Show and Tell: The effects of seeing, hearing and perceiving central bank messages*

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Abstract

Central bank communications come in a variety of formats including textual, audio-visual and graphical. This study examines how different formats of central bank communications affect individuals' expectations of inflation, interest rates, wage growth, consumption behavior, and message recall. Using two surveys conducted with Canadian Nielsen Homescan panelists shortly after Bank of Canada press conferences, we analyze the effects of the Bank's forecasts. The results show that graphical formats significantly influence inflation expectations, while audio-visual formats reduce uncertainty about future rates and strongly affect interest rate expectations. Graphical messages have longer-lasting effects and higher recall. Linking survey data to scanner data, we find that higher inflation expectations post-treatment correlate with reduced spending. There is no evidence of a perceived wage-inflation spiral; however, the data align with standard Taylor-rule coefficients. Our findings highlight the importance of communication format and emotional intensity in shaping public expectations and economic behavior. Repeated treatments with varying formats can further amplify these effects, reinforcing the importance of diverse communication methods.

Keywords: Central bank communication, Consumer survey, Perceptions, Facial emotion recognition, Vocal signal processing, Textual analysis, Inflation expectations.

JEL codes: D84, E30, E52

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1 Introduction

Central banks influence the economy and decision making by setting policy rates and through communications about their policies and reasons for their actions. Rate decisions impact savings and borrowing by firms and households. However, communications can also play a critical in influencing household and firm behaviour by altering awareness, comprehension and retention of information about policy. Past work using random control trials (RCTs) have demonstrated a short run impact on inflation expectations when participants are exposed to various central bank messages related to targets or information on current or past inflation in a low inflation environment. Most of these have focused on textual versions of messages - despite the fact central banks often use combinations of audio-visual, textual and graphical mediums to convey information to the public. Moreover, open questions remain regarding how results may change when individuals are experiencing a period of heightened inflation, as well as how the form of the messages seen effects retention of key aspects of it as well as how varying impacts future awareness of central bank messages and consumption behaviour following receipt of the messaging. We addressed these questions by running two waves of RCT during the recent high inflation period to obtain panel data from return participants, and by recruiting individuals from Nielsen's representative Homescan Panelists yo enable us to observe their reported household consumption pre and post treatments.[1]

The recent high inflation experienced post-COVID challenged many central banks. Policy rates increased rapidly and as households and firms experienced increases in the cost of living and the cost doing business, central bankers faced increasing pressure to communicate when they believed inflation would return to their targeted levels. As a result, many central bank press conferences and testimonies have increasingly included descriptions of their estimated path of future inflation in addition to reminding the public of their inflation mandates.[2] Communicating these expected paths provided more details on the central banks' expected timing of the return to target and gave extra information individuals could use for decision making.[3]

First, since central bank messages are often released in a variety of mediums (textual,

[1]Unlike many other Nielsen Homescan panels, the Canada one has been underutilized for surveys related to central bank messaging. Previously this panel was exposed to messaging in two surveys in 2019 and 2020.

[2]See e.g., ECB December 2023 monetary policy statement (https://www.ecb.europa.eu/press/press_conference/monetary-policy-statement/2023/html/ecb.is231214~df8627de60.en.html, the Reserve Bank of Australia's October 2023 statement (https://www.rba.gov.au/media-releases/2023/mr-23-25.html), and Bank of Canada Press releases October 25, 2023 (https://www.bankofcanada.ca/2023/10/fad-press-release-2023-10-25/).

[3]See, for example, the speech given by Fed Governor Mishkin in 2007 highlights the usefulness and rationale for providing projections following the Fed's enhancements to their communications (Mishkin 2007).

audio-visual, graphic), our treatments included *different formats* of the same message to explore how variations in the format influences: (i) the magnitude of the pre and post treatment updating of reported expectations for interest rates, and measures of inflation (price and wage), (ii) changes in future consumption behaviour, (iii) recall, and (iv) key features of the message that stood out to participants. Third, the timing of our RCTs and the versions of the messages used within them are aligned with the Bank of Canada's expected path of inflation released in multiple formats (audio-visual, graphic, and textual) in their Press Releases, Press Conference, and Monetary Policy Reports on October 25, 2023 and January 24, 2024. This enables us to obtain insights on responses to actual messaging and collect important information on whether participants had previous knowledge of the message shown, and if they had, what where their source(s). Finally, the data collected across our two Waves also enables us to gain some insight into individuals' perceptions of the relationships between inflation and interest rates, as well as perceptions related to an inflation-wage spiral.

Policy communications are multi-faceted and come in many forms such as press releases, written reports, press conferences, and speeches. They vary in length and in content. Reports typically contain a mix of text and graphics, while press conferences provide audio-visual content along with the messaging. For example, during a standard press conference, in addition to announcing any changes to the policy rate, a rationale for the decision is provided, as well as information that conveys the Central Bank's forecasts about the future path of key variables such as inflation and output, and potentially forward guidance on rates. Moreover, other non-verbal and verbal cues can be conveyed via the tone of voice, facial expressions and body language of the messenger which may also influence individuals perception of the messages - and hence the reactions to them.[4]

Using a randomized control trial (RCT) approach conducted with Canadian Nielsen Homescan panelists, this paper explores how *different formats* of the *same message* about the central bank's forecast of the future path of inflation influences individuals' expectations about inflation, interest rates, wage growth, their consumption behavior and the persistence of the messages effects' including recall. While past research, such as Coibion et al. (2023), explores how inflation expectations respond to central bank messaging on inflation targets and information on current or past inflation, they do this in periods of low inflation. In contrast, we focus on the response to the central bank's messaging on their *expected path of inflation* during the recent period where inflation has been unusually high and outside their targets. Recently, in addition to reminding the public of their inflation mandates, many central bank press conferences and testimonies have increasingly included descriptions of

[4]See e.g., Alexopoulos et al. (2024), Curti & Kazinnik (2023) and Gorodnichenko et al. (2023).

their estimated path of future inflation.[5] Provision of the expected paths in communication provides more information on the expected timing of the return to target which can both improve the public's understanding of the Bank's policies and give extra information individuals can use for decision making.[6]

The use of RCTs in macroeconomics allows the generation of exogenous variation in inflation expectations by randomly assigning different information treatments to respondents. Our study consists of two waves of RCT surveys conducted during Q4 2023 and Q1 2024 – periods marked by significant gaps between actual inflation rates and public inflation expectations. Therefore, our findings provide critical insights into how effectively communicating inflation forecasts can manage public expectations, which is essential for developing communication strategies that enhance the effectiveness of monetary policy and may be particularly influential during times when individuals attention to policy is heightened.

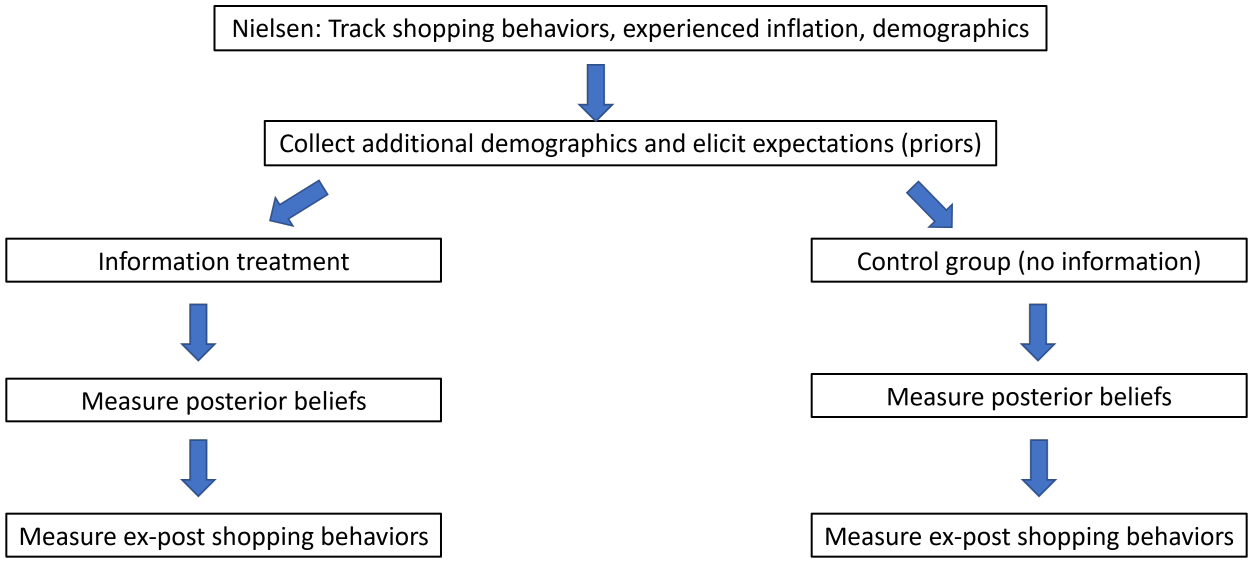
Our set-up allows us to examine both the static effects of treatments as well as the dynamic effects of multiple waves of treatment. Unlike most studies, which typically conduct a single survey wave and rarely track respondents over time, our study uses two waves to explore whether consistent treatment and varying formats impact expectations. Figure 1 illustrates the structure of the two waves. Across the waves we specifically look at the effects of graphical and non-graphical treatments (audio-visual & textual). Our findings suggest that graphical treatments have a significant impact on one-year inflation expectations when first introduced, but their effect diminishes with repeated exposure unless reintroduced in a different format. Our analysis also incorporates the emotional content of the messages, using vocal pitch and facial expression analysis to measure the emotional impact of the audio-visual treatments. We find that higher vocal pitch and positive facial expressions in the messenger enhance the impact of the messages on inflation expectations.

Another novel feature of our RCT relates to the timing. In contrast to the usual experiments conducted in the area, our surveys were launched within days of two Bank of Canada Press conferences - October 25, 2023 & January 24, 2024 - where the Bank's inflation forecasts we use for treatments were highlighted in the Governor's opening remarks, circulated in the Press Releases and presented in Monetary Policy Reports (MPR) published at the same time. Therefore, our RCT's timing allowed us to utilize the different formats of the communication provided by the Bank the day of the announcements and gather more

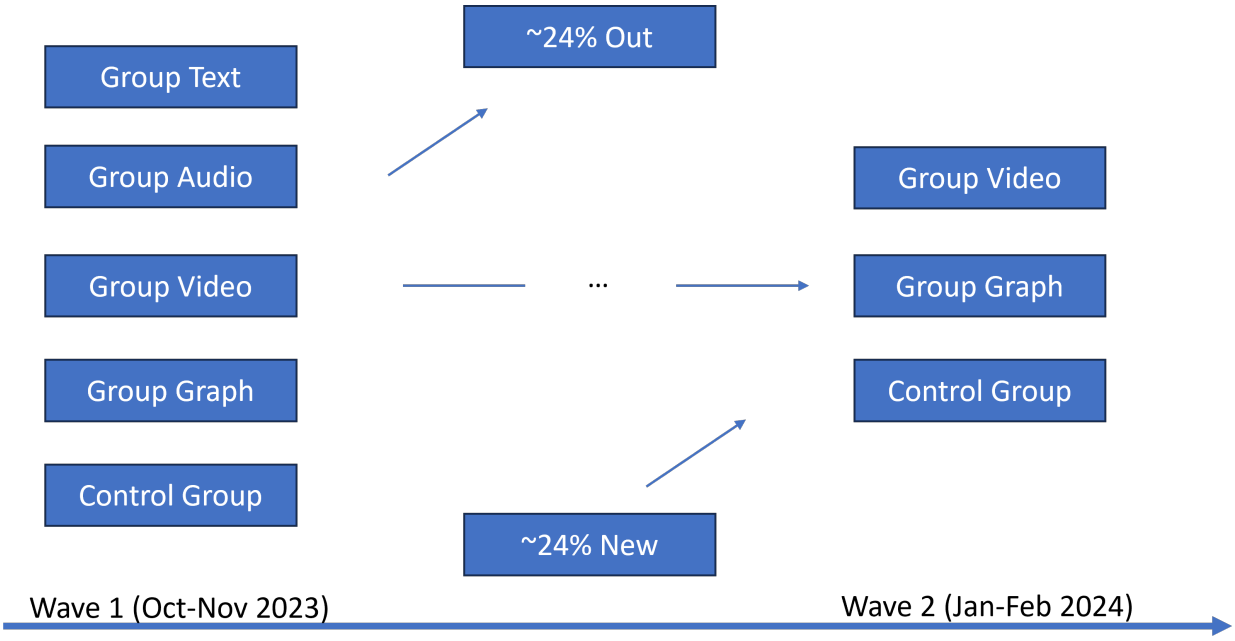
[5] See e.g., ECB December 2023 monetary policy statement (https://www.ecb.europa.eu/press/press_conference/monetary-policy-statement/2023/html/ecb.is231214~df8627de60.en.html, the Reserve Bank of Australia's October 2023 statement (https://www.rba.gov.au/media-releases/2023/mr-23-25.html), and Bank of Canada Press releases October 25, 2023 (https://www.bankofcanada.ca/2023/10/fad-press-release-2023-10-25/).

