The effects of inflation uncertainty on households' expectations and spending

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The views expressed here are those of the authors and not necessarily those of the Bank of Canada.

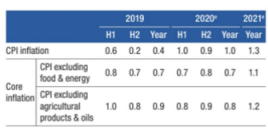
Motivation

Since the pandemic, managing inflation expectations became a critical challenge for central banks.

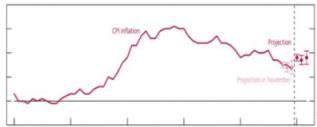
Communication challenge for central banks:

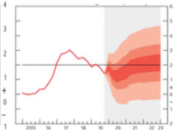
- Be transparent about their own uncertainty to instill credibility
- Be confident about outlook in an effort to more effectively anchor expectations

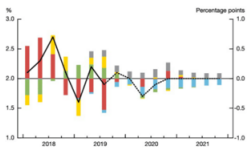
CB communication about inflation outlooks

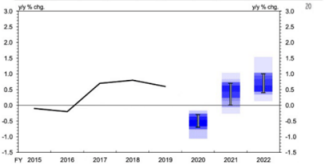


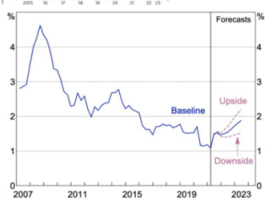
		2019			2020[e]		2021[f]
		H1	H2	Year	H1	H2	Year	Year
CPI inflation		0.6	0.2	0.4	1.0	0.9	1.0	1.3
Core inflation	CPI excluding food & energy	0.8	0.7	0.7	0.7	0.8	0.7	1.1
	CPI excluding agricultural products & oils	1.0	0.8	0.9	0.8	0.9	0.8	1.2

