

The Spillover Effect of US Monetary Policy on Canadian Economy–FAVAR Approach

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April 10, 2025

1 Introduction

In today's increasingly interconnected global environment, the impact of monetary policy is no longer confined to the domestic landscape. The spillover effects of monetary policy have received considerable attention in empirical research. Specifically, Canada and the US share one of the closest trading relationships, and they are deemed to exert significant influence on each other's economies. In this paper, we aim to assess the spillover effects of US monetary policy on the Canadian economy using a factor-augmented Bayesian bivariate vector autoregressive framework, employing 186 Canadian macroeconomic time series and the US federal funds rate.

The FAVAR model stems from the observation that the traditional vector autoregressive (VAR) model. However, VAR can only incorporate a limited number of variables, according to (Chiaides & Gambacorta, 2004). This restriction is particularly evident when policymakers design discretionary policy based on the reference of more than a thousand indicators. Thus, (Bernanke et al., 2005) proposed a FAVAR framework to address this limitation by combining the principal component analysis with the VAR model. A more detailed discussion in the literature review section on how FAVAR can effectively resolve this limitation in VAR. Hence, this paper makes threefold contributions to the current research. First, we implement the FAVAR model with Bayesian bi-variate estimation to provide a complementary analysis to the existing joint estimation approach (Ji, 2017). Second, we extend the research by using the most recent data. Finally, by studying the dynamic response of the Canadian economy to external monetary shocks, we can have a better understanding of the monetary structure of a small open economy in general. The results show that a hypothetical unexpected US contractionary monetary policy has a broad-based tightening effect on the Canadian economy. The tightening monetary shock is primarily transmitted through an upward pressure on the Canadian overnight rate, leading

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to higher borrowing costs and a consecutive depreciation of the Canadian dollar. The contractionary credit condition pressure is then transmitted to real economic activities, which dampen GDP and the manufacturing sectors. Both exports and imports exhibit negative growth due to weakened domestic and foreign demand. It is worth noting that both total and core inflation are not very pronounced, which contradicts (Boivin et al., 2010) results. In the end, the Canadian labour market is inevitably compressed due to the reduction in economic activities.

The remaining sections of the paper are structured as follows: Section II reviews the relevant literature; Section III outlines our methodology, including model setup and VAR specification; Section IV presents the estimation results and dynamic impulse responses; Section V discusses the economic implications of our findings; and Section VI summarizes the paper and suggests future research directions.

2 Literature Review

The VAR(vector autoregression) approach is widely used to study monetary shocks that allows economists to capture the variance within the targeted time series and analyze the impulse responses of the included variables. However, there are certain underlying limitations in the conventional methods that should be taken into account. (Bernanke & Boivin, 2003) highlights that the VAR model is generally effective when endogenous variables are restricted to six to eight, whereas incorporating additional variables will distort the estimation by increasing the risk of overfitting. As a result, this selective approach restricts the ability to collect information and is likely to omit important variables. In the real world, central banks and major commercial banks tend to monitor and collect a substantial amount of variables to capture the condition of the entire economy (Kozicki & Tinsley, 2001; Stock & Watson, 2002). For instance, the Bank of Canada makes various predictions using the LENS (Large Empirical and Semi-structural) model, which employs thousands of variables (Gervais & Gosselin, 2014). With a low-dimensional VAR model, there will be information that is not included in the model, indicating that the measurement of policy innovations is prone to contamination. In this case, the VAR framework is usually used in sector-level or provincial analysis (Far'ès & Srouf, 2001; Georgopoulos et al., 2009).

To address the issue of limited information in the VAR model, (Bernanke et al., 2005) introduces the FAVAR model, which incorporates the principal component analysis(PCA) under the VAR framework. PCA extracts a small number of factors from a large information set. The extracted factors serve as additional endogenous variables in the model, enhancing the VAR with additional information. FAVAR models present several advantages in addressing the issues of variable selection and information limitation presented in standard VAR. Bernanke, Boivin and Elias (2005) demonstrate that FAVAR can assess the monetary shock by incorporating 120 macroeconomic variables. The model addresses the problem of selective representative variables by regressing a small number of estimated factors that can effectively summarize a significant amount of economic information. Thus, this model is widely used in other studies; for example, (Potjagailo, 2017) employed the FAVAR framework to study the spillover effect

of European monetary policy. (Vasishtha & Maier, 2013) also used the FAVAR model to study the impact of global dynamics on the Canadian Economy.

3 Methodology

3.1 Model

This paper uses the FAVAR approach, developed by (Bernanke et al., 2005) to study the spillover effect of US monetary policy on the Canadian economy. Let Y_t be a $M \times 1$ vector of observable economic series and F be a $K \times 1$ vector of unobservable factors, where M is the number of series in Y_t and K the number of factors. In several cases, the dynamics of the economy are not fully represented by Y_t . Factors F_t are designed to capture additional information. The joint dynamics of (F_t, Y_t) are assumed to follow this transition equation:

