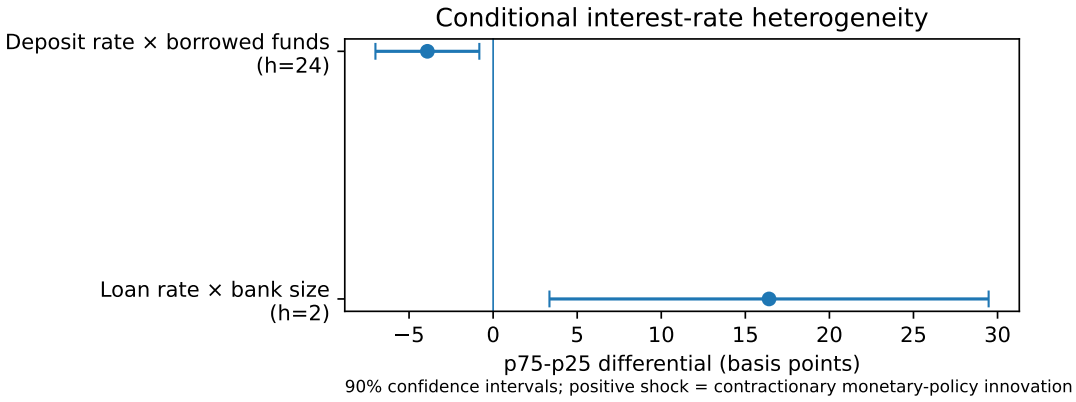

Figure 2: Conditional interest rate heterogeneity

Taken together, these results suggest that transmission heterogeneity is not explained simply through a weak-bank amplification mechanism. Conditional on the estimated policy shock, the relevant heterogeneity could be more closely related to business-model intensity, funding structure and repricing behavior.

The credit-intensity result is the clearest example. A contractionary monetary policy shock would normally be expected to reduce credit growth, especially among banks that are more exposed to lending. The result here goes in the opposite relative direction: more credit-intensive banks maintain stronger GTQ credit growth than less credit-intensive banks at medium horizons. It is very important to emphasize that this does not imply that monetary tightening expands credit in aggregate, but that, relative to banks with lower credit-to-assets ratios, banks whose balance sheets are more oriented toward lending show more resilient credit growth. Thus, relationship lending, pre-existing loan commitments and portfolio specialization are plausible explanations for these results.

On the other hand, the borrowed funds result points to the liability side of transmission. The negative deposit rate differential for banks with greater borrowed funds exposure is consistent with the idea that liability-side structure affects pass-through. If these banks' marginal funding costs are shaped less by retail deposit competition and more by non-deposit or external funding conditions, the domestic policy rate shock needs not translate into stronger deposit rate adjustment. We find this interpretation plausible and in line with the bank-level evidence to the emerging market "short rate disconnect" literature, while also locating the mechanism inside the domestic banking system.

Finally, the size result seems to be related to repricing. Larger banks adjust GTQ loan rates more strongly in the short run, which may reflect more formalized pricing systems, greater sensitivity to benchmark funding costs, stronger treasury operations, or different loan-product composition. Our current results cannot separate these mechanisms or their

relative importance, but they do show that loan rate pass-through is not uniform across institutions.

6.3 Qualified results: liquidity

The medium-term-liquidity response is economically important but should be viewed with caution. Banks with higher medium-term liquidity display a more negative GTQ credit growth differential after tightening. At the horizon of 18 months, the p75–p25 differential is approximately -1.01 percentage points, with a 90 percent conditional confidence interval of $[-1.89, -0.13]$. At horizon 19, the differential is approximately -1.53 percentage points, with a 90 percent conditional confidence interval of $[-2.56, -0.50]$.

