

Is anyone surprised? The high-frequency impact of US and domestic macroeconomic data announcements on Canadian asset prices

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1. Introduction

Small open economies and their financial markets are strongly influenced by international economic developments, particularly those in large countries with which they have significant trade and financial ties. For Canada, US economic conditions and interest rates play a critical role in shaping domestic financial markets. In addition, US macroeconomic releases and movements in US yields influence global markets because of the important role the US economy and US Treasury market play in the global financial system.

Macroeconomic data, such as consumer price index (CPI), gross domestic product (GDP) and labour market indicators, provide important information about the state of the business cycle. Accordingly, announcements about these data are highly anticipated by financial market participants and policy-makers. In a small open economy like Canada, in addition to domestic macroeconomic announcements, US macroeconomic releases are watched carefully due to the close financial and economic ties between the two countries.

This paper compares the impacts of domestic and US macroeconomic announcements on a broad set of Canadian asset prices using almost two decades' worth of high-frequency data. Quantifying Canadian market participants' reactions to macroeconomic announcements is valuable for several reasons:

- It sheds light on how efficiently financial markets process new information, as suggested by the efficient-market hypothesis.
- It provides monetary authorities with a critical tool for assessing how markets perceive the central bank's policy reaction function.

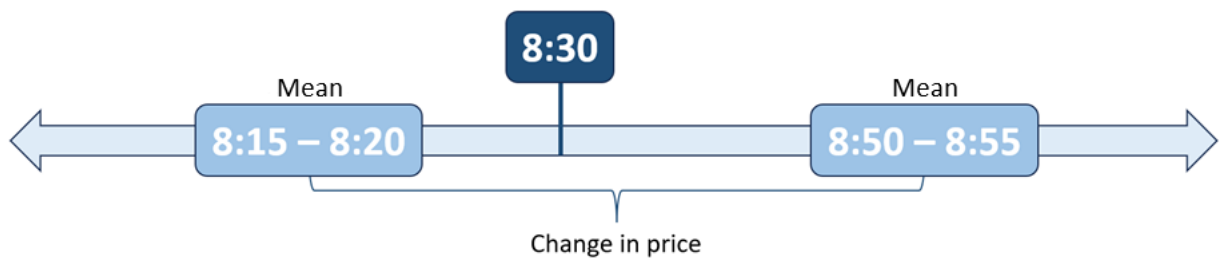
While previous literature, such as Gravelle and Moessner (2001) and Hayo and Neuenkirch (2012), examines the daily changes in Canadian interest rates due to domestic and US macroeconomic announcements, this is the first paper to look at this issue with high-frequency data.¹ Leveraging high-frequency data enables us to more cleanly isolate the impact of macroeconomic releases from other news hitting the financial markets. Additionally, we expand the set of asset prices to include short-term interest rate futures, the stock market index future and the spot exchange rate. The dynamics of the spot exchange rate, in particular, are crucial for open economies.

¹ Data for BAX and the S&P/TSX 60 Index futures are from the Montréal Exchange. Government of Canada bond data are from CanDeal and the Market Trade Reporting System 2.0 (MTRS 2.0). The CAD/USD exchange rate comes from Refinitiv and Olsen Financial Technologies.

2. Macroeconomic announcements and high-frequency data

Figure 1 shows how we construct asset price changes around events using our high-frequency data. Many important macroeconomic data releases occur at 8:30 a.m. ET.² To measure the changes in asset prices, we use the average price from 10–15 minutes before the macroeconomic announcement and the average price from 20–25 minutes after the announcement. By using the mean over a 5-minute trade window, we ensure the asset price changes are not driven by outliers.

Figure 1: Time window around macroeconomic announcements



We examine the impact of four key macroeconomic announcements—CPI, employment, production³ and retail sales—in the United States and Canada on Canadian financial markets. These indicators were selected based on their significant and persistent influence on Canadian fixed-income markets, as evidenced by market participants’ attention and empirical findings in the literature. While Xing et al. (2024) highlight their persistent effects using low-frequency data, our analysis focuses on their immediate impact using high-frequency data.