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \Phi(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + v_t \quad (1)$$

where Φ is a lag polynomial of finite order p (the number of lags), and v_t is the error term with mean zero and covariance matrix Q . The equation (1) cannot be directly estimated because F_t is unobservable. The factor can be interpreted as representing the underlying forces that can potentially affect many economic variables. We can then uncover those factors reservedly. Here is a simplified example:

$$F_t^{\text{Business Cycle}} = \alpha_1 GDP + \alpha_2 Unemployment + \alpha_3 InterestRate + \alpha_4 Consumption + \varepsilon_t$$

where the F_t is an unobservable variable that represents the business cycle. We include explanatory variables, as the observable variables representing macroeconomics that move along the business cycle. If we assume that this regression is a valid relationship, we can study the common variance shared by independent variables to estimate the unobservable latent factors. We set X_t as an $N \times 1$ matrix, which contains an extensive amount of data sets. The X_t is correlated with F_t and Y_t by the following equation:

$$X_t = \Lambda^f F_t + \Lambda^y Y_t + u_t \quad (2)$$

where Λ^f and Λ^y are the factor loadings relating F_t and Y_t to the data in X_t . The Λ^f is an $N \times M$ matrix and Λ^y is an $N \times M$ matrix. u_t is the vector of error terms, which are assumed to have zero mean and to be uncorrelated with the elements of F_t and Y_t . Then we substitute F_t with \hat{F} in two steps. First, we extract principal components \hat{C} from X_t (186 Canadian macro series) and Y_t Federal Funds Rate. All principal components are normalized to have unit variances. Second, to ensure the identification of the VAR model, the latent factors cannot respond contemporaneously to monetary policy innovations. Hence, to implement this identification scheme, we separate all Canadian variables into two categories: "fast-moving" and "slow-moving" vari-

ables. A variable is classified as “slow-moving” if it shows no contemporaneous response to monetary shocks, for example, the Consumer Price Index. The “fast-moving” variables are very sensitive to monetary shocks, such as stock prices and exchange rates. The classification of 186 macro variables is provided in the data section. The “slow-moving” factors \hat{F}_t^s are estimated as the principal components of the “slow-moving” variables. And they do not reacting contemporaneously to the monetary shock. We can then regress the regression (3), to obtain b_{Fs} and b_Y . The latent factors \hat{F}_t then can be constructed from $\hat{C}_t - \hat{b}_Y Y_t$

$$\hat{C}_t = b_{Fs} \hat{F}_t^s + b_Y Y_t + e_t, \quad (3)$$

3.2 VAR specification and Data

The purpose of this paper is to study the dynamic response of the Canadian economy to a US monetary policy shock. We use 186 Canadian macroeconomic monthly time series and the monthly average federal funds rate from January 1997 to November 2024¹. Our VAR model includes the federal funds rate and three latent factors extracted from the Canadian macroeconomic data. According to (Gorodnichenko, 2005), we order the variables from the most to least exogenous, followed by: principal component 1, principal component 2, principal component 3, and the federal funds rate. We place the federal funds rate last, allowing its innovations to be interpreted as exogenous monetary policy shocks following the standard identification strategy. This ordering assumes that the latent factors do not respond contemporaneously to those shocks. To satisfy this assumption, we then use equation 3 to extract the contemporaneous variance from the latent factors within the framework of slow-moving and fast-moving variables. In this way, the underlying endogeneity in the monetary structure is removed from the estimation.

4 Results and Estimates

In this study, we examine the spillover effects of US monetary policy on the Canadian economy over the period January 1997 to November 2024, using a factor-augmented vector autoregressive (FAVAR) model estimated via 5,000 iterations. The US federal funds rate serves as both the sole monetary policy shock and the policy variable Y in the model. To capture the overall state of the economy, we include 186 macroeconomic series and extract three latent factors via principal component analysis with three lags chosen based on the Hannan–Quinn (HQ) and Akaike information criterion (AIC) (Georgopoulos et al., 2009). Given the large pool of variables, we select 16 representative indicators to study their responses, providing a clear overview of policy effects across major sectors.

¹Detailed selected variables, including classification, are attached in Appendix A

4.1 Principal Component Analysis

Table 4.1 lists the principal component loadings from the Canadian data. These loadings show how much each observed macroeconomic variable contributes to the common factors and the federal funds rate. According to (Bernanke et al., 2005), principal components in the FAVAR framework capture the economy's aggregate variance. The factors do not have evident economic meaning, therefore, we only present the key observations. Factor_Y_total represents the share of each variable's variance explained by the common factors. For example, high values (near 1) indicate that most variability is explained by the common factors, whereas low values and high residual variance indicate variable-specific drivers. We can then examine the latent factors. PC 1 represents the real economic activity, which mostly captures variability in GDP, manufacturing, exports, imports, and the overnight rate. PC 2 shows a similar profile to PC 1. Finally, PC 3 captures mainly the general credit conditions, explaining most of the variance in total mortgage and household credit liabilities.

Variable	PC1	PC2	PC3	FFR	Factor_Y_total	<i>e</i>	Total
Total GDP	0.650	0.321	0.011	0.017	0.999	0.045	1.044
Canadian Bond All Sectors	0.042	0.004	0.003	0.003	0.051	0.955	1.006
Export	0.197	0.110	0.004	0.006	0.318	0.702	1.020
Import	0.286	0.167	0.000	0.008	0.462	0.563	1.025
Sales of Goods Manufactured (shipments)	0.473	0.261	0.007	0.012	0.752	0.283	1.035
Canadian Dollar Asset	0.002	0.002	0.006	0.000	0.009	1.000	1.009
Residential Mortgage	0.016	0.030	0.131	0.043	0.220	0.798	1.019
Overnight Rate	0.333	0.011	0.003	0.424	0.771	0.078	0.850
Total Credit Liabilities of Households	0.169	0.052	0.173	0.022	0.415	0.600	1.014
Chartered Bank Deposits	0.040	0.033	0.034	0.001	0.108	0.903	1.012
Total Mortgage	0.013	0.021	0.793	0.005	0.832	0.204	1.037
Core Inflation	0.009	0.006	0.000	0.000	0.014	0.995	1.010
Total Inflation	0.093	0.047	0.001	0.003	0.143	0.871	1.014
Unemployment Rate	0.047	0.018	0.002	0.037	0.104	0.904	1.009
Employment Rate	0.045	0.060	0.023	0.015	0.143	0.872	1.015
Effective Exchange Rate	0.168	0.013	0.036	0.063	0.280	0.683	0.963