[6] See, for example, the speech given by Fed Governor Mishkin in 2007 highlights the usefulness and rationale for providing projections following the Fed's enhancements to their communications (Mishkin 2007).

Figure 1. Survey structure



(a) Survey structure for waves



(b) Structure of the treatments across two waves

accurate information on what portions of messaging individuals were aware of at the time of RCT, and sources of their awareness. As such, our RCT is designed to provide novel insights on *which format(s)* used to communicate the future path of inflation has the largest impacts on individuals' expectations about inflation and interest rates, as well as their perceived uncertainty about these future rates.[7] Here we find striking evidence indicating that simple graphical representations impact inflation expectations the most across groups - including those reporting being previously aware of the message - while video or audio messaging tends to shrink uncertainty about expectations and has the largest impact on interest rate expectations. In short, the format of the communications seen by individuals does influence the size of the responses.

Our findings are based on a large sample of the Nielsen Canada Homescan panel. In each survey, approximately 42% of the panelists participated with approximately 76% of individuals in the first wave also participating in the second. As Panel a of Figure 1 illustrates, each survey first elicited each individual's inflation and interest rate expectations along with additional information on how often the individual obtained news about the economy and the Bank of Canada from different media sources. Individuals were then randomly split into different groups who were then assigned to a control group or exposed to one of the different forms of the Bank of Canada's expected path of inflation messaging. Next, the participant was asked additional information about the messaging they saw (if in a treated group), and again asked questions regarding their best guesses about future inflation and interest rates. As Panel b in Figure 1 highlights, there are some differences in the types of treatments across the two waves. In the first wave, treatments included video, audio, textual and a graphic version of the Bank's expected path of inflation used in the October 2023 messaging. The first three formats were selected because they represent common ways that individuals would have received the messaging through print media, radio and television. The graphical path, on the other hand, was derived from the path displayed in the Bank's monetary policy report released the same day.[8] In wave 2, only video and graphical treatments - the formats that most influenced interest rate and inflation expectations in the first wave - were used.[9]

As previously mentioned, by running a second wave of the survey we are able to: (1)

[7] Binder et al. (2023) and Ash et al. (2024) have incorporated treatments with audio-visual messaging. However, there are a few notable differences between their work and ours. First, our study includes two waves of treatments on a larger sample size. Second, we focus on providing real-time information and examine the path of inflation using graphical representations. Third, we link the survey with respondents' past experienced inflation and future spending decision. Fourth, even within the audio-visual treatments, we isolate the effects of emotional intensity (voice pitch and facial expressions) from the message formats.

[8] The graph used for the study removed the historical data from the figure in the report.

[9] The reduction of treatments also ensured that the sample size of each group was large enough for a meaningful analysis.

confirm if the main static findings from the first wave are hold at a later date, and (2) also investigate the impact of the treatments on expected wage inflation, as well as longer-run inflation and interest rate expectations. Indeed, the same patterns for the graph and video treatments on inflation and interest rate expectations also emerged in the second wave with magnitudes for the previously untreated participants being similar to those treated with these formats in the first wave. Longer-run inflation and interest rate expectations were significantly revised downwards in response to the treatments, while expected changes in wages were unresponsive.

New questions added to the second wave of the RCT along with the significant number of returning participants, enabled us to exploit the panel nature of our data to examine other important issues such as recall of the messaging and persistence of the message's impacts as well as how these differ across combinations of message formats. Specifically, we find that those treated with the graphical message in the first wave of the survey were more likely to have persistent responses to the messaging after 3 months, and were more likely to recall and report previous awareness in wave 2. The fact that the Bank's projected path of inflation did not significant change between the two waves, also enabled us to explore how exposure to repeated messaging in the same or a different format influenced further revisions of future expected inflation rates, interest rates and wage rates. Here we find evidence that exposure to a different form of the same message in the second wave have a significant impact on the magnitude of the revision suggesting that the informational content is different between forms and re-enforce the effects of the messaging.

In addition to the findings related to the instantaneous impact of treatment forms, and the impact of formats on recall and future awareness, additional contributions to the literature come from the use of the Canadian Homescan Panel - a survey pool that has not been heavily utilized for this type of research.[10] In addition to offering a fresh perspective on how uninformed consumers respond to messaging, a distinct advantage to using the Homescan panel for the RCT is the ability to link survey participants to individual consumption behaviour.[11] Similar to the US Homescan panel, households in the panel report detailed spending on a variety of goods bi-weekly. This high-frequency data allows us to quantify any impacts of the treatments on shopping behaviour. Here we find evidence that the individuals with higher posterior inflation after treatments do decrease their spending in the aftermath of the survey.

Finally, we use our experimental data and derived instruments to examine the perceived

[10]The only other research paper that uses customized survey on the Canadian Nielsen homescan panel is Kostyshyna & Petersen (2023).

[11]Coibion et al. (2022) and Coibion et al. (2023) use the US Nielsen Homescan panel and show that exogenous variation in households' inflation expectations affect their subsequent spending decisions.

relationship between future inflation and future wages (a perceived inflation-wage spiral) as well as the perceived Taylor rule. We find no evidence of a perceived wage-inflation spiral. However, we find the common value for the coefficient of 1.25 on expected inflation in the Taylor rule used in models would fall within the range of values estimated from our data.

The remainder of the paper is organized as follows. Section 2 describes the background, data and our survey design. Section 3 lays out the estimation specifications and summarizes the main results for inflation expectation. Section 4 study the recurring treatments. The results on other variables are shown in Section 5. The results on news attention and spending are shown in Section 6. Finally, Section 7 concludes.

2 Background, Data and Survey Design

In this section, we begin by providing details on the Bank of Canada's communications surrounding their monetary policy announcements as well as a series of descriptive statistics on realized and expected rates of inflation and interest rates to highlight the recent changes. Next, discuss the Nielsen Homescan panel used for the survey and describe our survey design to elicit expectations and the various treatments used in the RCT.

2.1 Bank of Canada communication events

The Bank of Canada is Canada's national central bank. Its monetary policy framework is centered around an inflation-control target of 2%, which is the midpoint of a 1% to 3% target range. The inflation-control target guides the Bank's decisions on the appropriate setting for the policy interest rate, which aims to maintain a stable price environment over the medium term.

The Bank of Canada employs a system of eight fixed-announced policy decision dates (FAD). Beginning in 2008, Monetary Policy Report (MPR) press conferences were established and held after every alternate rate announcement. Correspondingly, a Monetary Policy Report has been released during each of these alternate scheduled announcements.[12]

In Figure 2 we plot the time series of Canadian inflation rate, policy rate target, and expected inflation rates and interest rates from the Canadian Survey of Consumer Expectations[13]. The upper panel shows the inflation rate beginning to rise at the start of 2021, reaching a peak in mid-2022, and subsequently declining to around 3.5% by the latter half of 2024. The inflation expectations of Canadian households remained stable prior to the

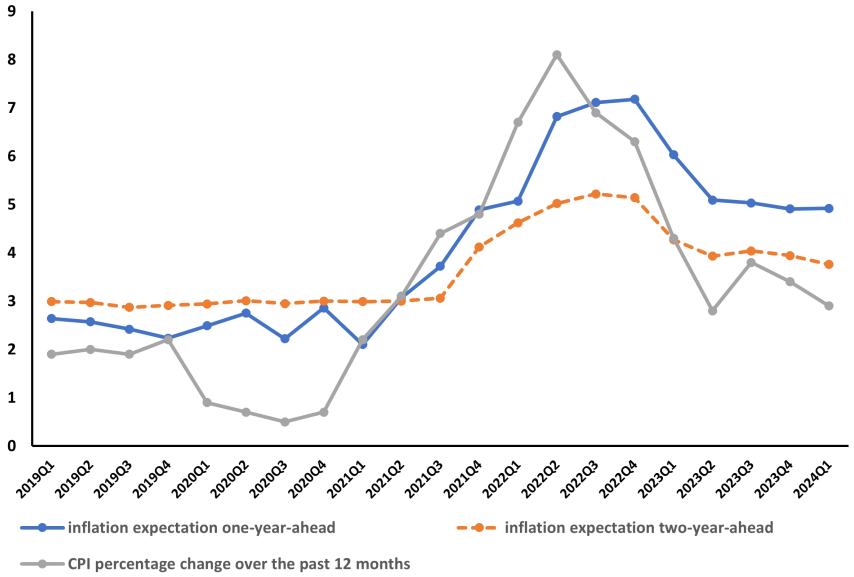
[12]Starting from March 2024, press conference is held after every FAD decision.

[13]https://www.bankofcanada.ca/publications/canadian-survey-of-consumer-expectations/

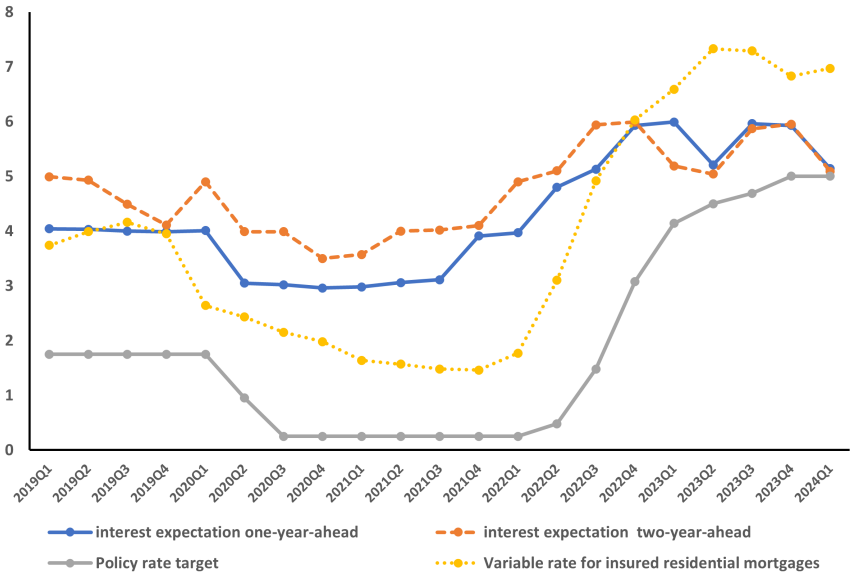
COVID-19 pandemic but began to increase in the latter half of 2021. By the end of 2023, the one-year-ahead inflation expectation was nearly 5%, significantly higher than actual inflation rates. The lower panel plots the time series for interest rates. The Bank of Canada's policy rate hit the zero-lower-bound in March 2020 and remained at a low level until it began to rise in 2021. By the end of 2023, the policy rate had reached 5%, the highest level since 2001. This panel also includes the variable mortgage rate for insured residential mortgages, illustrating the response of mortgage rates to policy changes over the period.