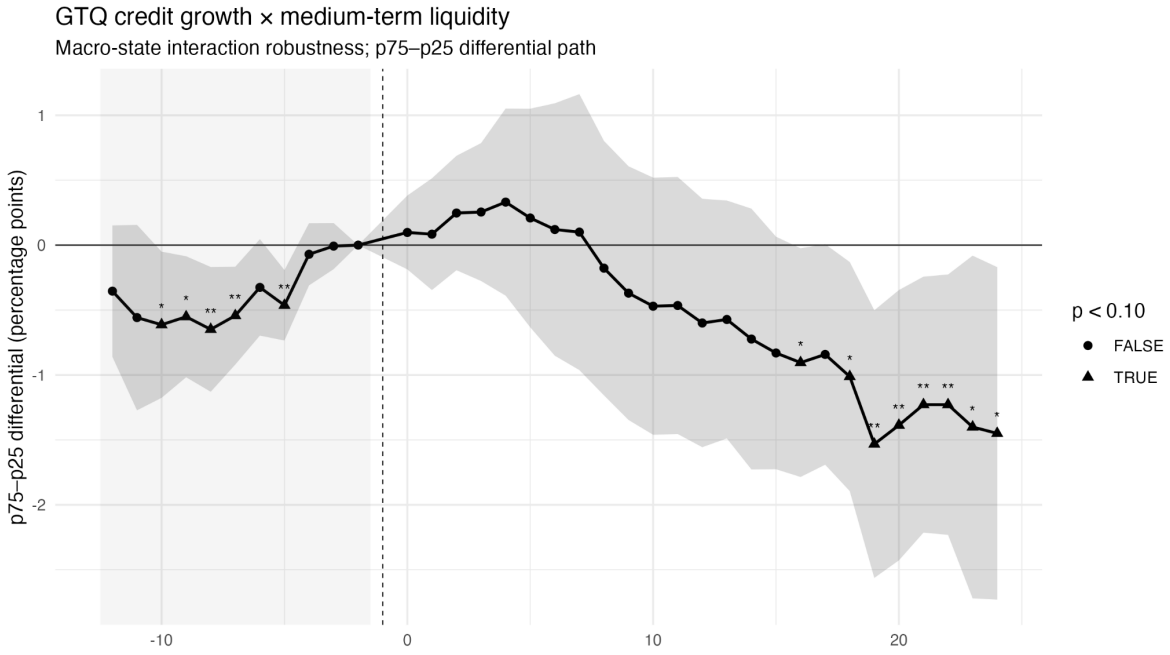

Figure 3: GTQ credit growth × medium-term liquidity: macro-state specification

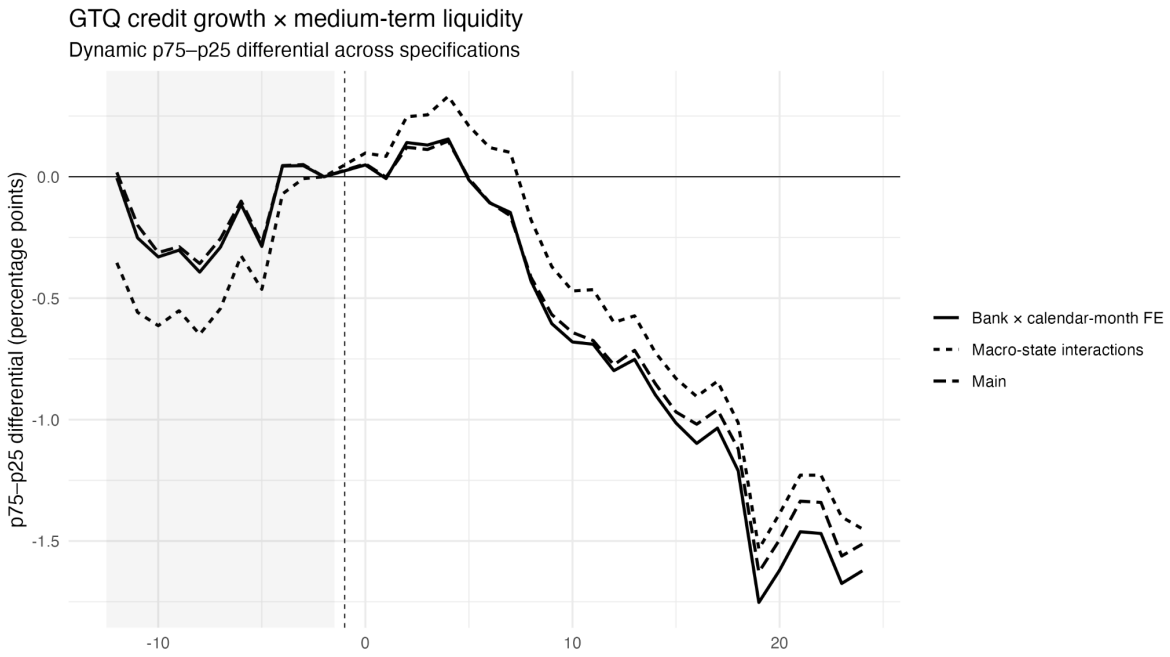

Figure 4: GTQ credit growth × medium-term liquidity across specifications

The dynamic path in Figure 3 does not look like a simple continuation of the pre-period. The pre-shock differential fades toward zero near impact, while the post-shock decline is larger and more persistent. Figure 4 also shows that the post-shock path is similar across the main, seasonal, and macro-state specifications. These two facts make the result economically relevant. Still, the negative horizon estimates in the macro-state specification are not clean enough to treat the result as irrefutable evidence, i.e., the liquidity channel is therefore best read as informative and stable in the post-shock period, but not free of some pre-trend concerns.