Table 4.1: Principal component loadings

4.2 Variance Decomposition

Following (Bernanke et al., 2005), we define the fraction of the *k*-th-month ahead variance due to the U.S. monetary policy shock as:

$$VD\left(u_t^{\text{USmp}}, k\right) = \frac{\text{var}\left(X_{i,t+k} - \hat{X}_{i,t+k} \mid u_t^{\text{USmp}}\right)}{\text{var}\left(X_{i,t+k} - \hat{X}_{i,t+k}\right)}.$$

Table 4.2 presents the results of the variance decomposition. This approach quantifies the proportion of forecast-error variance attributable to U.S. monetary policy shocks on the targeted

variables. In general, the federal funds rate shock contributes only an economically insignificant share of the total variance in the key variables, except for the effective exchange rate.

Nearly half of the forecast-error variance (0.499) in Canada's overnight rate is attributable to the US shock, which is much higher than the other variables of interest. This observation reflects that the federal funds rate is a key determinant of Canada's policy rate. The results also show strong explanatory power for aggregate measures (Total GDP and Total Mortgage), because these aggregates are largely captured by the latent factors as discussed in Section 4.1. Aside from the overnight rate, low forecast-error variance across other variables is consistent with (Ho et al., 2018), who finds that U.S. monetary shocks account for only a small share of fluctuations in the broader economy. Overall, U.S. monetary shocks affect Canada mainly via the overnight rate and, to a lesser extent, the exchange rate. Variables such as Real GDP, inflation, trade volumes, and most credit aggregates are predominantly driven by domestic shocks and structural factors.

Variables	Contribution	R^2
Total GDP	0.016	0.955
Canadian Bond All Sectors	0.003	0.053
Export	0.006	0.305
Import	0.008	0.442
Sales of Goods Manufactured (shipments)	0.012	0.720
Canadian Dollar Asset	0.000	0.009
Residential Mortgage	0.042	0.209
Overnight Rate	0.499	0.922
Total Credit Liabilities of Households	0.021	0.406
Chartered Bank Deposits	0.001	0.105
Total Mortgage	0.005	0.797
Core Inflation	0.000	0.014
Total Inflation	0.003	0.137
Unemployment Rate	0.037	0.104
Employment Rate	0.015	0.136
Effective Exchange Rate	0.066	0.323

Table 4.2: Variance Decomposition and R^2 for key variables

4.3 Impulse Reaction Function

Figure 1 displays the impulse response functions (IRFs) for a selected set of Canadian macroeconomic variables in response to an unexpected monetary shock of a 25-basis-point increase in the U.S. federal funds rate with 90 percent confidence intervals. The IRFs are estimated over a 50-month horizon with a bootstrap procedure based on (Kilian, 1998).

In response to U.S. contractionary monetary policy, the Canadian economy experiences a widespread tightening impact that unfolds gradually over time. After the declines in the first

five months, the downward pressure on Canadian GDP and manufacturing diminishes slowly but remains persistent. The international trading sector dip is due to the reduction in US demand under tighter US market conditions. As the main monetary policy instrument, the Canadian overnight rate responds with an immediate increase that creates contractionary pressure on the other sectors. As a result, the Canadian dollar depreciates substantially as capital flows toward higher U.S. yields. This depreciation can stimulate exports, but cannot fully offset the decline in foreign demand.

In the financial sector, bond valuations across all Canadian issuers fall by up to 1.5 percent by the end of the 50-month horizon. Mortgage markets tighten significantly as foreign borrowing costs rise. The total credit liabilities of households and deposits at chartered banks initially decline by 1.5 percent and 0.2 percent, respectively. They then gradually return to their pre-shock levels as households and banks adjust their investment and consumption behaviour to the new interest rate environment. Total inflation falls even more steeply than core² inflation. The larger drop in total inflation reflects weaker aggregate demand and lower import prices, whereas the core inflation places greater emphasis on domestic price dynamics. Finally, the employment rate highlights a tightening labour market, decreasing by 0.08 percentage points when the shock is applied and gradually recovering over the next 20 months. Overall, the U.S. monetary tightening shock produces a contractionary effect across the Canadian economy. The most significant negative spillovers occur in the bond and broader financial markets, largely due to increased borrowing costs and currency depreciation.