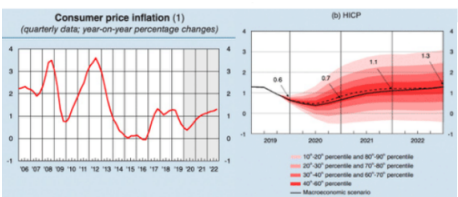


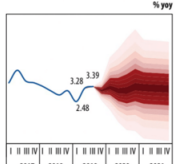


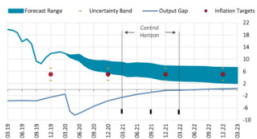












Communication about inflation: Bank of Canada

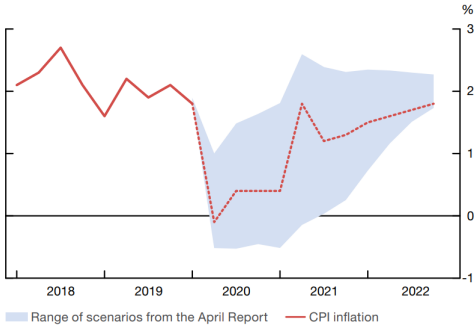


Figure 1: Monetary Policy Report, July 2020

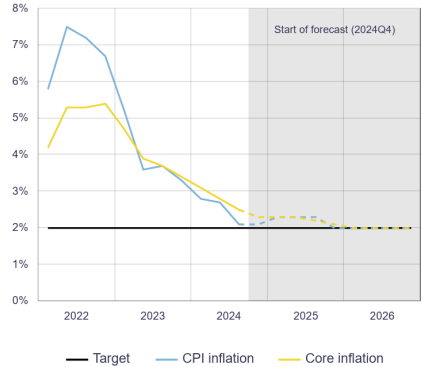


Figure 2: Monetary Policy Report, October 2024

Communication about inflation: Bank of England

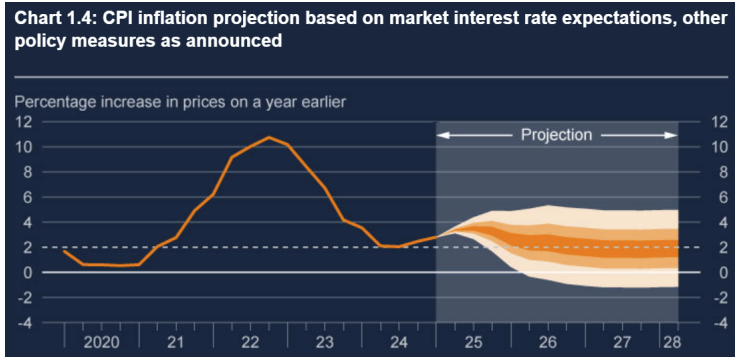


Figure 3: Inflation Projection, May 2025

CB communication about inflation targets

Point Targets	Point in Range	Range
ECB (2%)	Canada (1-3%, 2% midpoint)	Australia (2-3%)
Iceland (2.5%)	India (2-6%, aim 4%)	South Africa (3-6%)
Japan (2%)	Mexico (2-4%, aim 3%)	Switzerland (0-2%)
Norway (2%)	New Zealand (1-3%, aim 2%)	Thailand (1-3%)
South Korea (2%)	Peru (1-3%, aim 2%)	Uruguay (3-6%)
Sweden (2%)	Poland (1.5-3.5%, aim 2.5%)	
Bank of England (2%)	Ukraine (4-6%, aim 5%)	
United States (2%)		

Research questions

How does communication about inflation with uncertainty (ranges) affect households'

- inflation expectations?
- uncertainty about inflation?
- spending?
- information retention?

Communication about the inflation target, BoC's inflation outlook, and professional forecasters' outlook.

Key findings

All information interventions have immediate effects relative to the control group:

- Lower inflation expectations toward the provided information
- Lower uncertainty about future inflation
- Anchor probabilistic forecasts to the inflation-target-control range

Impact on household spending:

- Negative impact of inflation uncertainty on consumption

Most treatment effects dissipate by Wave 2

Pros and cons of communicating with uncertainty

✓ No detrimental impact on the level and uncertainty about expected inflation

- Bank target with a range lowers inflation expectations and uncertainty

✓ Anchoring of probabilistic expectations in target range

- forecasts of Bank of Canada with CI
- professional forecasters with a range

✓ Significant boost in durable and non-durable spending coming from lower uncertainty and more anchored expectations.

✓ Persistently lower inflation expectations of some demographic groups (higher education, women, young)

✗ But higher inflation expectations for respondents with lower levels of education in the follow-up survey

Methodology

We conducted a representative survey of macroeconomic expectations of Canadian households using NielsenIQ HomeScan Panel.

When	April-May 2020 Nov-Dec 2020
Economic context	Pandemic (low inflation)
Where	Canada
Sample size	5,000

RCT consisted of information interventions about past inflation, BoC's inflation target, BoC's inflation outlook, and professional forecasters' outlook.

RCT literature studying the impact of inflation uncertainty

	Kostyshyna and Petersen (2023, 2024)	Georgarakos et al. (2024)	Fischer et al. (2024)
When	April-May 2020 Nov-Dec 2020	September 2023 October 2023 January 2024	March 2024
Economic context	Pandemic (low inflation)	High inflation	High inflation, declining uncertainty
Where	Canada	EU	UK
Information	BoC target (range)		
	BoC forecast (CI)		
	Prof. forecast (range)	Prof. forecast (range)	Prof. forecast (range)
Sample size	5,000	19,000	6,000

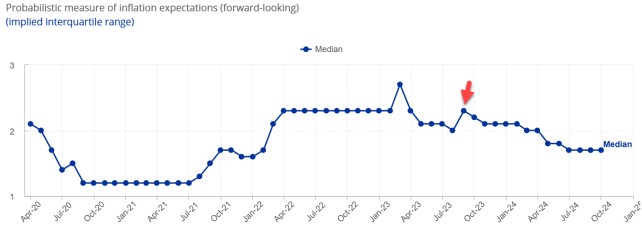
NK learning-to-forecast experiments studying the impact of inflation forecast uncertainty

	Petersen and Rholes (2022, 2023)
When	October-November 2019 Nov-Dec 2020 October-December 2021
Background economic context	Pre-Pandemic (low inflation) Pandemic (low inflation) Post-Pandemic (rising inflation)
Where	Univ. labs in Canada, U.S.
Information	CB projected path (range)
Sample size	400

Elevated uncertainty about inflation in Canada and EU

Canada

EU



Source: CES.