The sign is also worth noting: a simple liquidity-buffer story would predict that less-liquid banks contract credit more after tightening. Our result instead suggests that more liquid banks reduce GTQ credit growth more relative to less-liquid banks. One possible interpretation is related to portfolio flexibility: liquid banks may have more room to shift away from credit when the opportunity cost of lending changes. Another possible explanation is related to business-model composition: it could be that the liquidity measure may capture differences in asset management or customer base that are not fully absorbed by the current controls.

6.4 First stage shock uncertainty

The conditional results become less precise when uncertainty in the estimated policy shock is propagated into the bank-level regressions. Our shock uncertainty exercise uses bootstrap shock draws from the first stage aggregate model, recentered around the baseline shock series used in the bank panel. In this exercise, the qualitative signs of several results are partly preserved, but all 90 percent bootstrap intervals include zero.

Table 6: Conditional estimates and first stage shock uncertainty bootstrap

Result	Conditional estimate	Bootstrap median	Bootstrap 90% interval
GTQ credit growth × credit-to-assets, $h = 19$	0.89 pp	0.12 pp	[-0.56, 0.93]
GTQ deposit rate × borrowed funds, $h = 24$	-3.91 bp	-0.88 bp	[-2.88, 1.05]
GTQ loan rate × bank size, $h = 2$	16.41 bp	4.53 bp	[-7.38, 14.36]
GTQ credit growth × liquidity, $h = 18$	-1.01 pp	-0.22 pp	[-1.17, 0.70]
GTQ credit growth × liquidity, $h = 19$	-1.53 pp	-0.27 pp	[-1.19, 0.57]

Notes: Conditional estimates are p75–p25 response differentials from the macro-state robustness specification. Bootstrap intervals use shock draws from the first stage aggregate model recentered around the baseline shock series used in the bank panel. "pp" denotes percentage points and "bp" denotes basis points.