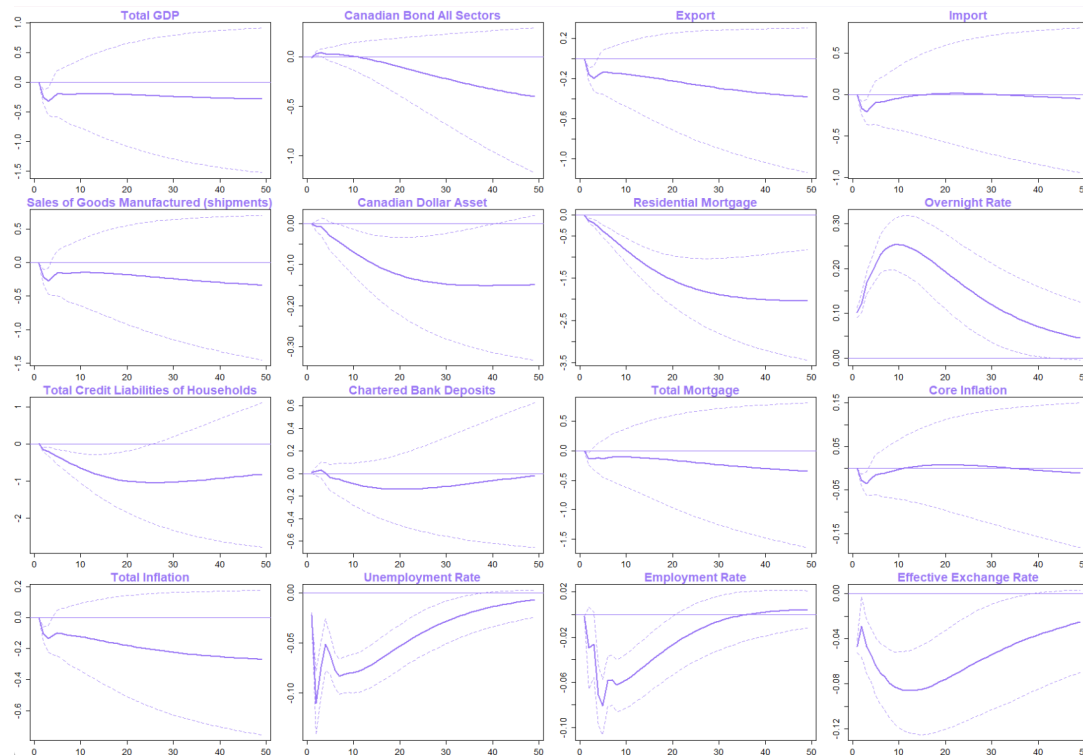


Figure 1: Impulse Reaction Plot for key variables

²Core inflation is a measure of the underlying trend in inflation, calculated by excluding volatile components like food and energy prices from the Consumer Price Index (CPI)

5 Discussion

The empirical findings provide valuable insights into the cross-border transmission of monetary policy shocks from the U.S. The FAVAR framework demonstrates the dynamics of Canadian macroeconomic indicators through three latent factors that effectively capture nuanced responses across different economic sectors. The principal component loadings in Table 1 suggest that these factors cover different economic dimensions. A dominant first factor appears to track general real activity, as evidenced by its strong loadings on Total GDP and manufacturing sales. In addition, the other factors appear to more effectively capture the credit conditions by acknowledging the contribution of different mortgage and liability segments. The variance decomposition results in Table 2 reveal the dynamics of the transmission mechanism. The relatively high contribution of U.S. monetary shocks to the forecast-error variance of the overnight rate highlights its direct and prominent role in the estimation. However, the contributions of variables such as real GDP and employment are much lower than expected, suggesting that spillovers from U.S. monetary policy shocks are channeled primarily through the Canadian policy rate rather than directly affecting the real economic activity.

The impulse reaction function shows that a 25 basis point increase in the U.S. policy rate transmits to Canada primarily through two channels. First, the direct policy rate channel raises the overnight rate by roughly 20 basis points in the first 10 months, leading to an increase in borrowing cost and a tightening credit conditions. Second, the contractionary pressure is then passed on to real economic activities, which moderately reduces the GDP and manufacturing by 0.5 percent. The reduction of economic activity weakens the labour market, leading to a rise in the unemployment rate and a fall in employment. The gap between total and core inflation underscores that Canadian domestic prices are mainly affected by declining imports and exports. Further, the persistence of output and credit spillover effects highlights the importance of lagged effects in a small open economy. The external contractionary monetary policy may cause long-lasting downward pressure on both goods and financial markets.

Overall, the empirical evidence supports the hypothesis that U.S. federal funds rate shocks, when transmitted through the policy-rate channel, have a more pronounced impact on the Canadian financial and credit market, while their impacts on the real economy in aggregate terms are relatively less significant.

6 Conclusion

This paper examines the spillover effects of U.S. monetary policy on the Canadian economy over the period January 1997 to November 2024 using a FAVAR model. By isolating the U.S. federal funds rate as the only monetary shock and extracting three potential factors from 186 Canadian macroeconomic series with three lags, this analysis presents a comprehensive picture of U.S.-CA monetary transmission.

The findings suggest that a contractionary U.S. monetary policy shock - a 25 basis-point in-

crease in the federal funds rate- triggers a significant and persistent reaction in Canadian financial markets, which is then transmitted to the Canadian real economy. The shock is accompanied by a sharp rise in the overnight rate and a significant depreciation of the Canadian dollar. In contrast, the direct impact of the U.S. contractionary shock on the real Canadian economic activity, while negative, is relatively small, suggesting that the transmission mechanism operates primarily through the policy rate channel. The variance decomposition results robustly support this conclusion, showing that the shock contributes significantly to the forecast-error variance of the overnight rate, but has little impact on aggregates such as real GDP.