Our two waves of randomized controlled trial surveys, one in Q4 2023 and another in Q1 2024, were conducted during periods of significant disparity between actual inflation rates and public inflation expectations. These surveys provide crucial insights into how effectively communicating inflation forecasts can help manage public expectations. Understanding these dynamics is crucial for developing communication strategies that effectively ease inflation expectations and enhance the effectiveness of monetary policy.

Figure 2. Realized and expected inflation rate and interest rate, 2019Q1–2024Q1



(a) Realized inflation rate and inflation expectations



(b) Policy rate, variable mortgage rate, and interest rate expectations

2.2 Canadian Nielsen homescan panel

While the U.S. Nielsen Homescan panel is widely used in research, studies employing Nielsen Homescan data from other countries are notably less common.[14] Similar to the U.S. version, the Canadian Nielsen Homescan panel contains information for Canadian households' expenditures on consumer goods, such as food and household goods and allows for the integration of customized survey responses with consumption data, providing rich insights into consumer behavior. In Canada, NielsenIQ biweekly collects detailed shopping behavior data from approximately 12,000 households across all provinces, except Newfoundland and Labrador and territories.

Nielsen ensures data accuracy by validating reported consumer spending against retailer scanner data quarterly and maintaining a high retention rate. In addition, incentives are provided to households for complete and accurate reporting. It filters households that do not report a minimum amount of spending over the previous 12 months. Households in the panel provide information about each of their shopping trips using a Universal Product Code (UPC) (i.e., barcode) scanning device provided by Nielsen. Panelists use the device to enter details about each of their shopping trips and then scan the barcode of each purchased good and enter the number of units purchased.

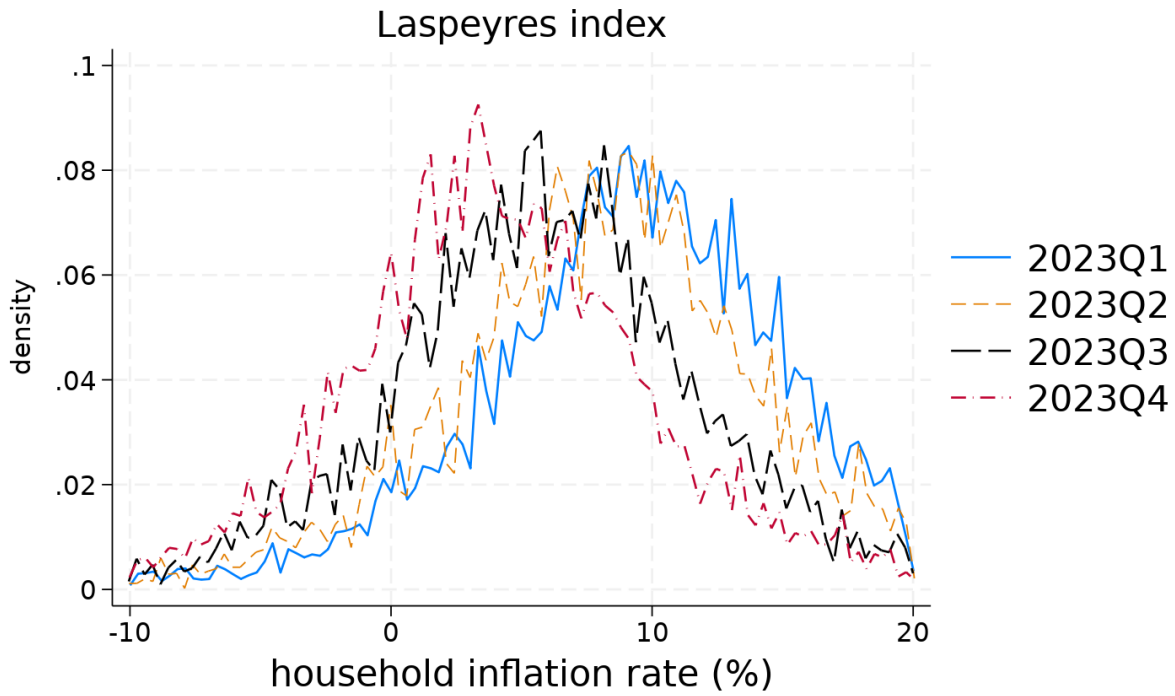
This panel records transactions at the UPC level, including the date of purchase, dollar expenditures, quantities purchased, product descriptions, retailer information, type and use of discount, and household demographics (household size, age, children, language, and income). To our knowledge, our study is pioneering in its use of Canadian Nielsen Homescan data, providing a unique insight into consumer behaviors in Canada.[15]

We follow Kaplan & Schulhofer-Wohl (2017) to compute household-level inflation indexes – Laspeyres, Paasche, and Fisher. Many prices exhibit marked seasonality. It would be virtually impossible to seasonally adjust the household-level price indexes because we do not observe a long time series for each household. Therefore, we remove seasonality in price changes by constructing price indexes at an annual frequency. When we calculate a household's inflation rate between quarters t and t+4, we consider only goods (defined by UPC) that the household bought in both of those quarters. To reduce sampling error, we restrict the sample to households with at least five matched barcodes in the two quarters.

[14] For instance, Argente et al. (2023) utilizes monthly, telephone-based data from Mexico's Nielsen panel. Ampudia et al. (2023) uses Nielsen scanner data from Europe.

[15] The other paper uses the Canadian Homescan data is Cavallo & Kryvtsov (2024).

Figure 3. Distributions of household-level inflation rates, 2023



Notes: Kernel density estimates using Epanechnikov kernel. Bandwidth is 0.05 percentage point. Plots truncated at -10% and 20%.

The Laspeyres index at the household level with CPI prices is defined as $\pi^{L,CPI}_{it,t+4}$,

$$\pi^{L,CPI}_{it,t+4} = \sum_{j:q_{ij,t}>0} s^{L}_{ij,t,t+4} \frac{p^{CPI}_{k(j),t+4}}{p^{CPI}_{k(j),t}},$$

$$\text{where} \quad s^{L}_{i,t,t+4} = \frac{p_{ij,t}q_{ij,t}}{\sum_{j:q_{ij,t}>0} p_{ij,t}q_{ij,t}}$$

Our household-level inflation rates are not directly comparable to published aggregate inflation rates because our data cover only a subset of goods. We construct an aggregate inflation rate that is comparable to our household-level indexes by measuring the aggregate consumption bundle in our data and using this bundle to aggregate the CPI item stratum price indexes.

Figure 3 shows the distributions of household-level inflation rates in 2023, calculated with Laspeyres indexes. The kernel density estimate of the distribution of household-level inflation rates with household-level prices is superimposed on estimates of the distributions of the household-level rates. First, household-level inflation rates with household-level prices are remarkably dispersed. Second, the distribution shifted to the left from 2024Q1 to 2024Q4.

2.3 Customized survey on Canadian Nielsen homescan panel

RCTs are becoming increasingly common in macroeconomics to study how beliefs respond to different types of information. We use RCTs in surveys to generate exogenous variation on inflation expectation. In particular, we designed two waves of customized questionnaires that provided random subgroups of respondents with different information treatments in real time. The first wave of the survey took place in October and November 2023, right after the 2023 October 25th, Bank of Canada FAD announcement and press conference. The second wave of the survey took place in January and February 2024, right after the Bank of Canada FAD announcement and press conference on January 24, 2024. For each wave, Nielsen provides weights to ensure representativeness of the households participating in the survey. All the respondents in the Nielsen pool received the survey invite. 5,100 Canadian households responded for a response rate of roughly 50% in wave 1, 4,918 individuals responded in wave 2, and among which 3,833 participated in both waves (76% of wave 1). Figure 1 illustrates the structure of the two waves.

2.3.1 Wave 1

The initial wave of the survey covers a wide range of questions. Our survey design is based on the Canadian Survey of Consumer Expectations, the New York Fed Survey of Consumer Expectations (SCE), as well as recent literature such as Coibion et al. (2024). First, respondents are presented with a series of questions about their demographic characteristics, which are more detailed relative to the basic demographic information. In addition to standard demographics, we collect information on various household characteristics that can help us better understand the workings of information providing, such as education, race and ethnicity, employment status, homeownership status, plan to purchase homes, plan to obtain mortgages. Second, we elicit their attention to news by asking how often they typically receive news about the economy from various sources, how often they receive news about the Bank of Canada and monetary policy, and the three most common sources of information they considered when forming their views about future inflation. Third, participants are then asked a sequence of questions about their expectations of inflation and interest rates.

We ask them about their expectations for 12-month-ahead inflation using a slider.

> What do you think the inflation rate will be over the next 12 months?
>
> Over the next 12 months, I expect the inflation rate to be ___%

To elicit inflation expectation uncertainty, we use three sliders and ask the following questions:

> Given the uncertainty in the economy, what do you think are the lowest and highest values the inflation rate could be over the next 12 months? Please provide your best guess.
>
> Over the next 12 months, I expect the lowest value the inflation rate could be is: A%
>
> Over the next 12 months, I expect the highest value the inflation rate could be is: B%
>
> Given the uncertainty in the economy, over the next 12 months what do you think is the percentage chance that the inflation rate will be greater than (A + B)/2 %? Please provide your best guess.
>
> Over the next 12 months, I believe that the percentage chance the inflation will be greater than (A + B)/2 % is:

For the number A, we restrict it to be lower than or equal to the point forecast from the previous question, and for the number B, we restrict it to be higher than or equal to the point forecast. Following Coibion et al. (2024), from the answers about how low and how high inflation respectively could potentially be, we compute the moments of the subjective distribution of inflation expectation by assuming that it follows a simple triangular distribution around the midpoint. Based on the elicited values for the probablity higher than the midpoints, we compute the household-specific mean forecast of inflation expectation and the uncertainty in their forecast as the standard deviation of the distribution of expected inflation.[16]

Next, using a slider, we ask survey participants their expectations regarding interest rates on a variable rate mortgage in one year. We focus on the variable rate instead of fixed rate because in Canada the prime rate is primarily influenced by the Bank of Canada's target for the overnight rate. When the Bank of Canada changes the target for the overnight rate, lenders will generally adjust their prime rates within a few days.

> One year from now, what annual interest rate do you think the average Canadian would be charged on a variable-rate mortgage? Please provide your best guess.
>
> One year from now, I expect the average Canadian would be charged an annual interest rate of ___% on a variable-rate mortgage.

[16] A popular alternative is to use bins-based method based on the New York Fed's Survey of Consumer Expectations. Respondents are asked to report their subjective probabilities for 10 bins of possible inflation values. Boctor et al. (2024) find that bins-based design may result in lumping responses at extreme bins and may prime respondents to choose unlikely outcomes.

Then, using three sliders, we elicit uncertainty by asking the highest, the lowest, and the probability higher than the midpoints. We then compute the household-specific mean forecast of interest rate expectation and the uncertainty in their forecast as the standard deviation of the distribution of expected interest rate.