Our sample spans from January 2002 to December 2023. However, given the extreme volatility in macroeconomic announcements at the onset of the COVID-19 pandemic, we remove the period of March to June 2020 from our sample.⁴

² Several macroeconomic data releases occur at different times of the day—for instance, ISM manufacturing data are released at 10 a.m. Most of the key releases in our study are scheduled for release at 8:30 a.m. In any case, we adapt the windows to revolve around the time of each event. Prior to April 2012, Canadian Labour Force Survey (LFS) and CPI data were released at 7:00 a.m.

³ We use monthly GDP at basic prices for Canada, and ISM Manufacturing PMI for the United States. Alternative US production data are considered in Appendix B.

⁴ A detailed description of the sample used for all announcement types and assets is shown in Appendix A at Table A-1. It is also important to note that the Canadian and US employment surveys are generally released on the same day, and since 2012, also at the same time, 8:30 a.m. In our sample, 90 out of the 261 announcements happen on the same day at the same time, which makes it difficult to determine the source of the effects on Canadian financial markets. Nonetheless, most of the employment announcements happened either on a different date or at a different time because the Canadian LFS was released at 7 a.m. prior to April 2012.

3. Changes in Canadian asset prices around domestic and US macroeconomic announcements

Table 1 below shows the mean absolute change in basis points of Canadian short- and long-term interest rates, the CAD/USD exchange rate and the return of S&P/TSX 60 Index futures around each type of domestic and US announcement. A series of interesting results emerge.

- Examining the reaction of interest rates, we see a notable pattern appear: domestic macroeconomic announcements tend to trigger greater changes in Canadian short-term interest rate futures (Canadian bankers' acceptance futures, i.e., BAX) and 2-year Government of Canada (GoC) benchmark bond yields than similar US announcements do. However, this trend reverses for long-term yields, such as 10-year and 30-year GoC bonds. For long-term yields, US macroeconomic announcements exert a larger impact on Canadian yields than their domestic counterparts do. This finding is in line with papers that document an important role for US monetary policy and macroeconomic announcements in explaining long-term yields and risk premiums in international bond yields, such as Bauer and Diez de los Rios (2012).
- The S&P/TSX 60 Index Standard futures return exhibits a stronger response to US macroeconomic announcements than to domestic ones. This is consistent with previous research, such as Boehm and Kroner (2023), that highlights the global influence of US economic news.
- Perhaps surprisingly, we show that the CAD/USD exchange rate moves more around domestic macroeconomic announcements than around US ones. While US macroeconomic announcements do significantly change Canadian interest rates, as shown in **Table 1**, the inverse is not likely. Hence, Canadian macroeconomic announcements generate a larger change in the relative interest rates between the two countries. In line with this result, Sekkel, Stern and Zhang (forthcoming) report a similar pattern when they examine the effects on the CAD/USD exchange rate of monetary policy announcements by both central banks.⁵

⁵ Table A-2 in Appendix A examines the statistical significance of the differences in reactions to US and Canadian macroeconomic announcements.

Table 1: Mean absolute change per announcement (basis points)

| Event | Bankers' acceptance futures | | | | | GoC benchmark bonds | | | | S&P/TSX 60 Index futures |
|---------------|-----------------------------|------|------|------|------|---------------------|------|------|------|--------------------------|
| | CAD/USD | BAX1 | BAX2 | BAX3 | BAX4 | 2yr | 5yr | 10yr | 30yr | |
| EMPC - CA | 28.57 | 1.19 | 2.4 | 2.91 | 2.89 | 2.32 | 2.87 | 2.42 | 2.21 | 17.45 |
| NFP - US | 25.61 | 1.12 | 2.03 | 2.61 | 2.95 | 2.29 | 2.94 | 2.75 | 2.19 | 23.93 |
| CPI - CA | 17.83 | 1.35 | 1.98 | 2.17 | 2.24 | 1.86 | 1.94 | 1.52 | 1.29 | 9.79 |
| CPI - US | 14.39 | 0.77 | 1.44 | 1.84 | 1.99 | 1.71 | 2.04 | 2.21 | 1.49 | 16.71 |
| GDP - CA | 17.36 | 0.97 | 1.61 | 1.93 | 2.02 | 1.55 | 1.59 | 1.51 | 1.07 | 10.97 |
| Man. PMI - US | 12.27 | 0.65 | 1.21 | 1.46 | 1.52 | 1.15 | 1.52 | 1.7 | 1.22 | 26.29 |
| Retail - CA | 18.7 | 1.08 | 1.67 | 1.94 | 1.85 | 1.43 | 1.43 | 1.45 | 1.07 | 9.05 |
| Retail - US | 11.56 | 0.62 | 1.13 | 1.52 | 1.5 | 1.28 | 1.49 | 1.59 | 1.5 | 11.44 |