Design of information experiment

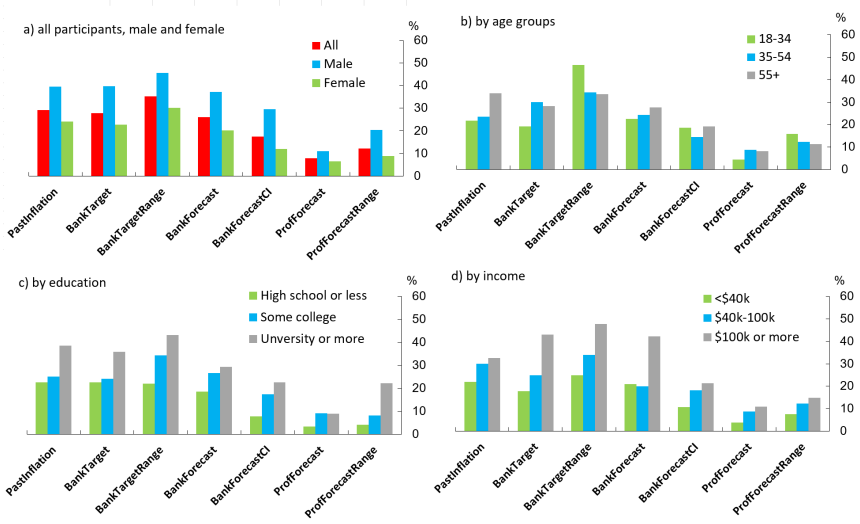
The Wave 1 survey consisted of the following parts.

- **Part 1: Elicit priors**. Respondents answered questions about their inflation expectations over the next 1 year, and pre-existing knowledge about the Bank's target and outlook for inflation.
- **Part 2: Information intervention**. Survey respondents are presented with randomly assigned information. Control group did not receive information.
- **Part 3: Elicit posteriors**. Respondents answered questions about their inflation expectations over the next 1 year.

Information interventions

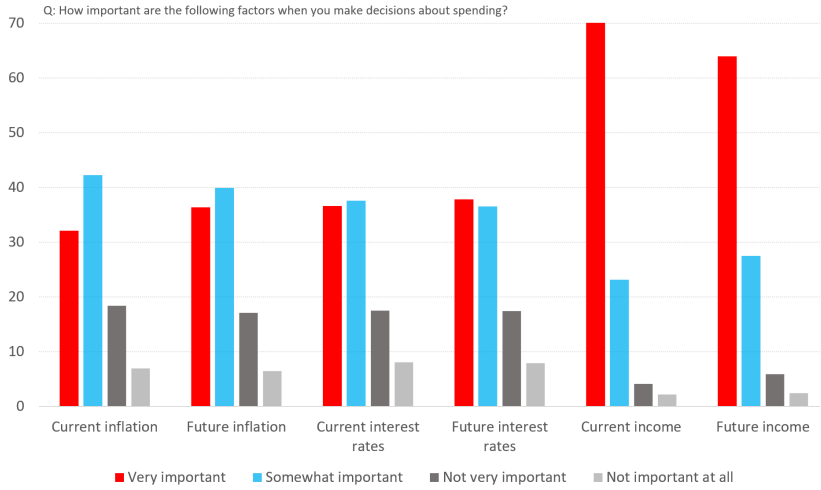
Treatment	Information
T1 - **PastInflation**	On average during the last year, January 2019 to January 2020, yearly inflation in Canada was **1.9%**.
T2 - **BankTarget**	The **Bank of Canada inflation target** is **2%**.
T3 - **BankTargetRange**	The **Bank of Canada inflation target** is **2%** with a **range between 1% and 3%**.
T4 - **BankForecast**	According to the **Bank of Canada**, **inflation is forecasted** to be around **2%** over the next year.
T5 - **BankForecastCI**	According to the **Bank of Canada**, **inflation is forecasted** to be around **2%** over the next year with a 90% change of being **between 1.4% and 2.6%**.
T6 - **ProfForecast**	According to Canadian **professional forecasters**, **inflation is forecasted** to be around **1.7%** over the next year.
T7 - **ProfForecastRange**	According to Canadian **professional forecasters**, **inflation is forecasted** to be around **1.7%** over the next year, with forecasts **ranging from 1.2% to 2.1%**.

Self-reported awareness of information



Avg belief about the Bank's target was 6.7% and outlook was 6.9%.

Income is the most important factor in spending decisions



This presents difficulty for the knowledge about inflation and communication about inflation.

Survey question: point forecasts

1-year-ahead inflation expectations $E_i\pi_{1yr}$ are elicited using these questions:

Part 1. Over the next 12 months, do you think that there will be inflation or deflation? (Note: deflation is the opposite of inflation.)
Please choose one.

- Inflation
- Deflation (the opposite of inflation)

Part 2. What do you expect the rate of [inflation/deflation] to be over the next 12 months? Please give your best guess.
Please enter a number greater than 0 or equal to 0.

Over the next 12 months, I expect the rate of [inflation/deflation] to be ___ percent.