We then randomly divided the sample into five groups, including four treatment groups and one control group that did not receive any information. Each group is a bit over 1000 observations. Nielsen employed a randomization function to assign numbers to all surveyable panelists. Furthermore, Nielsen compared demographic after, considering factors such as the age of the primary shopper in the household, income, and region. This was done to mitigate any potential skewness in demographics across different groups.

To study exposure to real-life news, we designed the treatments to disentangle the effects of different types of real-time communication. The first three treatment groups each received information in different formats: the first group received a real-time video of the governor's opening remarks during a press conference, the second group received the audio portion only, and the third group only received the text. These formats reflect common ways people receive news in their daily lives, such as by video clips from the evening news, newspaper text, and radio or podcast audio. To ensure it mirrored real-world dissemination, we also verified that by the evening of the announcement day, this information has appeared in major newspapers, news clips, and dealer reports.

The content of each treatment is based on inflation forecasts. The central bank makes inflation forecasts and communicates them to the public. Specifically, the sentence we use is as follows:

> We now expect inflation to be about $3\frac{1}{2}\%$ through to about the middle of next year. As excess supply in the economy increases, inflation should ease further in 2024 and reach 2% in 2025.

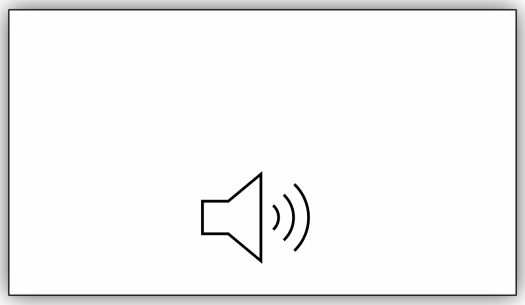
Figure 4 visualizes the English treatment. As coauthors of this paper, we did not initially know what to select as treatment formats. We made the decision only after watching the press conference. The original message was delivered in English and we translated the treatment into French. The translation was carefully reviewed by French experts. Subtitles were provided to all participants in the video and audio groups, and descriptions of the figures were also translated. The video clip we used is of the highest quality available. We then provided these materials to the survey company.

To understand the mechanism or the differences of the format, immediately after we show the messages to the respondents, we introduce the following question to elicit their takeaway of the messages.

Figure 4. Treatment in Wave 1



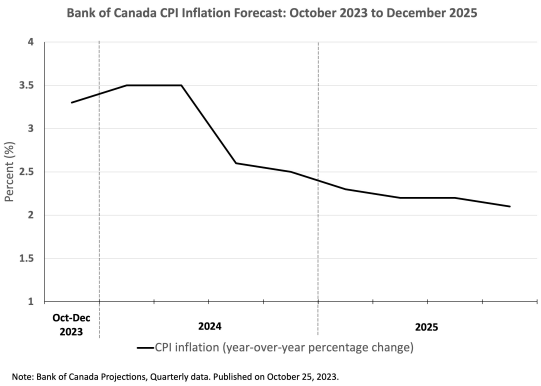
(a) Video



(b) Audio

We now expect inflation to be about 3½% through to about the middle of next year.
As excess supply in the economy increases, inflation should ease further in 2024 and reach 2% in 2025.

(c) Transcript



(d) Graph

What feature(s) of this video/audio/text/graphic message stood out most to you?

The feature(s) of the video/audio/text/graphic message that stood out most to me were: [textbox]

Following each treatment (as well as for the control group), respondents were again asked about their inflation and interest rate forecasts. However, this time, we reframed the question and asked participants to enter the numbers directly instead of using a slider. For example, we asked the following questions regarding to expected inflation:

We would now like to ask you again about the rate of inflation. What do you think the inflation rate will be over the 12-month period between November 2023 to November 2024? Please provide your best guess.

Over the 12-month period between November 2023 to November 2024, I expect the inflation rate to be ___%.

Given the uncertainty in the economy, what do you think are the lowest and highest values the inflation rate can be over the 12-month period between November 2023 to November 2024? Please provide your best guess.

Over the 12-month period between November 2023 to November 2024, I expect the lowest value for the inflation rate to be C%.

Over the 12-month period between November 2023 to November 2024, I expect the highest value for the inflation rate to be D%.

Given the uncertainty in the economy, what do you think is the percentage chance that the inflation rate over the 12-month period between November 2023 to November 2024 will be less than or equal to (C + D)/2 %? Please provide your best guess.

Over the 12-month period between November 2023 to November 2024, I believe that the percentage chance the inflation will be less than or equal to (C + D)/2 % is ___.

For the number C, we restrict it to be lower than or equal to the point forecast from the previous question, and for the number D, we restrict it to be higher than or equal to the point forecast.

2.3.2 Wave 2

After receiving the Wave 1 data in early December 2023, we conducted a preliminary analysis, which lead to results in Sections 3 and 5. Based on these findings, we decided to conduct a second wave. This follow-up survey took place three months later in January and February 2024, following the January 24, 2024, FAD release and monetary policy report press conference.

The second wave was designed for multiple purposes. Firstly, to evaluate the persistent impact of the information and understand why the effects are either persistent or not. Second, to investigate the impact of repeated treatment, examining whether reinforcing the message changes participants' expectations more significantly than a single exposure. Third, to study the effects of emotions, using variation across repeated waves to isolate the effects of emotional intensity. Finally, based on the results of the first wave, we identified one particular treatment group as especially interesting. We aimed to explore whether this group's response would be consistent in a subsequent wave and how it might influence other expectations. Additionally, we collected further information on participants' industry and

occupation, their trust in the central bank, their inflation and interest rate expectations over various horizons and their wage growth expectation for their own and the average Canadian.

Within the three-month window, the respondent pool remained largely consistent, with 3,833 participants appearing in both waves, indicating that 76% of the respondents from wave 1 also participated in wave 2.

Based on our initial analysis of the wave 1 data, we decided to focus on the video and graph treatments. Respondents were randomly assigned to one of two treatment groups or a control group, with each group comprising one-third of the participants. Nielsen used a randomization function to assign numbers to all surveyable panelists. Subsequently, Nielsen compared the demographics of each group, considering factors such as the age of the primary shopper in the household, income, and region. The analysis revealed no significant demographic skewness in any particular group.

We also introduce a few novel questions. We want to know if respondents will remember our first treatment. As documented in D'Acunto & Weber (2022), households recall systematically lower past prices than reality. We wonder if they can remember the treatment. We ask the following question to all the particpants, and they can choose yes and no.

> Do you recall taking a Homescan survey in November 2023 that asked about the Bank of Canada's October 2023 announcement?

Figure 5 provide the visualization of the two treatments. The information in the video is the following

> CPI inflation is expected to remain close to 3% over the first half of this year. It is then expected to ease to about $2\frac{1}{2}$% by year end and return to target in 2025.

To understand the mechanism or the differences of the format, immediately after we show the messages to the respondents, we introduce the following question to check if they understand the topics of the message and elicit their takeaway of the messages.

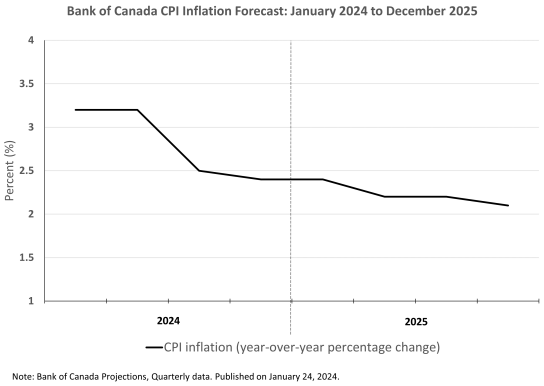
> We would like to ask you about the message's topic and the feature(s) of the video message that stood out most to you.
>
> The message was about (choose one):
> () Inflation
> () Interest rates
> () Population growth
> () GDP growth
> () Other: [text]

The feature(s) of the video message that stood out most to me were: [;Open text box]

Figure 5. Treatment in Wave 2



(a) Video treatment in wave 2



(b) Graph treatment in wave 2

To study the inflation and wage spiral, we introduce questions on earnings growth expectations. We ask all participants about their expectations for wage growth for the average Canadian. Employed respondents are also asked about their own wage growth expectations. For respondents who are laid off or retired, we ask about the expected wage growth if they were still working in their most recent job and working the exact same hours. The questions are as follows:

> Please think ahead to twelve months from now (February 2025).
>
> Suppose that you are working in the exact same main job at the same place you currently work and are working the exact same number of hours.
>
> By about what percent do you expect your earnings on your main job, before taxes and deductions, to have changed by? Please give your best guess.
>
> Twelve months from now (February 2025) I expect my earnings on my main job, before taxes and deductions, to have changed by ___%.
>
> Assume that the average Canadian is working in the exact same job, at their same place of employment with no change in their hours. By about what percent do you expect their earnings on their main job, before taxes and deductions, to have changed? Please give your best guess.
>
> Twelve months from now (February 2025), I expect their earnings to have changed by ___ %.

2.4 Summary statistics

In the first wave, the average respondent is 57 years old, and about 70% are women. Thirty-five percent of the respondents hold a college degree. The employment status shows 53% are employed, 2% unemployed, and 45% are not in the labor force. In terms of housing, 37% are homeowners with a mortgage, 36% own their home outright, and 24% are renters. Regionally, respondents are distributed with 36% on the West coast, 39% in Ontario, 17% in Quebec, and 8% in the Maritimes. The primary language spoken by 86% of the respondents is English.

In Table 1, we present descriptive statistics on respondents' expectations, both from the raw data and Huber robust moments that filter out outliers. The first panel (pre-treatment data) displays unconditional statistics before any information treatment is provided. The sample mean is 5.05%, in line with the sample average in the CSCE survey. The (robust) mean of inflation expectation over the 12 months when the survey is conducted is 4.22%.

In Table 2, we provide the summary statistics for wave 2 data. In the pre-treatment panel, the 9-month expected inflation point is 3.32% on average and the 9-month expected interest rate point is 5.68% on average. In contrast, the post-treatment data indicates a shift in expectations following the intervention. The expected inflation points for the 9-month and 2-year horizons show a noticeable decrease, with the mean values dropping to 2.73% and 2.68%, respectively. Similarly, the expected interest rates show a decline across all time horizons, with the 9-month and 2-year points averaging 4.63% and 4.16%, respectively.

Table 1. Descriptive Statistics of the Survey wave 1

	Obs	Robust moments		Moments		
		Mean	Standard Deviation	Mean	Median	Standard Deviation
Pre-treatment data (1-year ahead)						
Expected inflation (point)	5,150	4.22	2.52	5.05	4.10	5.42
Expected inflation (mean)	5,150	4.52	2.69	5.51	4.50	5.42
Expected inflation uncertainty	4,913	0.49	0.44	0.82	0.48	1.02
Expected interest rate (point)	5,150	6.15	1.90	6.52	6.00	3.05
Expected interest rate (mean)	5,150	6.55	2.04	7.06	6.55	3.22
Expected interest rate uncertainty	4,949	0.41	0.31	0.56	0.41	0.53
Post-treatment data (1-year ahead)						
Expected inflation (point)	5,150	3.02	1.55	3.46	3.10	3.22
Expected inflation (mean)	5,150	3.14	1.53	3.67	3.25	3.11
Expected inflation uncertainty	5,083	0.28	0.20	0.47	0.30	0.58
Expected interest rate (point)	5,150	5.27	2.14	5.54	5.50	3.22
Expected interest rate (mean)	5,150	5.34	2.06	5.62	5.50	3.02
Expected interest rate uncertainty	5,073	0.33	0.22	0.45	0.35	0.44

Notes: Moments in columns (2) and (3) are computed using the Huber-robust method.