Note: This table shows the mean absolute change in basis points for each asset around each type of Canadian and US macroeconomic release. EMPC-CA refers to employment changes in Canada, NFP refers to non-farm payroll. GDP refers to month-over-month Canadian GDP at basic prices and Man. PMI is the ISM Manufacturing Purchasing Managers' Index. The remaining releases are year-over-year CPI and month-over-month retail sales for both countries.

4. Estimating the effects of macroeconomic announcement surprises on Canadian financial markets

If the numbers in the data releases are fully anticipated and accurately forecasted, efficient market theory suggests that these forecasts would already be reflected in market prices. Thus, we would not see sudden price changes around these releases. However, the observed price fluctuations in **Table 1** indicate that market participants are on average surprised. In this section, we quantify the size of the surprise by comparing actual data releases with forecasts, and then examine how these surprises are transmitted to market prices.

For each macroeconomic announcement k at time t , we construct a surprise measure by subtracting from the macroeconomic announcement k its median forecast from Bloomberg. To make magnitudes comparable, we then divide the surprise by its sample standard deviation, denoted by $\hat{\sigma}^k$:

$$S_t^k = \frac{k_t - E[k_t|I_{t-1}]}{\hat{\sigma}^k},$$

where k_t is the first release of variable k , $E[k_t|I_{t-1}]$ is the median expectation conditional on information available just before the announcement, and $\hat{\sigma}^k$ is the standard deviation of $k_t - E[k_t|I_{t-1}]$.

We then estimate the following regression for each financial variable y^i and macroeconomic announcement k :