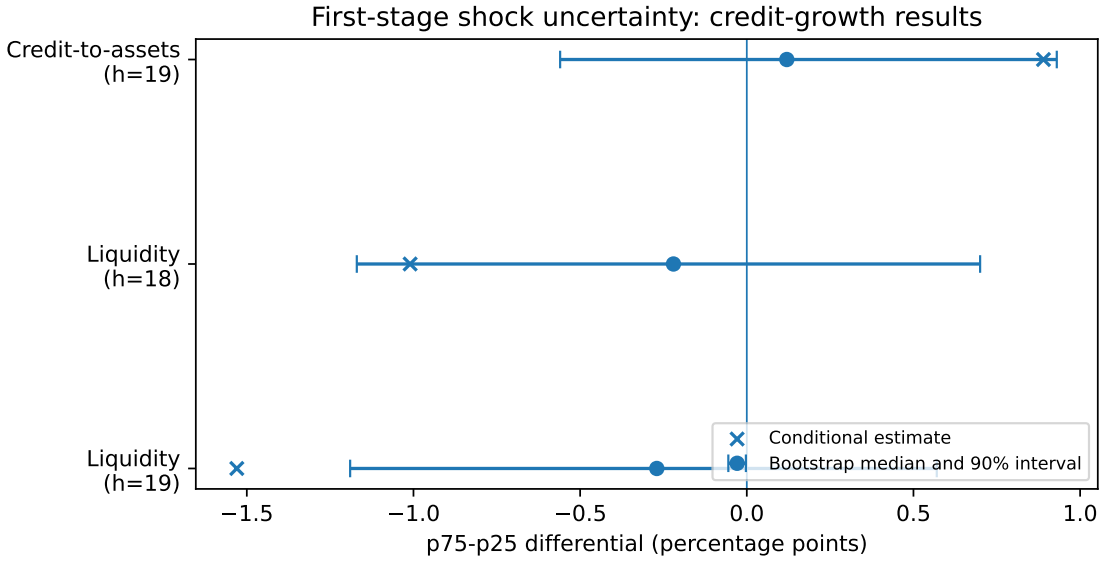

Figure 5: first stage shock uncertainty: credit growth results

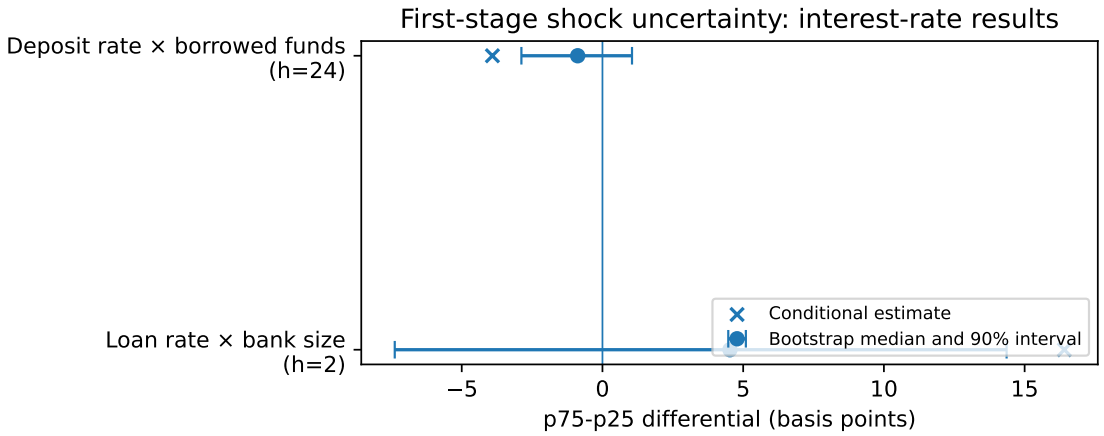

Figure 6: first stage shock uncertainty: interest rate results

However, we should not conclude from this that the heterogeneous patterns disappear, but rather that the estimates are conditional on a shock estimate whose first stage uncertainty is empirically relevant. As such, we view the results as informative about the cross-sectional structure of transmission, but not statistically decisive after accounting for shock estimation uncertainty.

6.5 Discussion and policy relevance

Our conditional estimates are best read jointly. Together, the results point to a banking system in which a common policy rate shock reaches institutions through several transmission margins at once: the composition of assets, the structure of liabilities, the speed of loan rate repricing and the opportunity cost of holding liquid assets. Our estimates do not line up with a uniform weak-bank amplification story: smaller, less capitalized, or less-liquid banks do not appear, in a systematic way, to be the institutions that contract most after tightening. Rather, the more useful distinction is between banks with different business models and different balance-sheet margins of adjustment.

The credit-intensity result is informative for the lending channel. In a narrow lending-channel interpretation, one might expect banks more exposed to credit to pull back more after a contractionary shock. The estimates show the opposite relative pattern: banks with higher credit-to-assets ratios record stronger GTQ credit growth performance than banks with lower credit intensity at medium horizons. This does not imply that monetary tightening expands aggregate credit, but that, within the banking system, the slowdown in credit is not concentrated in the banks whose balance sheets are most oriented toward lending. A plausible interpretation is that credit-intensive banks have more persistent loan relationships,

pre-existing credit lines, and organizational capacity specialized around lending. Their loan portfolios may be harder to reduce quickly, or their client base may include borrowers with stronger banking relationships. For policymakers, the implication is that the aggregate credit channel depends on which banks are marginal lenders during a tightening cycle. If credit-intensive banks remain relatively resilient, the contractionary effect on credit quantities may come from institutions for which lending is less central or more discretionary.

The borrowed funds result speaks to the liability side of transmission. Banks with higher borrowed funds-to-assets ratios show weaker GTQ deposit rate pass-through. As we pointed out before, this pattern is consistent with a marginal-funding interpretation. Banks that rely more on non-deposit funding may have less need to compete for domestic deposits when the policy stance tightens. Their deposit rates may therefore move less, even if the policy rate and some wholesale or interbank funding costs move more. In Guatemala, where central-bank liquidity operations, public-sector liquidity and banks' reserve positions can all affect funding conditions, our result suggests that the deposit rate channel should not be summarized by a single system wide pass-through coefficient, and may depend on which banks are actually using deposits as their marginal source of funds.