Table 2. Descriptive Statistics of the Survey wave 2

	Obs	Robust moments		Moments		
		Mean	Standard Deviation	Mean	Median	Standard Deviation
Pre-treatment data						
Expected inflation (point), 9-month	4,918	3.32	1.97	3.68	3.30	4.41
Expected inflation (point)	4,918	3.05	2.02	3.54	3.00	4.80
Expected inflation (mean)	4,918	3.18	2.18	3.86	3.33	4.73
Expected inflation (point), 2-year	4,918	2.67	2.15	3.26	2.60	5.36
Expected inflation uncertainty	4,783	0.47	0.41	0.98	0.49	1.26
Expected interest rate (point), 9-month	4,915	5.68	1.80	6.06	5.70	3.01
Expected interest rate (point)	4,915	5.37	1.89	5.97	5.30	3.19
Expected interest rate (mean)	4,915	5.66	1.97	6.26	5.65	3.19
Expected interest rate (point), 2-year	4,915	4.84	2.10	5.71	4.90	3.63
Expected interest rate uncertainty	4,847	0.43	0.33	0.64	0.45	0.60
Expected own wage growth	4,344	1.71	1.96	1.90	1.80	5.37
Expected Canadian wage growth	4,918	1.94	2.01	1.95	2.00	5.01
Post-treatment data						
Expected inflation (point)	4,918	2.73	1.44	3.12	3.00	3.03
Expected inflation (mean)	4,918	2.86	1.44	3.33	3.00	2.96
Expected inflation (point), 2-year	4,918	2.28	1.41	2.92	2.50	3.35
Expected inflation uncertainty	4,801	0.23	0.18	0.39	0.23	0.52
Expected interest rate (point)	4,918	4.63	1.99	4.83	5.00	2.98
Expected interest rat (mean)	4,918	4.72	1.93	5.00	4.92	2.96
Expected interest rate (point), 2-year	4,918	4.16	1.98	4.61	4.20	3.18
Expected interest rate uncertainty	4,786	0.29	0.21	0.42	0.31	0.45
Expected own wage growth	4,344	1.50	1.58	2.40	1.70	4.58
Expected Canadian wage growth	4,918	1.67	1.59	2.52	2.00	4.22

Notes: Moments in columns (2) and (3) are computed using the Huber-robust method.

3 Average Treatment Effects on Inflation Expectations

We now consider how randomized information treatments affect the beliefs of households.

3.1 Immediate effect in wave 1

To estimate the average treatment effects in Wave 1, we employ the following regression specification:

$$\text{Outcome}_i^{\text{post}} - \text{Outcome}_i^{\text{pre}} = \sum_{j=v,a,t,g} \beta^j \text{Treat}_i^j + \text{controls} + \text{constant} + \varepsilon_i \tag{1}$$

where Outcome is our outcome variable of interests, e.g., inflation expectation at various horizons, interest rate expectations at various horizons, wage growth expectations, and the uncertainty around inflation expectation and interest rate expectations; for the posterior forecasts of individuals, we use the forecast provided immediately after the treatment; Treat_i^j represent whether individual i belongs to treatment group j, where j is video, audio, text, and graph, respectively. Controls include age group, gender, education category, race, ethnicity, region of residence, income category, employment status, language (English or French), presence of children, using the desktop or mobile for the survey. Motivated by D'Acunto et al. (2021) that inflation expectation can be affected by the memory of grocery prices, we also include the year-over-year household level inflation rate during 2022Q3 to 2023Q3.

The β^j is the average effect of Treat^j on the revisions of Outcome relative to the average change in the control group. Including the control group is important because we use questions with different wording to measure inflation expectations before and after the treatment and we remind people to think about inflation topics, so the control group serves to capture any effect driven by wording and reminder. In each regression, we use sampling weights in the regressions and use Huber regressions to control for outliers and influential observations as in Coibion et al. (2022). Sampling weights correct for possible imbalances in the sample. Huber-robust regressions differ from using winsorized data in standard regressions because they also take correlations across variables into account.

In Table 3, we report estimated values of β^j for each treatment group in wave 1 for inflation expectation revisions. Cols (1)-(3) is the immediate effects. On impact, all four treatments reduce the average inflation forecast by 0.3–0.6% relative to the control group. Hence, these very simple information treatments have large effects on the beliefs of individuals. The effects of video and audio treatment are very similar. But their effects are smaller than the text treatment, which is also statistically smaller than the graph treatment.

In Table 4, we report estimated values of β^j for each treatment group in wave 1 for

inflation uncertainty revisions. Cols (1)-(3) is the immediate effects. It shows that all group expectations are reduced except the graph group treatment. Its impact is statistically different from the video group.

3.2 Persistent effect

After we see the results in wave 1, we decided to design a second wave. To estimate the average persistence of the treatment effects in Wave 1, we employ the following regression specification:

$$\text{Outcome}_{i,2}^{\text{pre}} - \text{Outcome}_{i,1}^{\text{pre}} = \sum_{j=v,a,t,g} \beta^j \text{Treat}_{i,1}^{j} + \text{controls} + \text{constant} + \varepsilon_i \tag{2}$$

where $\text{Outcome}_{i,j}^{\text{pre}}$ is our outcome variable of interests observed before the treatment in wave j. We also introduce a new variable of interests, which is the attention to news.

Table 3 Cols (4) - (6) present the persistent effects. It shows that, three months later, the average expectations of graph treated individuals are still lower than those of the control group, with the effect having dissipated by about 50%. In Table 4, Cols (4) - (6) show the persistent effects for inflation uncertainty revision. It shows that, only the video group has the positive significant effects.

Table 3. Estimation results for wave 1, inflation expectation

	(1)	(2)	(3)	(4)	(5)	(6)
	Immediate effects			3-month effects		
Video	-0.272***	-0.281***	-0.373***	-0.177	-0.074	-0.168
	(0.096)	(0.098)	(0.104)	(0.130)	(0.132)	(0.141)
Audio	-0.336***	-0.322***	-0.361***	-0.084	-0.026	-0.010
	(0.095)	(0.097)	(0.102)	(0.126)	(0.127)	(0.141)
Text	-0.492***	-0.438***	-0.543***	-0.232*	-0.205	-0.231*
	(0.097)	(0.100)	(0.107)	(0.126)	(0.127)	(0.139)
Graph	-0.539***	-0.540***	-0.658***	-0.283**	-0.234*	-0.300**
	(0.097)	(0.099)	(0.106)	(0.131)	(0.133)	(0.142)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes
Observations	4,834	4,714	3,409	3,645	3,563	2,676
R-squared	0.007	0.044	0.053	0.002	0.019	0.022

This table reports the average change in inflation expectations of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the immediate change in expectations after the treatment, cols. 4 to 6 consider the changes in beliefs after 3 months. In each case, differences in beliefs are measured relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. For each time horizon, col. 2 uses the same specification as in col. 1 but augmented with respondent-specific demographic controls; col. 3 uses the same specification as in col. 2 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4. Estimation results for wave 1, inflation expectation uncertainty

	(1)	(2)	(3)	(4)	(5)	(6)
	Immediate effects			3-month effects		
Video	-0.060***	-0.060***	-0.053***	0.073***	0.074***	0.081***
	(0.018)	(0.018)	(0.020)	(0.027)	(0.028)	(0.030)
Audio	-0.081***	-0.073***	-0.084***	0.032	0.013	-0.022
	(0.019)	(0.019)	(0.020)	(0.027)	(0.028)	(0.029)
Text	-0.037**	-0.032*	-0.012	0.030	0.038	0.051*
	(0.018)	(0.018)	(0.019)	(0.026)	(0.028)	(0.029)
Graph	0.013	0.011	0.009	-0.006	-0.005	0.011
	(0.018)	(0.018)	(0.020)	(0.027)	(0.028)	(0.029)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes
Observations	4,477	4,359	3,173	3,320	3,248	2,427
R-squared	0.008	0.038	0.049	0.003	0.037	0.045

This table reports the average change in inflation expectation uncertainty of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the immediate change in expectations after the treatment, cols. 4 to 6 consider the changes in beliefs after 3 months. In each case, differences in beliefs are measured relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. Cols. 2 and 5 use the same specification as in cols. 1 and 4 but augmented with respondent-specific demographic controls; cols. 3 and 6 use the same specification as in cols. 2 and 5 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

3.3 Mechanism

Readings of the message To understand the mechanism or the differences of the format, immediately after we show the messages to the respondents, we introduce the following question to elicit their takeaway of the messages.

> What feature(s) of this video/audio/text/graphic message stood out most to you?
>
> The feature(s) of the video/audio/text/graphic message that stood out most to me were: [textbox]

We perform textual analysis to identify recognized features, as illustrated in Figure 6. Graphs can effectively convey complex messages in an easily digestible format. This aligns with the picture superiority effect, where pictures are more easily recalled than words due to dual encoding.

In addition, people often remember the basic meaning of information (gist) while forgetting precise details. This is known as gist memory and contrasts with verbatim memory, which involves remembering information exactly. One potential avenue is that video, audio, and transcripts may evoke verbatim memory, whereas MPR graphs may evoke gist memory.

Figure 6. Features in Wave 1



(a) Video



(b) Audio



(c) Transcript



(d) Graph

Recall To understand more of the persistent effects, at the beginning of wave 2, we asked participants if they recalled taking a Homescan survey in November 2023 about the Bank of Canada's October 2023 announcement. Among the 3,833 respondents who participated in both waves, 1,381 (36%) were treated and correctly recalled the survey, 280 (7.3%) were not treated but correctly recalled the survey, 1,703 (44.4%) were treated but incorrectly recalled the survey, and 469 (12%) were not treated and incorrectly recalled the survey.

To investigate who is more likely to recall, and how it is being affected by estimate the average treatment effects in Wave 1, we employ the following regression specification:

$$\text{CorrectRecall}_i = \sum_{j=v,a,t,g,c} \beta^j \text{Treat}_i^j + \text{controls} + \varepsilon_i \tag{3}$$

where CorrectRecall is our outcome variable of interests, equal to 1 if recall correctly; Treat_i^j represent whether individual i belongs to group j, where j is video, audio, text, and graph, control, respectively. The baseline group is the new respondents to wave 2. This group shall not recall participating in wave 1. We find out that all the estimates for βs are negative and significant.

Next, we distinguish respondents according to whether they correctly recalled participating in the survey. Instead of the original five groups, we now have ten groups: the original five groups (Video, Audio, Text, Graph, Control) multiplied by whether or not their recall was correct. For our analysis, the baseline group is the respondents in the control group from wave 1 who, in wave 2, did not recall participating in the November 2023 survey about the Bank of Canada's October 2023 announcement.

$$\text{Outcome}_{i,2}^{\text{pre}} - \text{Outcome}_{i,1}^{\text{pre}} = \sum_{j=v,a,t,g*RecallCorrectly} \beta^j \text{TreatRecall}_{i,1}^j + \text{controls} + \varepsilon_i \tag{4}$$

In Table 5, we report estimated values of β^j, focusing on inflation expectation revisions in Columns (1)-(3). The results indicate that for most groups, as long as respondents recall the treatment, their inflation expectations remain lower than the pre-treatment levels even after three months. The exception is that the point estimate is negative but insignificant from zero for the video group. In Cols (4)-(6), we report estimated values of β^j for each treatment group in wave 1 for inflation uncertainty revisions. Both the video group and the group that did not recall the treatment experience an increase in uncertainty over time. For individuals who recall the treatment, the uncertainty remains relatively stable.