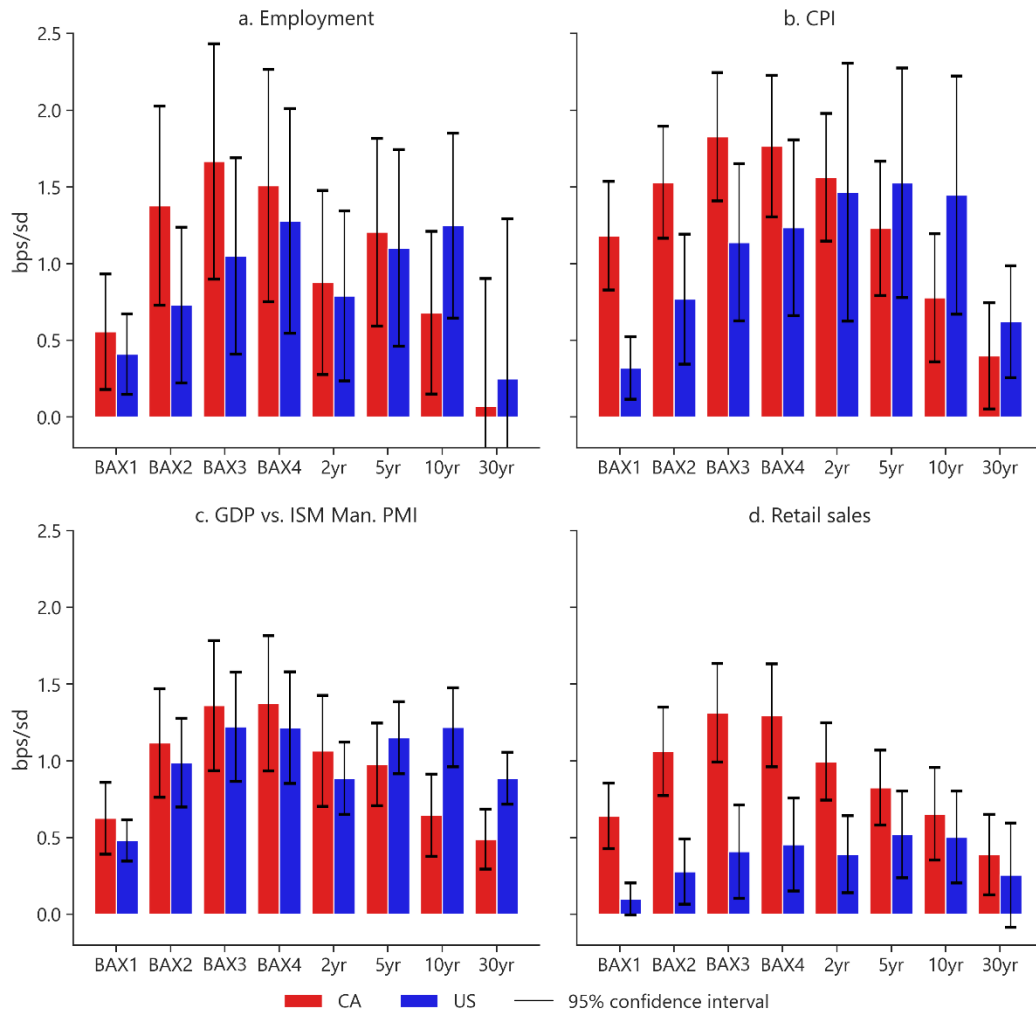
$$y_t^{i,k} = a^{i,k} + \beta^{i,k} S_t^k + \varepsilon_t^{i,k}, \quad (1)$$

where $y_t^{i,k}$ is the change in log price or interest rate for asset i around the macroeconomic announcement k measured in basis points, and S^k represents the standardized surprise component of a macroeconomic announcement k as defined above. The coefficient $\beta^{i,k}$ measures the impact of a standard deviation unit of the surprise k on asset price y^i .

We estimate the regression equation (1) for US and domestic macroeconomic announcements on Canadian fixed-income markets ranging from a short-term yield such as the BAX1 to a 30-year GoC bond yield. **Chart 1** shows the estimates and the 95% confidence interval for the $\beta^{i,k}$ coefficient. The vertical axis represents the resulting basis point shift in the corresponding asset from a one-unit standard deviation surprise. A few results emerge:

- First, the impacts of most domestic and US macroeconomic surprises are highly statistically significant.
- Second, employment and CPI surprises have a higher impact than production and retail sales indicators for both US and domestic announcements.
- Third, and like the results in the previous section, it is clear from the figure that the effects of Canadian macroeconomic announcement surprises, represented by the red bars, are larger on the short-term BAX or 2-year bond than on long-term bond yields. This is not the case for US macroeconomic announcement surprises, which are represented by the blue bars. These usually have a greater impact on long-term bond yields, often larger than the corresponding Canadian announcements, as in the case of employment, CPI and production announcements. Gravelle and Moessner (2001) and Xing et al. (2024) also find that US macroeconomic announcements have a stronger impact on Canadian government bond yields. Gravelle and Moessner (2001) looked at daily variations, while Xing et al. (2024) looked at quarterly variations.

Chart 1: Effect of macroeconomic announcement surprises on yields of varying maturities