We also pointed out that the size result may be related to repricing rather than balance-sheet weakness. Larger banks show stronger short run pass-through to GTQ loan rates, which may reflect more formal loan-pricing systems, more active treasury and risk-management functions, greater sensitivity to benchmark rates, or a loan mix in which contractual rates adjust more quickly. In a banking system where large institutions account for a substantial share of intermediation, this channel has practical importance. Movements in average lending rates may first reflect the pricing behavior of larger banks before they reflect broader system wide adjustment. If smaller banks reprice more slowly, the aggregate lending rate response can look gradual even when leading banks adjust quickly.

As we mentioned above, the liquidity result deserves special care because its sign is not the one suggested by a simple liquidity-buffer view. One possible interpretation is portfolio flexibility. When monetary tightening raises the relative return on liquid or low-risk assets, banks with larger liquidity buffers may find it easier to shift away from credit, place funds in financial investments, or respond to central-bank absorption operations. Less-liquid banks, by contrast, may be tied more closely to existing loan relationships or may have less room to adjust portfolios without affecting funding stability. Under this reading, liquidity would not simply insulate banks from monetary policy, but can also give them the option to adjust more actively.

This point is particularly relevant in the Guatemalan context. The previous work of Blanco, Catalán-Herrera, and Ramirez (2026) emphasizes the distinction between liquidity

held by the public and liquidity held by banks. If monetary operations affect public liquidity more directly than bank liquidity, or if reserve accumulation and fiscal operations affect the distribution of liquidity, bank balance sheets become part of the transmission mechanism. A monetary policy shock can change the incentives faced by liquid and illiquid banks differently, even when both are exposed to the same aggregate stance. At the very minimum, this suggests that the composition and distribution of liquidity across banks deserve as much detailed attention as system wide liquidity aggregates.

Our results are also informative in the negative. Capitalization, deposit-funding share, dollarization measures, and several NPL interactions are plausible channels, but they are not supported as particularly important heterogeneity dimensions in our results.

We should emphasize that our first stage shock uncertainty exercise shows that the interpretation of our results should remain diagnostic: the results identify balance-sheet dimensions along which transmission appears to differ; but should not be used as precise elasticities for calibration without additional evidence. In other words, the central bank could use the patterns as a guide for monitoring tightening episodes: compare credit growth across banks with different credit intensity, track deposit rate adjustment by funding structure, examine loan rate repricing by bank size, and watch whether liquid banks reallocate portfolios after policy shocks.

In that sense, the paper's main policy contribution is a way of organizing bank-level evidence around the transmission mechanism. Aggregate impulse responses remain necessary for judging the macroeconomic effects of monetary policy, while Bank-level differentials show where the aggregate response is likely to come from and which balance-sheet characteristics may dampen, delay, or reallocate the effects of a common policy innovation.

7 Conclusion

This paper studies heterogeneous bank-level monetary policy transmission in Guatemala. It uses a monetary policy shock identified in an aggregate VARX model and asks whether banks with different lagged balance-sheet characteristics respond differently to that same shock.

Conditional on the estimated shock, the evidence points to several coherent patterns. More credit-intensive banks show relatively stronger GTQ credit growth performance after tightening. Banks with greater borrowed funds exposure show weaker GTQ deposit rate pass-through. Larger banks show stronger short run GTQ loan rate pass-through. Banks with higher medium-term liquidity show a more negative GTQ credit growth differential, although this result is pretrend sensitive.

These findings suggest that transmission is not well described by a simple weak-bank story. The relevant heterogeneity appears to be related to business model, funding structure, bank size, and liquidity-related portfolio adjustment. At the same time, the estimates are sensitive to uncertainty in the first stage policy shock. Bootstrap draws from the first stage shock-estimation model produce wide intervals.

Our main conclusion is therefore cautious. The bank-level patterns are economically meaningful and stable across several conditional specifications, but they should be interpreted as suggestive conditional evidence and not as definitive causal estimates.

Future work could strengthen the analysis in several directions. A high-frequency or narrative shock proxy could help validate the baseline shock. Richer bank- or loan-level data could clarify the role of borrower composition, credit type, maturity, collateral, and currency denomination. Additional work could also study how system wide liquidity, participations in the foreign exchange market, remittance inflows or Treasury operations interact with bank-level transmission.