In sum, this study provides strong evidence of the significant impact of U.S. monetary policy on the Canadian economy, highlighting the importance of the international monetary transmission channel in driving market dynamics. These results highlight the importance of the need for policy measures responding to external shocks in an increasingly interconnected global economy. Future research could extend these findings by exploring additional channels and examining their longer-term impact on the more augmented sectors.

References

- Bernanke, B. S., & Boivin, J. (2003). Monetary policy in a data-rich environment. *Journal of monetary economics*, 50(3), 525–546.
- Bernanke, B. S., Boivin, J., & Elias, P. (2005). Measuring the effects of monetary policy: A factor-augmented vector autoregressive (favar) approach. *The Quarterly journal of economics*, 120(1), 387–422.
- Boivin, J., Giannoni, M. P., & Stevanovic, D. (2010). Monetary transmission in a small open economy: More data, fewer puzzles. *Manuscript, HEC Montreal, Erişim tarihi*, 17(2015), 10–2139.
- Chiades, P., & Gambacorta, L. (2004). The bernanke and blinder model in an open economy: The italian case. *German Economic Review*, 5(1), 1–34.
- Far'ès, J., & Srouf, G. (2001). The monetary transmission mechanism at the sectoral level. (2001-12). <https://www.bankofcanada.ca/2001/12/monetary-transmission-mechanism-sectoral-level/%7D>
- Georgopoulos, M., Polak, K., Prager, F., Pruenste, C., & Schmidt-Erfurth, U. (2009). Characteristics of severe intraocular inflammation following intravitreal injection of bevacizumab (avastin). *British Journal of Ophthalmology*, 93(4), 457–462.
- Gervais, O., & Gosselin, M.-A. (2014, July). *Analyzing and forecasting the canadian economy through the LENS model* (Technical Report No. 102). Bank of Canada, Canadian Economic Analysis Department. Ottawa, Ontario, Canada.
- Gorodnichenko, Y. (2005). Reduced-rank identification of structural shocks in vars. *Available at SSRN 590906*.
- Ho, S. W., Zhang, J., & Zhou, H. (2018). Hot money and quantitative easing: The spillover effects of us monetary policy on the chinese economy. *Journal of Money, Credit and Banking*, 50(7), 1543–1569.
- Ji, J. (2017). Monetary policy transmission in canada: A favar analysis. *Journal of Monetary Economics*, 91, 1–14. <https://doi.org/10.1016/j.jmoneco.2017.01.001>
- Kilian, L. (1998). Small-sample confidence intervals for impulse response functions. *The Review of Economics and Statistics*, 80(2), 218–230. <https://doi.org/10.1162/003465398557465>
- Kozicki, S., & Tinsley, P. A. (2001). Shifting endpoints in the term structure of interest rates. *Journal of monetary Economics*, 47(3), 613–652.
- Potjagailo, G. (2017). Spillover effects from euro area monetary policy across europe: A factor-augmented var approach. *Journal of International Money and Finance*, 72, 127–147.
- Stock, J. H., & Watson, M. W. (2002). Forecasting using principal components from a large number of predictors. *Journal of the American statistical association*, 97(460), 1167–1179.
- Vasishtha, G., & Maier, P. (2013). The impact of the global business cycle on small open economies: A favar approach for canada. *The North American Journal of Economics and Finance*, 24, 191–207.

Appendix A Data

Table .1: Appendix A: List of Variables and Transformations

Variable name (category)	Identifier	Type	Transformation
Bond Portfolio_variables	Variable Identification	Fast/Slow	Log_diff
CBAS	CBAS	Fast	$\Delta \ln$
Government	CBGV	Fast	$\Delta \ln$
Federal government	CBFG	Fast	$\Delta \ln$
Provincial governments	CBPG	Fast	$\Delta \ln$
Municipal governments	CBMG	Fast	$\Delta \ln$
Corporations	CBCP	Fast	$\Delta \ln$
Government business enterprises	CBGBE	Fast	$\Delta \ln$
Federal government business enterprises	CBFGBE	Fast	$\Delta \ln$
Provincial government business enterprises	CBPGBE	Fast	$\Delta \ln$
Private corporations	CBPC	Fast	$\Delta \ln$
MMAS	MMAS	Fast	$\Delta \ln$
Government	MMAS_GV	Fast	$\Delta \ln$
Federal government	MMAS_FG	Fast	$\Delta \ln$
Provincial governments	MMAS_PG	Fast	$\Delta \ln$
Corporations	MMAS_CP	Fast	$\Delta \ln$
Government business enterprises	MMAS_GBE	Fast	$\Delta \ln$
Federal government business enterprises	MMAS_FGBE	Fast	$\Delta \ln$
Provincial government business enterprises	MMAS_PGBE	Fast	$\Delta \ln$
Private corporations	MMAS_PC	Fast	$\Delta \ln$
Manufacturing_variables	Variable Identification	Fast/Slow	Log_diff
Sales of goods manufactured (shipments)	SOG	Fast	$\Delta \ln$
New orders, estimated values of orders received during month	NOE	Fast	$\Delta \ln$
Unfilled orders, estimated values of orders at end of month	UOE	Fast	$\Delta \ln$
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Variable name (category)	Identifier	Speed	Transformation
Raw materials, fuel, supplies, components, estimated values at end of month	RMF	Slow	$\Delta \ln$
Goods or work in process, estimated values at end of month	GOW	Slow	$\Delta \ln$
Finished goods manufactured, estimated values at end of month	FGM	Slow	$\Delta \ln$
Total inventory, estimated values of total inventory at end of the month	TIE	Slow	$\Delta \ln$
Ratio of total inventory to sales	ROT	Slow	No transformation
Ratio of finished goods to sales	ROF	Slow	No transformation
Credit Liability Household	Variable Identification	Fast/Slow	Log_diff
Non-mortgage loans	NML	Fast	$\Delta \ln$
Chartered banks 2	NML_CB	Fast	$\Delta \ln$
Personal loans 2 3	NML_PL	Fast	$\Delta \ln$
Credit cards 2 3	NML_CC	Fast	$\Delta \ln$
Lines of credit 2 3 4	NML_LC	Fast	$\Delta \ln$
Lines of credit, of which: excluding home equity lines of credit 2 3	NML_EHELC	Fast	$\Delta \ln$
Other personal loans 2 3	NML_OPL	Fast	$\Delta \ln$
Unincorporated business 2 3	NML_UB	Fast	$\Delta \ln$
Non-banks 2	NML_NB	Fast	$\Delta \ln$
Government 2 5	NML_GV	Fast	$\Delta \ln$
Non-bank financial corporations 2 5	NML_NBFC	Fast	$\Delta \ln$
Credit unions and caisse populaires 2 5	NML_CUCP	Fast	$\Delta \ln$
Trust companies and mortgage loan companies 2 5	NML_TCMLC	Fast	$\Delta \ln$
Financial vehicle corporations engaged in securitization 2 6	NML_FVCES	Fast	$\Delta \ln$
Other financial corporations n.e.i. 2 7	NML_OFC	Fast	$\Delta \ln$
Other lenders n.e.i. 2 8	NML_OL	Fast	$\Delta \ln$
Mortgage loans	ML	Fast	$\Delta \ln$
Residential mortgages 9	RM	Slow	$\Delta \ln$