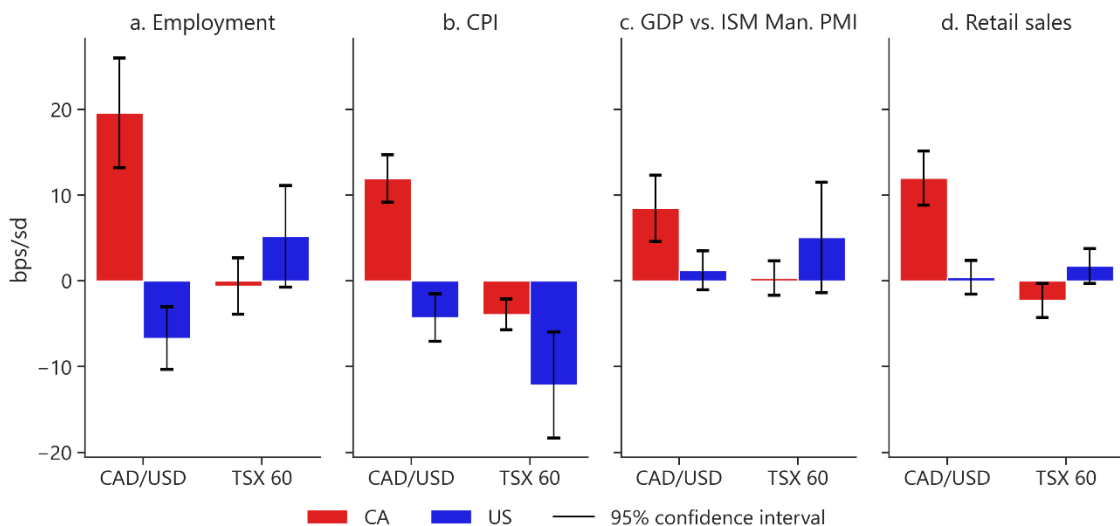


Note: This figure presents the estimated regression (1) coefficients and 95% confidence intervals for the impact of Canadian and US macroeconomic news on each fixed-income asset. Regression coefficients are expressed in basis points of yield change per standard deviation of the standardized surprise from the news release, represented as bps/sd. CPI is consumer price index, GDP is gross domestic product, ISM Man. PMI is the ISM Manufacturing Purchasing Managers Index, and BAX are Bankers' acceptance futures with an integer suffix that indicates the number of quarters to maturity.

Next, we depict in **Chart 2** the impact of US and Canadian macroeconomic announcements on the CAD/USD spot exchange rate and the return of S&P/TSX 60 Index futures. Positive surprises in Canadian macroeconomic data result in an appreciation of the Canadian dollar, whereas positive US macroeconomic data release surprises tend to lead to a depreciation of the Canadian dollar, but at a lower magnitude and significance. Hence, Canadian macroeconomic announcements have a larger impact on the CAD/USD spot exchange rate than US macroeconomic announcements do; the difference is statistically significant and what one

would expect if Canadian macroeconomic announcements do not move US interest rates.⁶ Announcements about employment and CPI have the largest impact on the CAD/USD spot exchange rate. Finally, we find that US macroeconomic announcements usually have a larger impact on the stock market return than their corresponding domestic announcements, though these impacts are not always statistically significant. Positive surprises in CPI naturally result in a decline in S&P/TSX 60 Index futures returns, likely driven by heightened expectations of monetary policy tightening in response to higher-than-expected inflation.

Chart 2: Effect of macroeconomic surprises on CAD/USD spot exchange rate and S&P/TSX 60 Index futures



Note: This figure presents the estimated regression (1) coefficients and 95% confidence intervals for the impact of Canadian and US macroeconomic data surprises on the CAD/USD exchange rate and the stock market returns. Regression coefficients are expressed in basis points of log price change per standard deviation of the standardized surprise from the news release, represented as bps/sd. CPI is consumer price index, GDP is gross domestic product, and ISM Man. PMI is the ISM Manufacturing Purchasing Managers Index.

5. Taking stock

Using daily data, Gravelle and Moessner (2001) find that US macroeconomic news has a stronger impact on Canadian fixed-income markets than domestic news, which they attribute to the absence of fixed announcement dates (FADs). In this note, we study the high-frequency impact of US and Canadian domestic macroeconomic announcements on Canadian fixed-income, currency and stock markets. Using data starting from the early 2000s after FADs were

⁶ We show in Appendix C that the responses of the CAD/USD spot exchange rate to US and Canadian surprises in trade balance announcements is consistent with this pattern.

introduced, our study finds that domestic macroeconomic news now plays a significant role, often outweighing the impact of US news on the short-term yield curve. This is probably because Canadian monetary policy, driven by domestic factors, limits US influence on short-term rates. However, US news remains a key driver of global term premiums, which explains its greater influence on long-term yields (Rey 2015). Interestingly, we find that domestic macroeconomic announcements have a larger impact than US ones on the CAD/USD spot exchange rate. Sekkel, Stern and Zhang (forthcoming) find a similar result when studying monetary policy announcements from both the Federal Reserve and the Bank of Canada.