Prior 1-year-ahead inflation expectations are dispersed across respondents

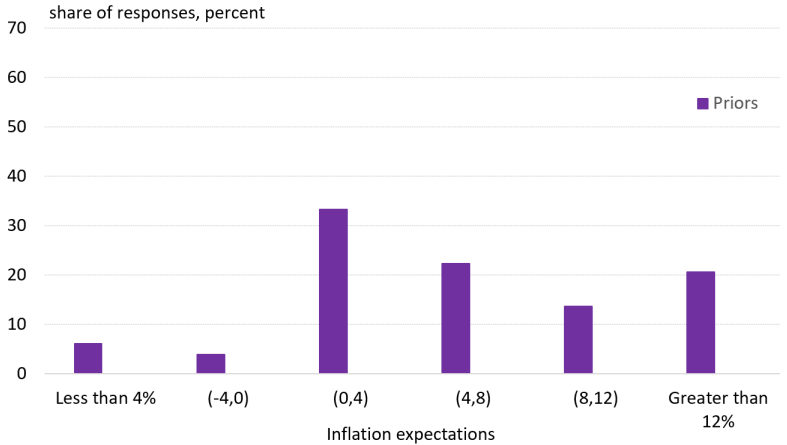


Figure 4: Prior expectations for point one-year-ahead inflation

Average forecast ranged between 7-8%. Realized inflation in Apr/May 2021 was 3.5%.

Posterior 1-year-ahead inflation expectations in control group

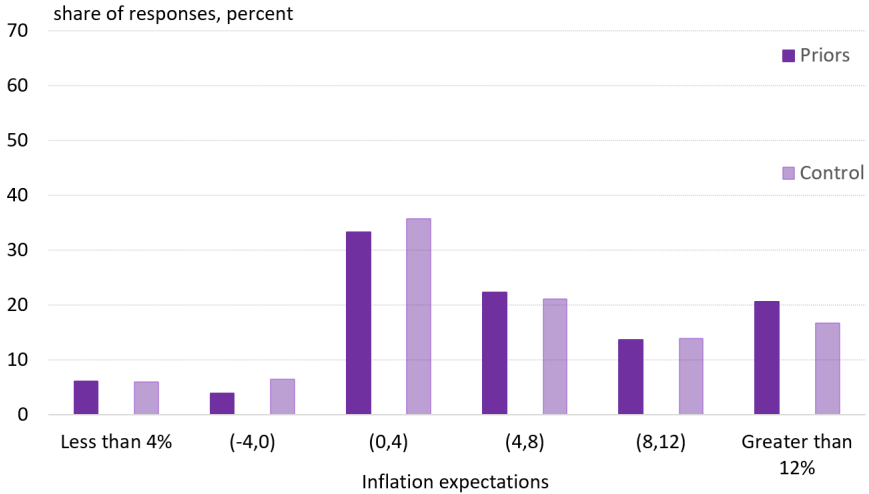


Figure 5: Posterior expectations for point one-year-ahead inflation, control group

Information interventions focus inflation expectations close to provided information

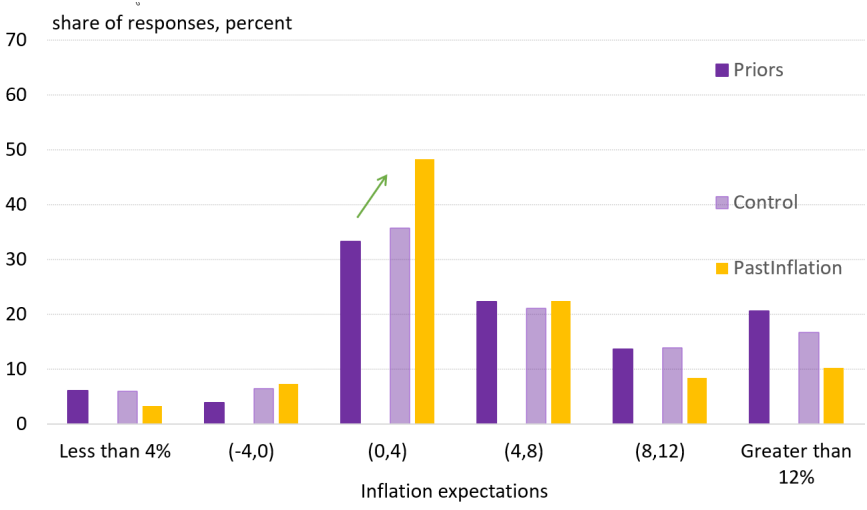


Figure 6: Point one-year-ahead inflation, posteriors by treatment compared with priors

Information interventions focus inflation expectations close to provided information