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Variable name (category)	Identifier	Speed	Transformation
Chartered banks 9 10	RM_CB	Slow	$\Delta \ln$
Non-banks 9 10	RM_NB	Slow	$\Delta \ln$
Government 9 10	RM_NB	Slow	$\Delta \ln$
Non-bank financial corporations 9 10 11	RM_NBFC	Slow	$\Delta \ln$
Credit unions and caisse popu- lares 9 10	RM_CUCP	Slow	$\Delta \ln$
Trust companies and mortgage loan companies 9 10	RM_TCMLC	Slow	$\Delta \ln$
Financial vehicle corporations engaged in securitization 6 9 10	RM_FVCES	Slow	$\Delta \ln$
Of which: off balance-sheet NHA-MBS 9 10 12	RM_NHA_MBS	Slow	$\Delta \ln$
Other financial corporations n.e.i. 7 9 10	RM_OFC	Slow	$\Delta \ln$
Other lenders n.e.i. 8 9 10	RM_OL	Slow	$\Delta \ln$
Non-residential mortgages 9	RM_NRM	Slow	$\Delta \ln$
Chartered banks 9 13	RM_CB	Slow	$\Delta \ln$
Non-banks 9 13	RM_NB	Slow	$\Delta \ln$
Government 9 13	RM_NRM_GV	Slow	$\Delta \ln$
Non-bank financial corporations 9 13	RM_NRM_NBFC	Slow	$\Delta \ln$
Credit unions and caisse popu- lares 9 13	RM_NRM_CUCP	Slow	$\Delta \ln$
Trust companies and mortgage loan companies 9 13	RM_NRM_TCMLC	Slow	$\Delta \ln$
Other financial corporations n.e.i. 7 9 13	RM_NRM_OFC	Slow	$\Delta \ln$
Other lenders n.e.i. 8 9 13	RM_NRM_OL	Slow	$\Delta \ln$
Total credit liabilities of house- holds	TCLH	Slow	$\Delta \ln$
Of which: real estate secured lending 14	TCLH_RESL	Slow	$\Delta \ln$
Residential mortgages 14	TCLH_RM	Slow	$\Delta \ln$
Chartered banks 10 14	TCLH_CB	Slow	$\Delta \ln$
Non-banks 10 14	TCLH_NB	Slow	$\Delta \ln$
Non-residential mortgages 14	TCLH_NRM	Slow	$\Delta \ln$
Chartered banks 13 14	TCLH_CB	Slow	$\Delta \ln$
Non-banks 13 14	TCLH_NB	Slow	$\Delta \ln$