Appendix A: Data sample and pairwise t-tests of market responses to Canadian and US macroeconomic announcements

Table A-1: Sample start date by announcement and asset

| Monthly data release | BAX | GoC bonds | S&P/TSX 60 | CAD/USD |
|---|------|-----------|------------|---------|
| US macroeconomic announcements | | | | |
| Non-farm payroll | 2005 | 2012 | 2009 | 2002 |
| CPI | 2005 | 2012 | 2009 | 2002 |
| ISM Manufacturing PMI | 2002 | 2002 | 2009 | 2002 |
| Retail sales | 2002 | 2002 | 2009 | 2002 |
| Canadian macroeconomic announcements | | | | |
| Employment change | 2005 | 2012 | 2009 | 2002 |
| CPI | 2005 | 2012 | 2009 | 2002 |
| GDP | 2002 | 2002 | 2009 | 2002 |
| Retail sales | 2002 | 2002 | 2009 | 2002 |

Note: CPI and Canadian employment announcements occurred at 7 a.m. until 2012. This resulted in missing values where early pre-market data were unavailable or sparse. Pre-7 a.m. BAX trading volumes were very low prior to 2005, so we consider only the CPI and employment surprises for both countries on BAX from 2005 onward. CanDeal does not report any trades before 7 a.m., so the sample for CPI and employment on benchmark bonds begins in 2012. Until 2009, trading of the S&P/TSX 60 Index began at 9:30 a.m., which is too late to observe any of our announcements. So, for all announcement types, the S&P/TSX 60 Index surprises are calculated only from 2009 onward.

Table A-2: Results of pairwise t-tests of market responses to Canadian and US macroeconomic announcements

| Event | Bankers' acceptance futures | | | | | Government of Canada benchmark bonds | | | | S&P/TSX 60 Index futures |
|----------|-----------------------------|-------|-------|-------|-------|--------------------------------------|-------|------|-------|--------------------------|
| | CAD/USD | BAX1 | BAX2 | BAX3 | BAX4 | 2yr | 5yr | 10yr | 30yr | |
| EMPC/NFP | -1.56 | -0.44 | -1.58 | -1.13 | 0.2 | -0.12 | 0.24 | 1.26 | -0.06 | 2.85 |
| CPI | -2.37 | -3.3 | -2.5 | -1.31 | -0.91 | -0.49 | 0.32 | 2.46 | 1.08 | 2.9 |
| GDP/PMI | -4.19 | -3.14 | -2.44 | -2.52 | -2.58 | -2.79 | -0.56 | 1.36 | 1.47 | 6.48 |
| Retail | -5.54 | -3.8 | -3.73 | -2.68 | -2.27 | -1.21 | 0.55 | 0.92 | 2.15 | 2.06 |

Legend (for a level of statistical significance at 5%):