Table 5. Estimation results for wave 1, inflation expectation and recall

	(1)	(2)	(3)	(4)	(5)	(6)
	inflation exp.			uncertainty		
Recall correctly						
Video	-0.116	-0.024	-0.221	0.077**	0.082**	0.072*
	(0.178)	(0.182)	(0.190)	(0.037)	(0.039)	(0.040)
Audio	-0.396**	-0.352**	-0.386*	0.007	0.006	-0.061
	(0.173)	(0.176)	(0.198)	(0.037)	(0.038)	(0.042)
Text	-0.396**	-0.366**	-0.494***	0.011	0.035	0.030
	(0.169)	(0.173)	(0.189)	(0.036)	(0.038)	(0.039)
Graph	-0.335*	-0.310*	-0.485**	-0.014	-0.011	-0.038
	(0.175)	(0.180)	(0.195)	(0.037)	(0.039)	(0.040)
Recall incorrectly						
Video	-0.268	-0.163	-0.321*	0.110***	0.112***	0.109***
	(0.175)	(0.181)	(0.193)	(0.036)	(0.038)	(0.040)
Audio	0.166	0.226	0.102	0.096***	0.067*	0.028
	(0.169)	(0.169)	(0.185)	(0.036)	(0.037)	(0.038)
Text	-0.099	-0.076	-0.172	0.091**	0.089**	0.088**
	(0.172)	(0.174)	(0.186)	(0.036)	(0.038)	(0.038)
Graph	-0.259	-0.195	-0.346*	0.046	0.050	0.082**
	(0.180)	(0.184)	(0.193)	(0.036)	(0.038)	(0.038)
Control	-0.043	-0.046	-0.278	0.053	0.059	0.029
	(0.186)	(0.187)	(0.210)	(0.039)	(0.041)	(0.044)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes
Observations	3,647	3,566	2,681	3,315	3,252	2,429
R-squared	0.005	0.023	0.026	0.007	0.039	0.050

This table reports the estimated results for equation 4. Columns 1 to 3 consider the change in expectations 3 months after the treatment, cols. 4 to 6 consider the changes in inflation uncertainty after 3 months. In each case, differences in beliefs are measured relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. Columns 2 and 5 uses the same specification as in cols. 1 and 4 but augmented with respondent-specific demographic controls; cols. 3 and 6 uses the same specification as in cols. 2 and 5 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

3.4 Do the respondents become more aware?

For both wave 1 and wave 2, we have a dummy variable “awareness" to indicate if the treated respondent states they are aware of the message. We take the difference between the two answers across the two waves. We regress the change in awareness on the treatment in wave 1. We use the video group as the baseline. We find that graph treatment group has increased the percentage of awareness significantly, compared to the video group. The results are shown in Table 6.

Table 6. Change in awareness

	change in awareness	
Audio	0.05	0.07*
	-0.04	-0.04
Text	0.05	0.06
	-0.04	-0.04
Graph	0.10***	0.12***
	-0.04	-0.04
Constant	0.01	0.05
	-0.03	-0.1
Observations	1,991	1,949
R-squared	0.00	0.04
Using sampling weights	Yes	Yes
Controls for demographics	No	Yes

This table reports the effects of treatment in wave 1 on the awareness. The baseline group is the video treatment group in wave 1. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

3.5 Baseline results in wave 2

In Table 7, we report estimated values of β^j for each treatment group in wave 2. Cols (1)-(3) is for one-year inflation expectation revisions. Cols (4)- (6) is for two-year inflation expectation revisions. It shows that all group expectations are reduced, but the graph group reduces the largest amount. Cols (7)- (9) is for inflation uncetainty revisions. The video has almost twice size impacts compared to the graph treatment.

Table 7. Estimation results for wave 2, inflation expectation and uncertainty

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		infl. 1 year			infl. 2 year			infl. uncertainty	
Video	-0.219***	-0.206***	-0.131**	-0.390***	-0.396***	-0.324***	-0.086***	-0.092***	-0.077***
	(0.057)	(0.057)	(0.061)	(0.057)	(0.058)	(0.063)	(0.013)	(0.013)	(0.015)
Graph	-0.347***	-0.357***	-0.277***	-0.412***	-0.412***	-0.319***	-0.046***	-0.049***	-0.041***
	(0.057)	(0.057)	(0.061)	(0.057)	(0.058)	(0.062)	(0.013)	(0.013)	(0.015)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes	No	Yes	Yes
Observations	4,564	4,452	3,079	4,497	4,387	3,058	4,165	4,062	2,798
R-squared	0.007	0.041	0.037	0.012	0.036	0.042	0.009	0.043	0.040

This table reports the average change in inflation expectations of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the immediate change in expectations after the treatment, cols. 4 to 6 the immediate change in uncertainty after the treatment. In each case, differences in beliefs are measured relative to initial beliefs from the second wave measured before all treatments. Treatments are described in detail in the main text. Cols. 2 and 5 use the same specification as in cols 1 and 4 but augmented with respondent-specific demographic controls; Cols. 3 and 6 use the same specification as in cols 2 and 5 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

We perform textual analysis to identify recognized features, as illustrated in Figure 7. Graphs can effectively convey complex messages in an easily digestible format. This aligns with the picture superiority effect, where pictures are more easily recalled than words due to dual encoding.

Figure 7. Features in Wave 2



(a) Video



(b) Graph

3.6 Heterogeneity

We investigate further if the information treatments affect everyone equally, and which formats matter more. Video is closer to a TV program, audio is closer to Radio and podcast, Text is similar to newspapers and newswires, and graphs can be utilized across various media channels. Understanding this heterogeneity can be valuable for policymakers if they aim to target a specific audience group.

Awareness After we show the treatment, we ask the respondent whether the respondents were aware of the message prior to the study. Only 18% of the respondents said that they are aware. We then compare the responses of those who were aware of the message to those who were unaware. As shown in Table 8, larger effects on unaware group; muted effects on aware group except for the graph.

Language The comparison extends to respondents who are English speakers versus those who are French speakers.

Table 8. Estimation results for wave 1, inflation expectation, awareness

	(1)	(2)	(3)	(4)
	inflation exp.		uncertainty	
	aware	unaware	aware	unaware
Video	0.283*	-0.434***	0.005	-0.079***
	(0.147)	(0.104)	(0.027)	(0.019)
Audio	0.011	-0.404***	-0.010	-0.095***
	(0.163)	(0.101)	(0.034)	(0.020)
Text	-0.084	-0.594***	0.023	-0.051***
	(0.156)	(0.104)	(0.027)	(0.019)
Graph	-0.325**	-0.590***	0.004	0.012
	(0.157)	(0.106)	(0.032)	(0.020)
Removing outliers	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes
Observations	1,650	4,043	1,526	3,751
R-squared	0.005	0.010	0.000	0.011

This table reports the average treatment effects for wave 1. Columns 1 to 2 consider the revision in inflation expectations, and cols. 3 to 4 consider the revision in inflation expectation uncertainty. Specially, cols 1 and 3 show results for the aware group. 2 and 4 show results for the unaware group. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

There is surprisingly significant heterogeneity in how respondents change their beliefs in response to new information on average.

Respondents who are English speakers exhibit larger effects, while the French-speaking group shows muted effects except in response to text and graphs.

‘

3.7 Why the format matter? – emotion effects

One advantage of two waves of survey is that each wave has a real-time message delivered by the same central banker, and we can use the emotion variations in the two waves. Therefore, we can not only test the effects of formats by proving the same information with different contents.

To measure emotion, we use the techniques developed in Alexopoulos et al. (2024). Our measure of audio cues is based on vocal pitch since experiments in psychology have demonstrated that increases in vocal pitch may reflect a variety of emotions and levels of excitement

(Kamiloglu et al. 2020, Dietrich et al. 2019). Therefore, we extract the fundamental frequency ($F0$)[17] for each Chair and congressional representatives using the vocal signal processing tool, *Praat* (Boersma & Weenink 2001), at 0.015 second intervals. The vocal pitch is measured by calculating the mean $F0$ of each audio sentence. We then calculate the deviations from the mean F0 when creating our audio cue measures.

For the face-emotion measure, we combine video frame outputs from face recognition and facial expression analysis software to obtain facial muscle action units for participants. This method, commonly used in psychology to evaluate facial emotions, involves analyzing every frame of our videos (29.97 frames per second) to capture both macroexpressions (obvious signs of emotions typically lasting 0.5 to 4 seconds) and microexpressions (uncontrollable expressions typically related to concealed emotions that can occur in as little as 1/30 of a second) [18] For each sentence, we construct facial emotion indexes based on upper facial actions classified in the Facial Action Coding System (FACS) created by Ekman & Friesen (1969). This approach is chosen since the existing software packages that predicts emotions are not designed to analyze cases where people are talking - as they are during the majority of testimonies.

Figure 8 plots the measures for the four sentences. For both the voice and face measures, we demeaned the voice and face by the Governor's voice pitch and the face expression over the remarks session, and standardized them to have unit standard deviation.

We pool wave 1 and wave 2 together. To estimate the average treatment effects of emotion intensity, we employ the following regression specification:

$$\text{Outcome}_i^{\text{post}} - \text{Outcome}_i^{\text{pre}} = \beta_1 \text{Sentiment}_i + \beta_2 \text{Stance}_i + \beta_3 \text{Voice}_i + \beta_4 \text{Face}_i + \text{controls} + \varepsilon_i \tag{5}$$

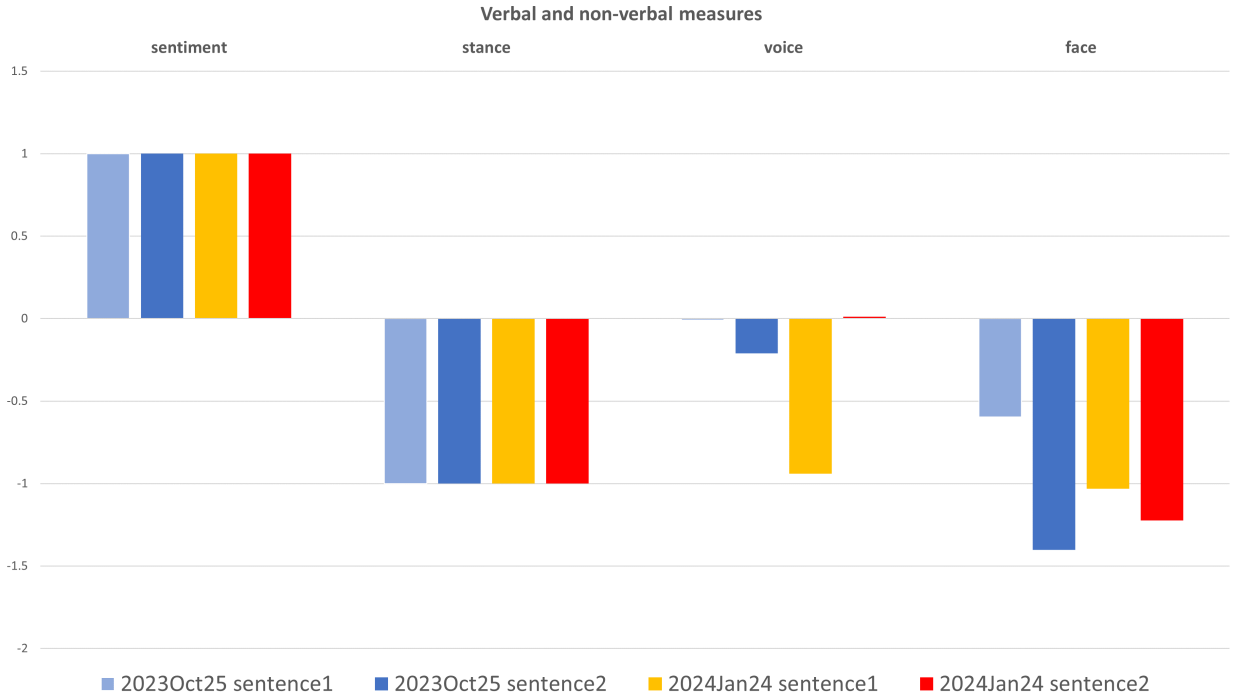
where Outcome is our outcome variable of interests. Treat_i^j represent whether individual i belongs to treatment group j, where Sentiment_i, Stance_i, Voice_i and Face_i are the corresponding text sentiment, monetary policy stance, demeaned voice pitch, demeaned face emotions associtated with the treatement peopele have received.