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Variable name (category)	Identifier	Speed	Transformation
Home equity lines of credit 14	TCLH_HELC	Slow	$\Delta \ln$
Chartered banks 14	TCLH_CB	Slow	$\Delta \ln$
Chartered Bank	Variable Identifica- tion	Fast/Slow	Log_diff
Personal loan plan loans	PLPL	Fast	$\Delta \ln$
Credit card loans	CCL	Fast	$\Delta \ln$
Personal lines of credit	PLC	Fast	$\Delta \ln$
Other personal loans	OPL	Fast	$\Delta \ln$
Chartered bank deposits, total Canadian dollar (gross)	CBP_CD	Slow	$\Delta \ln$
Bankers' acceptances	BA	Fast	$\Delta \ln$
Subordinated debt payable in Canadian dollars	SBPCD	Slow	$\Delta \ln$
Total, foreign currency deposits of Canadian residents	TFCDRC	Slow	$\Delta \ln$
Estimated Canadian dollar items in transit (net)	ECDIT	Fast	$\Delta \ln$
Canadian dollar assets, total	CDA	Slow	$\Delta \ln$
Non-mortgage loans, total	NML	fast	$\Delta \ln$
Mortgages, total	MT	Slow	$\Delta \ln$
CPI(2002 =100)	Variable Identifica- tion	Fast/Slow	Log_diff
Total Inflation	TI	Slow	$\Delta \ln$
Food	FOO	Slow	$\Delta \ln$
Shelter	SHE	Slow	$\Delta \ln$
Household operations, furnish- ings and equipment	HOFE	Slow	$\Delta \ln$
Clothing and footwear	CF	Slow	$\Delta \ln$
Transportation	TRAN	Slow	$\Delta \ln$
Health and personal care	HPC	Slow	$\Delta \ln$
Recreation, education and read- ing	RED	Slow	$\Delta \ln$
Alcoholic beverages, tobacco products and recreational cannabis	ABTPRC	Slow	$\Delta \ln$
All-items excluding food	AIEF	Slow	$\Delta \ln$
Core_Inf	CI	Slow	$\Delta \ln$
Real_GDP	RGDP	slow	$\Delta \ln$

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Variable name (category)	Identifier	Speed	Transformation
Labour	Variable Identification	Fast/Slow	Log_diff
Unemployment rate 8	UR	Slow	No transformation
Participation rate 9	PR	Slow	No transformation
Employment rate 10	ER	Slow	No transformation
Canada's official international reserves, millions of United States dollars, Bank of Canada, monthly (x 1,000,000)	Variable Identification	Fast/Slow	Log_diff
Total, Canada's official international reserves	TCOIR	Slow	$\Delta \ln$
Convertible foreign currencies, United States dollars	CFCUSD	Slow	$\Delta \ln$
Convertible foreign currencies, other than United States	CFC	Slow	$\Delta \ln$
Gold	GD	Slow	$\Delta \ln$
Special drawing rights	SDR	Slow	$\Delta \ln$
Reserve position in the International Monetary Fund (IMF)	RPIMF	Slow	$\Delta \ln$
Effective Exchange Rate(Base year =1992)	EER	Fast	No transformation
Import	Variable Identification	Fast/Slow	Log_diff
Import Price Index by Origin (NAICS): All Industries for Canada (CANTOT)	CANTOT	Fast	$\Delta \ln$
Import Price Index by Origin (NAICS): Nonmanufacturing for Canada (CANNONM)	CANNONM	Fast	$\Delta \ln$
Import Price Index by Origin (NAICS): Manufacturing for Canada (CANMANU)	CANUMANU	Fast	$\Delta \ln$
Export	Variable Identification	Fast/Slow	Log_diff
International Merchandise Trade Statistics: Exports: Commodities for Canada (XTEXVA01CAM664S)	IMTS	Fast	$\Delta \ln$

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Variable name (category)	Identifier	Speed	Transformation
Asset	Variable Identifica- tion	Fast/Slow	Log_diff
Total assets	TA	Slow	$\Delta \ln$
Total, Government of Canada, direct and guaranteed securities	GCDGS	Slow	$\Delta \ln$
Government of Canada, Treasury Bills	GCTB	Slow	$\Delta \ln$
Total, Government of Canada, bonds	GCB	Slow	$\Delta \ln$
Loans and receivables, advances to members of Payments Canada 4	LCAMP	Fast	$\Delta \ln$
Loans and receivables, securities purchased under resale agreements	LCSPRA	Slow	$\Delta \ln$
Loans and receivables, other 5	LAR	Slow	$\Delta \ln$
Other investments 6	OVES	Slow	$\Delta \ln$
Foreign currency deposits	FCD	Slow	$\Delta \ln$
All other assets 7	AOA	Slow	$\Delta \ln$
Liability	Variable Identifica- tion	Fast/Slow	Log_diff
Total liabilities	TLB	Slow	$\Delta \ln$
Total, notes in circulation	TNC	Slow	$\Delta \ln$
Canadian dollar deposits, Government of Canada	CDD_GC	Fast	$\Delta \ln$
Canadian dollar deposits, members of Payments Canada 3 4	CDD_MPC	Fast	$\Delta \ln$
Canadian dollar deposits, other 5	CDD_DO	Fast	$\Delta \ln$
Foreign currency liabilities	FCL	Slow	$\Delta \ln$
All other liabilities 6	AOL	Slow	$\Delta \ln$
Credit Conditon	Variable Identifica- tion	Fast/Slow	Log_diff
All sectors credit with households and private non-financial corporations, loans and debt securities, not seasonally adjusted	All_CHPNF	Slow	$\Delta \ln$

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Variable name (category)	Identifier	Speed	Transformation
Chartered bank credit with households and private non-financial corporations, loans and debt securities, not seasonally adjusted	PNFCLDS	Slow	$\Delta \ln$
Chartered bank credit with households and private non-financial corporations, loans and debt securities, seasonally adjusted	PNFC_LDS	Slow	$\Delta \ln$
Chartered bank credit with households, private non-financial corporations and governments, loans, not seasonally adjusted	PNFC_GL	Slow	$\Delta \ln$
Chartered bank credit with households, private non-financial corporations and governments, debt securities, not seasonally adjusted	CBCHPNF_D	Slow	$\Delta \ln$
Chartered bank credit with governments, loans, not seasonally adjusted	CBCGL	Slow	$\Delta \ln$
Chartered bank credit with governments, debt securities, not seasonally adjusted	CBDS	Slow	$\Delta \ln$
Monetary Aggregate	Variable Identification	Fast/Slow	Log_diff
M3 (gross) (M2 (gross), chartered bank non-personal term deposits, chartered bank foreign currency deposits of Canadian residents booked in Canada, adjustments to M3 (continuity adjustments and inter-bank term deposits))	TD_CDC	Slow	$\Delta \ln$
M2+ (gross) 5	MGSS	Slow	$\Delta \ln$