References

Banco de Guatemala. (2024). *Evaluación de la Política Monetaria, Cambiaria y Crediticia a noviembre de 2024, y Perspectivas Económicas para 2025*. Banco de Guatemala.

Banco de Guatemala. (2026). Calendario de sesiones de Junta Monetaria: Tasa de Interés Líder de Política Monetaria. Banco de Guatemala.

Banco de Guatemala. (2022). *Evaluación del Diseño e Implementación de la Política Monetaria, Cambiaria y Crediticia a Noviembre de 2022, y Perspectivas Económicas para 2023*. Banco de Guatemala.

Blanco V., J. A. and Valle S., H. A. (2018). What Microeconomic Banks Data Tell Us About Monetary Policy Transmission and Financial Stability in Guatemala. In Ortiz-Bolaños, A. (ed.), *Monetary Policy and Financial Stability in Latin America and the Caribbean*, CEMLA.

Blanco V., A., Catalán-Herrera, J. C., and Ramirez Hunter, V. H. (2026). Monetary Policy Transmission in Guatemala: Evidence from a Semi-Structural VARX. Manuscript.

Blanco V., J. A., Valle S., H. A., and Delgado, F. L. (2017). Challenges to Inflation Targeting in Central America. Banco de Guatemala, Documento de Trabajo No. 141.

Bernanke, B. S. and Blinder, A. S. (1988). Credit, money, and aggregate demand. *American Economic Review*, 78(2), 435–439.

Bernanke, B. S. and Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. *Journal of Economic Perspectives*, 9(4), 27–48.

Boivin, J., Kiley, M. T., and Mishkin, F. S. (2010). How has the monetary transmission mechanism evolved over time? In Friedman, B. M. and Woodford, M. (eds.), *Handbook of Monetary Economics*, Vol. 3A, Elsevier.

Cetorelli, N. and Goldberg, L. S. (2012). Banking globalization and monetary transmission. *Journal of Finance*, 67(5), 1811–1843.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1999). Monetary policy shocks: What have we learned and to what end? In Taylor, J. B. and Woodford, M. (eds.), *Handbook of Macroeconomics*, Vol. 1, Elsevier.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (2005). Nominal rigidities and the dynamic effects of a shock to monetary policy. *Journal of Political Economy*, 113(1), 1–45.

Gambacorta, L. (2005). Inside the bank lending channel. *European Economic Review*, 49(7), 1737–1759.

Jiménez, G., Ongena, S., Peydró, J.-L., and Saurina, J. (2012). Credit supply and monetary policy: Identifying the bank balance-sheet channel with loan applications. *American Economic Review*, 102(5), 2301–2326.

Kashyap, A. K. and Stein, J. C. (2000). What do a million observations on banks say about the transmission of monetary policy? *American Economic Review*, 90(3), 407–428.

Kilian, L. and Lütkepohl, H. (2017). *Structural Vector Autoregressive Analysis*. Cambridge University Press.

Kishan, R. P. and Opiela, T. P. (2000). Bank size, bank capital, and the bank lending channel. *Journal of Money, Credit and Banking*, 32(1), 121–141.

Medina, S., Carrion-Menendez, A., and Frantischek, F. (2011). The Policy interest rate Pass-Through in Central America. IMF Working Paper 11/240.

Mishkin, F. S. (1996). The channels of monetary transmission: Lessons for monetary policy. NBER Working Paper No. 5464.

Montiel, P. (2015). The Monetary Policy Transmission Mechanism in Guatemala. Regional Technical Assistance for Central America, Panama and Dominican Republic, Final Report.

Rubio-Ramirez, J. F., Waggoner, D. F., and Zha, T. (2010). Structural vector autoregressions: Theory of identification and algorithms for inference. *Review of Economic Studies*, 77(2), 665–696.

Superintendencia de Bancos. (2026). *Boletín Mensual de Estadísticas del Sistema Financiero*. Superintendencia de Bancos de Guatemala.

Valle S., H. A., Morales C., E. F., Arriaza H., J. C., and Ramirez H., V. H. (2022). El Canal del Crédito en Guatemala. *Banca Central*, No. 83, 25–54.

Anagol, S. and Wang, S.-Y. (2026). Do monetary policy rates reach borrowers? Evidence from household and firm loans in 96 countries. NBER Working Paper No. 35439.

De Leo, P., Gopinath, G., and Kalemli-Özcan, Ş. (2024). Monetary policy and the short-rate disconnect in emerging economies. Working paper.