In Table 9, we report estimated values of β^j for each verbal and nonverbal measures for inflation expectation revisions. It shows that all group expectations are reduced, but higher voice and happier face reduce the largest amount. In Table 10, we report estimated values of β^j for each verbal and nonverbal measures for inflation expectation revisions. It shows that all group expectations are reduced, but higher voice and happier face reduce the largest

[17] $F0$ corresponds to the rate of vocal fold vibrations: high pitch is associated with rapid vibrations and low pitch with slow vibrations

[18] See Ekman (2003), Matsumoto & Hwang (2011) and Porter & ten Brinke (2008).

Figure 8. Emotion intensity



Notes: Emotion intensity for the four sentences used in the wave 1 and wave 2 treatments. We look at the sentiment, stance, demeaned and standardized voice pitch and demeaned and standardized voice facial expressions.

amount.

Table 9. Estimation results for emotion intensity, inflation

	(1)	(2)	(3)	(4)
	inflation exp.		uncertainty	
Face	-0.065	-0.061	-0.020	-0.023
	(0.093)	(0.094)	(0.018)	(0.018)
Voice	-1.511***	-1.497***	0.232***	0.257***
	(0.358)	(0.361)	(0.068)	(0.068)
Removing outliers	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	No	Yes
Observations	4,428	4,419	4,103	4,074
R-squared	0.024	0.042	0.007	0.034

This table reports the estimates for regression equation 5. Columns 1 to 2 consider the revision in inflation expectations, and cols. 3 to 4 consider the revision in inflation expectation uncertainty. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10. Estimation results for emotion intensity, interest rate

	(1)	(2)	(3)	(4)
	interest rate exp.		uncertainty	
Face	0.176***	0.188***	-0.011	-0.014
	(0.061)	(0.061)	(0.013)	(0.013)
Voice	-0.790***	-0.843***	0.145***	0.164***
	(0.237)	(0.236)	(0.049)	(0.050)
Removing outliers	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	No	Yes
Observations	4,444	4,418	4,285	4,260
R-squared	0.002	0.027	0.005	0.021

This table reports the estimates for regression equation 5. Columns 1 to 2 consider the revision in interest rate expectations, and cols. 3 to 4 consider the revision in interest rate expectation uncertainty. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

4 The dynamic effects of being treated twice

4.1 Dynamic treatment effects

We look at the dynamic effects of multiple waves of treatment. As far as we know, the exisitng literature only conduct one wave of survey, and among the literature, only a few will track the respondents to see the persistent effects. However, to be practical, and to be more related to daily life, one of the question is do we need to treat the respondent once or do we need to consistently treat the respondes, and if yes, will varying the formats matter?

To answer this important question, instead of pooling respondents from different waves together, we look at the dynamic effects by combining Wave 1+ Wave 2 treatment. Since the graph group is so different from the other groups, we group the treatment groups into Graph group, and non-Graph group, and keep the same control group. We also have Graph group, and non-Graph group, and control group in wave 2. For individual particles that appear in both waves, we can divide them into 9 different groups: {N, G, C} by {N, G, C}. For consumers who are not in our wave 1 and new to our wave 2, we group them as if they are in the wave 1 control group. But the results are robust if we drop them.

We re-estimate the regression 1.

$$\text{Outcome}_i^{\text{post}} - \text{Outcome}_i^{\text{pre}} = \sum_{\substack{j=NN,NG,NC,\\ GN,GG,GC,CN,CG}} \beta^j \text{Treat}_i^j + \text{controls} + \varepsilon_i \tag{6}$$

where Outcome is our outcome variable of interests; Treat_i^j represent whether individual i belongs to treatment group j, where j is 9 different groups: {N, G, C} by {N, G, C}. We use the CC group as the baseline group. The β^j is the average effect of Treat^j on the revisions of Outcome relative to the average change in the control group.

In Table 11, we report estimated values of β^j for respondents in wave 2 who are also in wave 1. Columns (1)-(3) present the effects on one-year inflation expectations, while columns (3)-(4) focus on revisions of two-year ahead inflation expectations. Columns (7)-(9) is for the inflation uncertainty. The results indicate that for the group graph treated in wave 1, the treatment in wave 2 is ineffective for one-year inflation expectations but has an effect on two-year expectations. However, if the treatment is never graph treated in wave 1, the graph treatment in wave 2 has significant effects on one-year inflation expectations.

Table 11. Estimation results for wave 2, combined treatments in two waves, returning respondents only

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		inflation 1 year			inflation 2 year			inflation uncertainty	
NG-NG	-0.107	-0.138	-0.026	-0.094	-0.182	-0.197*	-0.042	-0.051*	-0.023
	(0.116)	(0.115)	(0.122)	(0.115)	(0.115)	(0.116)	(0.029)	(0.029)	(0.030)
NG-G	-0.296**	-0.335***	-0.293**	-0.204*	-0.293**	-0.415***	-0.005	-0.009	-0.004
	(0.118)	(0.117)	(0.123)	(0.118)	(0.118)	(0.119)	(0.029)	(0.029)	(0.030)
G-NG	-0.242*	-0.189	0.040	-0.379***	-0.390***	-0.443***	-0.042	-0.043	-0.043
	(0.144)	(0.144)	(0.148)	(0.146)	(0.146)	(0.149)	(0.035)	(0.035)	(0.037)
G-G	-0.187	-0.212	-0.107	-0.251*	-0.365**	-0.215	0.029	0.007	0.025
	(0.137)	(0.136)	(0.145)	(0.140)	(0.142)	(0.141)	(0.034)	(0.034)	(0.035)
NG-C	0.175	0.148	0.168	0.275**	0.192*	0.038	0.066**	0.064**	0.061**
	(0.114)	(0.113)	(0.119)	(0.114)	(0.114)	(0.115)	(0.028)	(0.029)	(0.030)
G-C	0.046	0.029	-0.026	0.191	0.136	-0.013	0.095***	0.083**	0.094***
	(0.139)	(0.137)	(0.145)	(0.141)	(0.141)	(0.148)	(0.035)	(0.035)	(0.036)
C-NG	-0.180	-0.199	-0.240	-0.240*	-0.336**	-0.469***	-0.044	-0.064*	-0.050
	(0.145)	(0.146)	(0.152)	(0.146)	(0.146)	(0.156)	(0.036)	(0.036)	(0.039)
C-G	-0.455***	-0.501***	-0.258*	-0.406***	-0.448***	-0.417***	-0.009	-0.007	0.001
	(0.143)	(0.142)	(0.147)	(0.138)	(0.137)	(0.139)	(0.035)	(0.034)	(0.035)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes	No	Yes	Yes
Observations	3,551	3,475	2,617	3,521	3,446	2,609	3,293	3,217	2,398
R-squared	0.013	0.045	0.038	0.019	0.039	0.046	0.015	0.050	0.044

This table reports the average treatment effects relative to the control group. Columns 1 to 3 consider the one-year ahead inflation expectation, cols. 4 to 6 consider the two-year ahead inflation expectation, and cols 7 to 9 are for the inflation expectation uncertainty. Treatments are described in detail in the main text. For each time horizon, cols. 2, 6 and 8 use the same specification as in col. 1 but augmented with respondent-specific demographic controls; cols. 3, 6 and 9 use the same specification as in col. 2 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

5 Expectations of Other Variables

5.1 Interest rate expectations, wage growth expectations

In both wave 1 and wave 2, we also elicit the interest rate expecations and the uncertainty around them. In Table 12, we report estimated values of β^j for each treatment group in wave 1 for interest rate expectation revisions. In Table 13, we report estimated values of β^j for each treatment group in wave 1 for uncertainty revisions of interest rate expectations. In both tables, cols (1)-(3) is the immediate effects, and cols (4)-(6) is the 3-month effects. On impact, all four reduce the average interest rate forecast by 0.3–0.5% relative to the control group. Video has the largest effect on the beliefs of individuals. All treatments reduce the uncertainties about the interest rates. All treatments show weak persistent effects on interest rate forecasts. But the video, audio and the text treatment still have significant effects on the interest rate uncertainty three months after.

Table 14 shows the average treatment effects for wave 2 interest rate expectations and uncertainties. Results are similar to those in wave 1. In Table 15, we repeat the exercise of

recalling as in Table 5. We find that the respondents being treated with audio and being able to recall the treatment, will have lower interest rate expectations.

We introduced the earnings growth expectation questions in wave. Table 16 shows the average treatment effects. Providing information about inflation appears to have minimal impact on perceived wage growth, regardless of whether it pertains to the expectations for the average Canadian or the individual's own expectations.

Table 12. Estimation results for wave 1, interest rate expectation

	(1)	(2)	(3)	(4)	(5)	(6)
	Immediate effects			3-month effects		
Video	-0.501***	-0.521***	-0.494***	-0.018	-0.033	0.037
	(0.059)	(0.060)	(0.066)	(0.097)	(0.098)	(0.109)
Audio	-0.337***	-0.352***	-0.373***	-0.249**	-0.248**	-0.118
	(0.058)	(0.059)	(0.063)	(0.099)	(0.099)	(0.110)
Text	-0.324***	-0.335***	-0.293***	0.047	0.045	0.116
	(0.056)	(0.058)	(0.063)	(0.096)	(0.098)	(0.111)
Graph	-0.367***	-0.360***	-0.278***	-0.167*	-0.166*	-0.085
	(0.059)	(0.060)	(0.065)	(0.097)	(0.098)	(0.109)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes
Observations	4,829	4,704	3,431	3,742	3,652	2,737
R-squared	0.014	0.044	0.054	0.003	0.016	0.025

This table reports the average change in interest rate expectations of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the immediate change in expectations after the treatment, cols. 4 to 6 consider the changes in beliefs after 3 months. In each case, differences in beliefs are measured relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. For each time horizon, col. 2 uses the same specification as in col. 1 but augmented with respondent-specific demographic controls; col. 3 uses the same specification as in col. 2 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 13. Estimation results for wave 1, interest rate uncertainty

	(1)	(2)	(3)	(4)	(5)	(6)
	Immediate effects			3-month effects		
Video	-0.046***	-0.041***	-0.037***	-0.043**	-0.041**	-0.047**
	(0.012)	(0.013)	(0.014)	(0.019)	(0.019)	(0.020)
Audio	-0.054***	-0.049***	-0.052***	-0.034*	-0.032*	-0.058***
	(0.012)	(0.012)	(0.014)	(0.020)	(0.019)	(0.020)
Text	-0.054***	-0.051***	-0.031**	-0.047**	-0.042**	-0.042**
	(0.012)	(0.012)	(0.014)	(0.019)	(0.019)	(0.020)
Graph	-0.030**	-0.031**	-0.021	-0.016	-0.015	-0.036*
	(0.012)	(0.012)	(0.014)	(0.019)	(0.019)	(0.021)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes
Observations	4,673	4,535	3,297	3,537	3,451	2,589
R-squared	0.005	0.027	0.030	0.002	0.026	0.029