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Variable name (category)	Identifier	Speed	Transformation
Monetary base (notes and coin in circulation, chartered bank and other Payments Canada members' deposits with the Bank of Canada) (excluding required reserves) 6	MBE	Slow	$\Delta \ln$
Non-money market mutual funds	NMMMMF	Slow	$\Delta \ln$
M2++ (gross) (M2+ (gross), Canada Savings Bonds, non-money market mutual funds)	NMMM	Slow	$\Delta \ln$
M1+ (gross) 7	MGSS	Slow	$\Delta \ln$
All Industries	Variable Identifica- tion	Fast/Slow	Log_diff
All industries [T001] 4	AID	Slow	$\Delta \ln$
Goods-producing industries [T002] 4	GPI	Slow	$\Delta \ln$
Service-producing industries [T003] 4	SPI	Slow	$\Delta \ln$
Industrial production [T010] 4	IP	Slow	$\Delta \ln$
Non-durable manufacturing industries [T011] 4	NDMI	Slow	$\Delta \ln$
Durable manufacturing industries [T012] 4	DMI	Slow	$\Delta \ln$
Energy sector [T016] 4	ES	Slow	$\Delta \ln$
All industries (except cannabis sector) [T020] 4	AIECS	Slow	$\Delta \ln$
Cannabis sector [T021] 4	CST	Slow	$\Delta \ln$
All industries (except unlicensed cannabis sector) [T024] 4	ADEUC	Slow	$\Delta \ln$
Agriculture, forestry, fishing and hunting [11]	AFFH	Slow	$\Delta \ln$
Mining, quarrying, and oil and gas extraction [21]	MQCGE	Slow	$\Delta \ln$
Utilities [22]	UTL	Slow	$\Delta \ln$
Construction [23]	CTT	Slow	$\Delta \ln$
Manufacturing [31-33]	MFT	Slow	$\Delta \ln$
Wholesale trade [41]	WTD	Slow	$\Delta \ln$
Retail trade [44-45]	RTD	Slow	$\Delta \ln$

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Variable name (category)	Identifier	Speed	Transformation
Transportation and warehousing [48-49]	TAW	Slow	$\Delta \ln$
Information and cultural industries [51]	IACI	Slow	$\Delta \ln$
Finance and insurance [52]	FAI	Slow	$\Delta \ln$
Real estate and rental and leasing [53]	RERL	Slow	$\Delta \ln$
Professional, scientific and technical services [54]	PSTS	Slow	$\Delta \ln$
Administrative and support, waste management and remediation services [56]	ASWRS	Slow	$\Delta \ln$
Educational services [61]	EDS	Slow	$\Delta \ln$
Health care and social assistance [62]	HCSA	Slow	$\Delta \ln$
Arts, entertainment and recreation [71]	AER	Slow	$\Delta \ln$
Accommodation and food services [72]	AAFS	Slow	$\Delta \ln$
Other services (except public administration) [81]	OSEPA	Slow	$\Delta \ln$
Public administration [91]	PAD	Slow	$\Delta \ln$
Government Security	Variable Identification	Fast/Slow	Log_diff
Government of Canada benchmark bond yields, 10 year	GOCB_10	Fast	No transformation
2_Year_bond	BOND_2	Fast	No transformation
Government of Canada benchmark bond yields, 3 year	GOCB_3	Fast	No transformation
Government of Canada benchmark bond yields, 5 year	GOCB_5	Fast	No transformation
Government of Canada benchmark bond yields, 7 year	GOCB_7	Fast	No transformation
Government of Canada benchmark bond yields, long term	GOCB_long	Fast	No transformation
Government of Canada marketable bonds, 1 to 3 years	GOCB_1 to 3	Fast	No transformation
Government of Canada marketable bonds, 3 to 5 years	GOCB_3 to 5	Fast	No transformation

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Variable name (category)	Identifier	Speed	Transformation
Government of Canada marketable bonds, 5 to 10 years	GOCB_5 to 10	Fast	No transformation
Government of Canada marketable bonds, over 10 years	GOCB_over 10	Fast	No transformation
Overnight_rt	RT_Overnight	Fast	No transformation
Real return benchmark bond yield, long term	RECB_long	Fast	No transformation
Target_rate	RATE_Target	Fast	No transformation
Treasury Bills, 1-month	TRCB_1	Fast	No transformation
T_bill_1_year	YEAR_T	Fast	No transformation
Treasury Bills, 2-month	TRCB_2	Fast	No transformation
Treasury Bills, 3-month	TRCB_3	Fast	No transformation
Treasury Bills, 6-month	TRCB_6	Fast	No transformation
Grand Total	TOTAL_Grand	Fast	No transformation
Canada Monetary Instrument	Variable Identification	Fast/Slow	Log_diff
Bank rate	BANR	Slow	No transformation
Operating band, high	OBH	Slow	No transformation
Operating band, low	OBL	Slow	No transformation