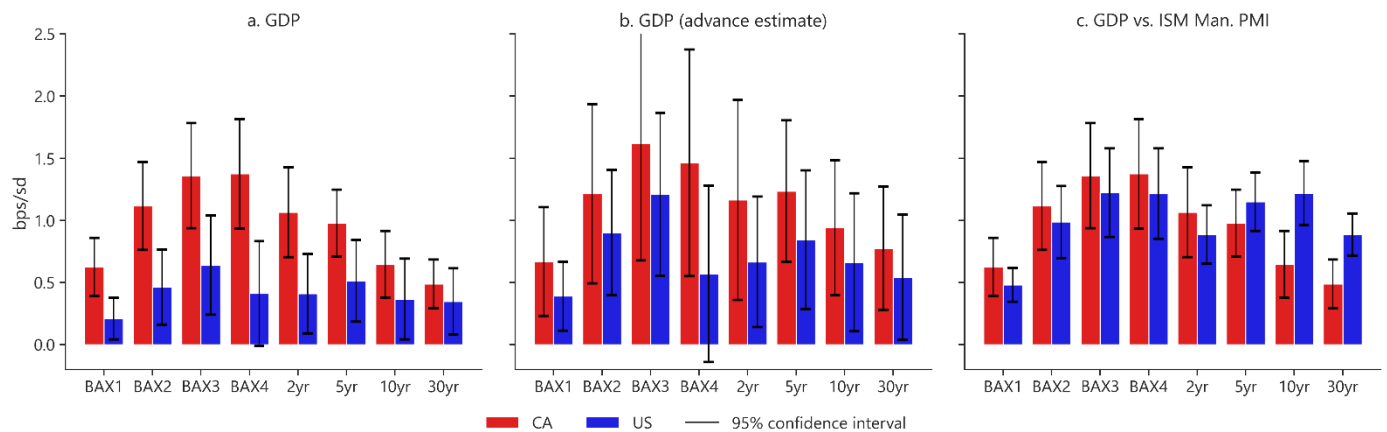
| | | | |
|-------------------------|---------------------------|---------------------------|-------------------------|
| | | | |
| CA significantly larger | CA insignificantly larger | US insignificantly larger | US significantly larger |

Table A-2 shows the t-statistics for pairwise t-tests of whether the mean absolute price change of US releases of each type on each asset is equal to the effect of the equivalent Canadian releases. Negative values indicate that Canadian events have larger impacts, and positive values indicate that US events have larger impacts. Canadian CPI, production indicators and retail releases generate significantly greater price movements for exchange rates and most short-term interest rate futures. US CPI and retail releases are significantly more important for some longer-term benchmark bonds and S&P/TSX 60 Index futures. Canadian and US employment releases generate similar responses for all assets except S&P/TSX 60 Index futures, for which US releases are significantly more important.

Appendix B: Selecting the comparison for the data release of Canadian monthly GDP at basic prices

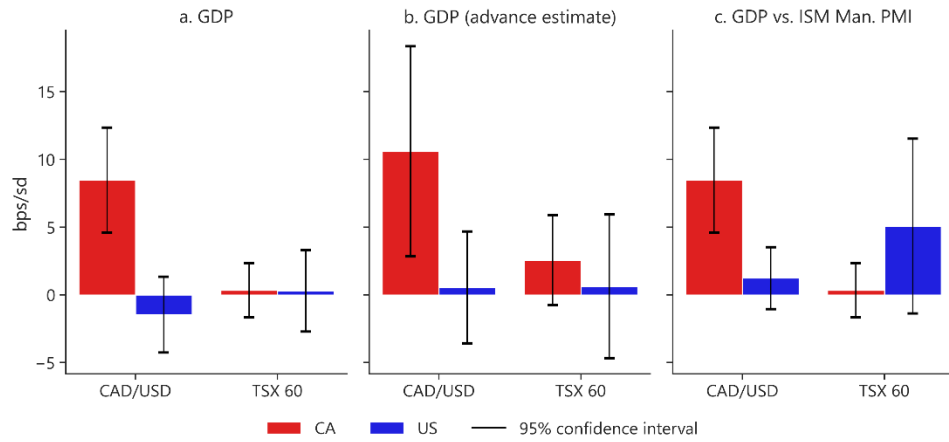
There is no direct US equivalent to the data release of Canadian monthly GDP at basic prices, but it is important that we compare the effects of Canadian and US surprises to production because these variables are closely watched. We first compare Canadian monthly GDP to the US monthly update to quarterly GDP. We find that surprises to US GDP have far less impact on Canadian assets than Canadian surprises. However, only the advanced US GDP release substantially affects markets, which partly explains this difference. If we compare only US advanced GDP releases with the Canadian releases from that same month, the effects of US data release increase greatly, as **Chart B-1** below shows. However, doing so greatly diminishes the number of observations, and confidence bands become much wider. Ultimately, we choose to compare monthly Canadian GDP to the monthly release of the ISM Manufacturing PMI. Canadian PMI is not a closely watched indicator in Canada, but in the United States, it is broadly followed as a leading indicator of GDP. This makes it an appropriate comparison for the Canadian monthly GDP release.