This table reports the average change in interest rate expectation uncertainty of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the immediate change in expectations after the treatment, cols. 4 to 6 consider the changes in beliefs after 3 months. In each case, differences in beliefs are measured relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. For each time horizon, col. 2 uses the same specification as in col. 1 but augmented with respondent-specific demographic controls; col. 3 uses the same specification as in col. 2 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 14. Estimation results for wave 2, interest rate expectation and uncertainty

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	interest rate. 1 year			interest rate 2 year			interest rate uncertainty		
Video	-0.204***	-0.211***	-0.231***	-0.264***	-0.258***	-0.204***	-0.018*	-0.014	-0.009
	(0.043)	(0.044)	(0.050)	(0.045)	(0.046)	(0.051)	(0.010)	(0.010)	(0.011)
Graph	-0.095**	-0.130***	-0.128***	-0.129***	-0.139***	-0.085	0.003	0.006	0.008
	(0.043)	(0.044)	(0.049)	(0.046)	(0.046)	(0.052)	(0.010)	(0.010)	(0.011)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes	No	Yes	Yes
Observations	4,533	4,422	3,065	4,533	4,426	3,056	4,450	4,330	2,991
R-squared	0.004	0.033	0.037	0.006	0.037	0.039	0.001	0.030	0.038

This table reports the average change in interest rate expectations of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the immediate change in expectations after the treatment, cols. 4 to 6 the immediate change in uncertainty after the treatment. In each case, differences in beliefs are measured relative to initial beliefs from the second wave measured before all treatments. Treatments are described in detail in the main text. Cols. 2 and 5 use the same specification as in cols 1 and 4 but augmented with respondent-specific demographic controls; Cols. 3 and 6 use the same specification as in cols 2 and 5 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 15. Estimation results for wave 1, interest rate expectation and recall

	(1)	(2)	(3)	(4)	(5)	(6)
	interest rate exp.			uncertainty		
Recall correctly						
Video	0.029	0.013	0.083	-0.040	-0.046*	-0.058**
	(0.134)	(0.138)	(0.150)	(0.027)	(0.028)	(0.029)
Audio	-0.296**	-0.281**	-0.224	-0.055**	-0.048*	-0.069**
	(0.134)	(0.135)	(0.148)	(0.027)	(0.027)	(0.028)
Text	0.107	0.062	0.105	-0.032	-0.034	-0.034
	(0.130)	(0.135)	(0.152)	(0.025)	(0.025)	(0.027)
Graph	-0.205	-0.234*	-0.169	-0.051*	-0.051*	-0.067**
	(0.133)	(0.134)	(0.145)	(0.027)	(0.027)	(0.029)
Recall incorrectly						
Video	0.024	0.005	0.022	-0.041	-0.032	-0.033
	(0.130)	(0.133)	(0.143)	(0.025)	(0.025)	(0.026)
Audio	-0.121	-0.137	-0.018	-0.010	-0.012	-0.041
	(0.135)	(0.138)	(0.146)	(0.026)	(0.026)	(0.026)
Text	0.075	0.109	0.144	-0.056**	-0.045*	-0.042
	(0.132)	(0.134)	(0.145)	(0.025)	(0.025)	(0.026)
Graph	-0.048	-0.027	0.011	0.017	0.019	-0.003
	(0.131)	(0.135)	(0.145)	(0.025)	(0.025)	(0.027)
Control	0.106	0.098	0.034	0.007	0.007	0.009
	(0.139)	(0.141)	(0.159)	(0.028)	(0.027)	(0.029)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes
Observations	3,741	3,652	2,729	3,536	3,446	2,590
R-squared	0.004	0.017	0.026	0.005	0.028	0.030

This table reports the average change in inflation expectations of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the immediate change in expectations after the treatment, cols. 4 to 6 consider the changes in beliefs after 3 months. In each case, differences in beliefs are measured relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. For each time horizon, col. 2 uses the same specification as in col. 1 but augmented with respondent-specific demographic controls; col. 3 uses the same specification as in col. 2 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 16. Estimation results for wave 2, wage growth expectation

	(1)	(2)	(3)	(4)	(5)	(6)
	avg. Canadian's wage			own wage		
Video	-0.033	-0.051	-0.018	-0.019	-0.018	-0.016
	(0.036)	(0.037)	(0.042)	(0.024)	(0.024)	(0.028)
Graph	-0.063*	-0.071*	-0.069*	0.010	0.006	-0.013
	(0.037)	(0.037)	(0.041)	(0.024)	(0.025)	(0.029)
Removing outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	Yes	No	Yes	Yes
Controls for hh inflation	No	No	Yes	No	No	Yes
Observations	4,183	4,064	2,870	3,549	3,488	2,471
R-squared	0.001	0.011	0.013	0.000	0.010	0.015

This table reports the average change in wave expectations of individuals in each treatment group relative to those in the control group. Columns 1 to 3 consider the average Canadian's wage, cols. 4 to 6 consider the respondent's own wage. Cols. 2 and 5 use the same specification as in cols 1 and 4 but augmented with respondent-specific demographic controls; Cols. 3 and 6 use the same specification as in cols 2 and 5 but augmented with respondent-specific year-over-year inflation rate in 2023Q3. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

5.2 How is inflation expectation related to other expectations

Since we have asked many questions about expectations, there are a few "perceived" relationships we can estimate. The information provided about the central bank's forecasts of the inflation rate affects inflation expectations, wage growth expectations, and interest rate expectations.

We estimate the relationship between these variables by estimating the following equation.

$$\text{Outcome}_i^{\text{post}} - \text{Outcome}_i^{\text{pre}} = \beta(\pi_i^{\text{post}} - \pi_i^{\text{pre}}) + \text{controls} + \varepsilon_i \tag{7}$$

where the Outcome is either the interest rate expectation or the wage growth expectation. We rely on an instrumental variable (IV) strategy in which the treatments are used to identify exogenous variation in inflation expectations.

Perceived monetary policy When the Outcome variable is interest rate expectations, we are estimating the perceived monetary policy rule. Our estimates for the coefficient is

about 0.8 with confidence interval from 0.24 to 1.38. The results are shown in Table 17.

Perceived inflation-wage spiral When the Outcome variable is wage growth expectations, we are estimating the perceived inflation wage spiral. We cannot reject the hypothesis that the coefficient is zero, no matter we use the expected Canadian wage growth or own wage growth. It indicates a very low pass-through from inflation expectations to wage expectations. The results are shown in Table 18.

Table 17. Perceived monetary policy reaction

	wave 1				wave 2			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Revision in inflation exp.	0.81***	0.55***	1.06***	0.73***	0.50	0.55**	0.50	0.67**
	(0.29)	(0.17)	(0.34)	(0.19)	(0.32)	(0.28)	(0.34)	(0.28)
Observations	4,698	4,653	4,698	4,654	4,447	4,435	4,447	4,432
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group treatment together	No	No	Yes	Yes	No	No	Yes	Yes
Jacknife	No	Yes	No	Yes	No	Yes	No	Yes
First stage F-statistics	9.132	10.42	29.08	35.49	18.74	19.59	32.40	19.59

This table reports the IV regression. The dependent variable in cols 1-4 is the revision in interest rate expectation in wave 1. The dependent variable in cols 5-8 is the revision in interest rate expectation in wave 2. Cols 1, 2, 5 and 6 use the wave 1 treatment groups separately as the instrument. Cols 3, 4, 7 and 8 group the wave 1 treatments together. Cols 1 3, 5, 7 uses sample weights and Huber regression. Cols 2, 4, 6 and 8 also uses the jacknife procedure. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 18. Perceived inflation-wage spiral

	Revision in Canadian wage growth				Revision in own wage growth			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Revision in inflation exp.	0.20	0.10	0.20	0.10	-0.53	-0.03	-0.16	-0.19
	(0.62)	(0.31)	(0.62)	(0.31)	(0.69)	(0.30)	(0.71)	(0.34)
Observations	4,449	4,333	4,449	4,333	3,986	3,877	3,986	3,873
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Group treatment together	No	No	Yes	Yes	No	No	Yes	Yes
Jacknife	No	Yes	No	Yes	No	Yes	No	Yes
First stage F-statistics	18.93	18.07	18.93	18.07	16.04	15.44	27.03	24.53

This table reports the IV regression. The dependent variable in cols 1-4 is the revision in wage growth expectation for the average Canadian. The dependent variable in cols 5-8 is the revision in own wage growth expectation. Cols 1, 2,5 and 6 use the wave 2 video treatment and graph treatment as the instrument. Cols 3, 4, 7 and 8 group the wave 2 video treatment and graph treatment together. Cols 1 3, 5, 7 uses sample weights and Huber regression. Cols 2, 4, 6 and 8 also uses the jacknife procedure. Robust standard errors are in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

6 Average Treatment Effects on Actions

6.1 News attention

We examine whether individuals exhibit increased attention to the central bank following the treatment. In particular we estimate

$$\text{Newsattention}_{i,2}^{\text{pre}} - \text{Newsattention}_{i,1}^{\text{pre}} = \sum_{j=v,a,t,g} \beta^j \text{Treat}_{i,1}^{j} + \text{controls} + \text{constant} + \varepsilon_i$$

where $\text{Newsattention}_{i,j}$ is the frequency that respondents spend reading general news or news about the Bank of Canada. We did not find strong evidence that the effects are statistically different from zero.

6.2 Household goods spending

Participants in the information treatment group are presented with information intended to influence or inform their shopping expectations. The impact of this intervention is measured by the “posterior beliefs" of the consumers, reflecting their updated expectations post-treatment. A critical measure of the study is to observe any shifts in shopping behavior that

occur after the introduction of the new information.

We estimate the total effect of exogenously changed inflation expectations on different types of spending over time, though this total effect can encompass many different channels. We characterize how changes in inflation expectations are related to households' total weekly spending. This is done using the following regression:

$$(logSpend_{i,t+h}) * 100 = \alpha_h + \beta_h \times \pi_i^{\text{post}} + \text{controls} + \epsilon_{i,t+h} \tag{8}$$

where the dependent variable is the (log) spending of household i h weeks after the treatment, where h=1,2,...,8 weeks. The coefficient β provides a causal estimate of how changes in inflation expectations translate into subsequent spending decisions.

We use Huber regression in the first stage, then apply a jackknife procedure to control for any remaining outliers in the second stage of the regression, as in Coibion et al. (2023). We find the coefficients are slightly negative, indicating that reducing inflation expectations will boost the spending.

7 Conclusion

Central banks influence the economy and decision-making through setting policy rates and communicating their policies in various formats such as press releases, reports, press conferences, and speeches. These communications include a mix of text, graphics, and audio-visual content, with non-verbal cues also playing a role. This study uses a randomized control trial to explore how different formats of the same message about the central bank's forecast of future inflation affect individuals' expectations about inflation and interest rates, their consumption behavior, and the persistence of these effects. The findings indicate that individuals significantly adjust their expectations when exposed to information about the future path of inflation, with graphical representations having the most substantial impact on inflation expectations across groups, while video or audio messaging reduces uncertainty and significantly influences interest rate expectations.

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