Chart B-1: Effect of production announcement surprises on yields of varying maturities



Note: This figure presents the estimated regression (1) coefficients and 95% confidence intervals for the impact of Canadian monthly GDP surprises and three alternate US production surprises on each fixed-income asset. Regression coefficients are expressed in basis points of yield change per standard deviation of the standardized surprise from the news release, represented as bps/sd. GDP is gross domestic product, ISM Man. PMI is the ISM Manufacturing Purchasing Managers Index, and BAX are bankers' acceptance futures with an integer suffix that indicates the number of quarters to maturity.

Chart B-2: Effect of production surprises on CAD/USD spot exchange rate and S&P/TSX 60 Index futures



Note: This figure presents the estimated regression (1) coefficients and 95% confidence intervals for the impact of Canadian monthly GDP surprises and three alternate US production surprises on the CAD/USD exchange rate and stock market index future. Regression coefficients are expressed in basis points of log price change per standard deviation of the standardized surprise from the news release, represented as bps/sd. GDP is gross domestic product, and ISM Man. PMI is the ISM Manufacturing Purchasing Managers Index.

Appendix C: The effect of trade balance surprises

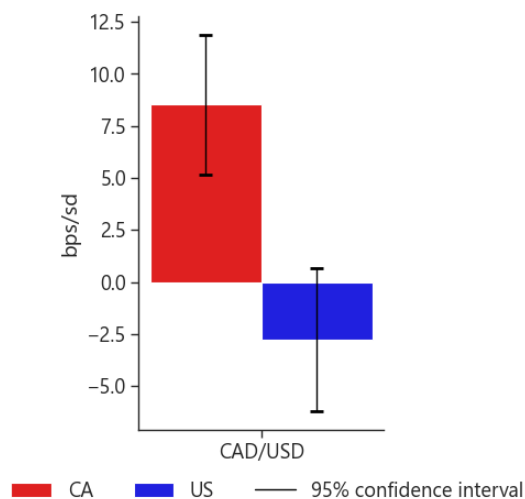
The US macroeconomic announcements we examine all have a far smaller impact on the CAD/USD spot exchange rate than the equivalent Canadian announcements. Therefore, we decided to investigate whether this is a broad phenomenon—specifically, whether the CAD/USD exchange rate responds similarly to surprises to the US and Canadian trade balance.

Data for the US trade balance are released at the same time as Canadian trade data, so we must modify our regression for this analysis. Using the standardized trade balance surprises for each country, we fit the following regression:

$$y_t = a + \beta_{CA}S_{CA,t} + \beta_{US}S_{US,t} + \varepsilon_t, \quad (2)$$

where y is the change in the CAD/USD exchange rate around the trade balance announcement measured in basis points, $S_{CA,t}$ is the surprise to the Canadian trade balance, and $S_{US,t}$ is the surprise to the US trade balance. As in our main results, a one-standard-deviation surprise to the US trade balance does not have a significant effect on the CAD/USD exchange rate, while the beta to a Canadian trade balance surprise is highly significant. The beta for the Canadian trade balance is also significantly greater than the absolute beta for the US trade balance (p-value = 0.02). The positive beta for Canada suggests that higher-than-expected Canadian net exports cause CAD to appreciate against USD. This could be due to the higher-than-expected demand for CAD for the purchase of Canadian exports. The same mechanism would support a negative beta to US surprises. Neither Canadian nor US trade balance surprises have a significant impact on any other financial asset.

Chart C-1: Effect of trade balance surprises on CAD/USD spot exchange rate



Note: This figure presents the estimated regression (2) coefficients and 95% confidence interval for the impact of Canadian and US trade balance surprises on the CAD/USD exchange rate. Regression coefficients are expressed in basis points of log (exchange rate) change per standard deviation of the standardized surprise from the news release, represented as bps/sd.

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