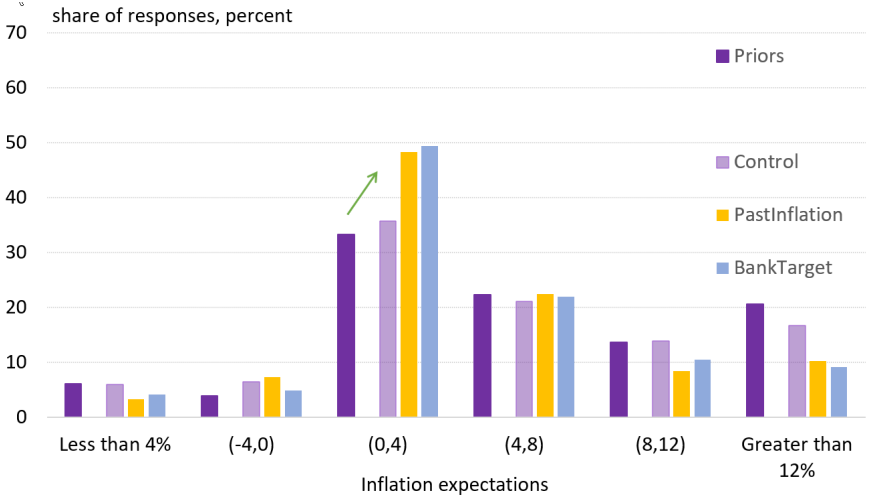


Figure 7: Point one-year-ahead inflation, posteriors by treatment compared with priors

Information about forecasts is more effective

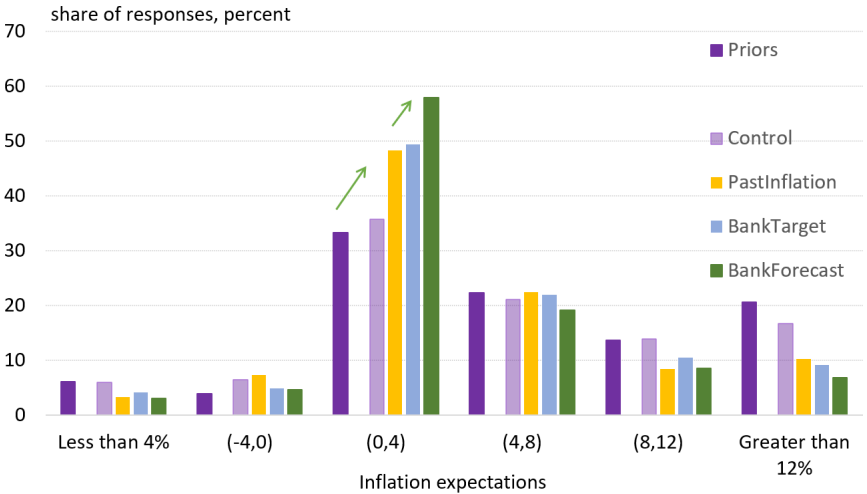


Figure 8: Point one-year-ahead inflation, posteriors by treatment compared with priors

Information about forecasts is more effective

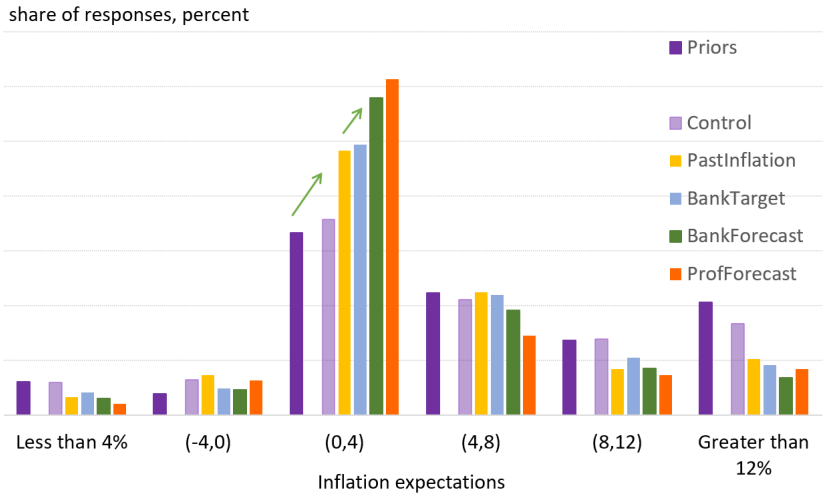


Figure 9: Point one-year-ahead inflation, posteriors by treatment compared with priors

Information with ranges is not detrimental

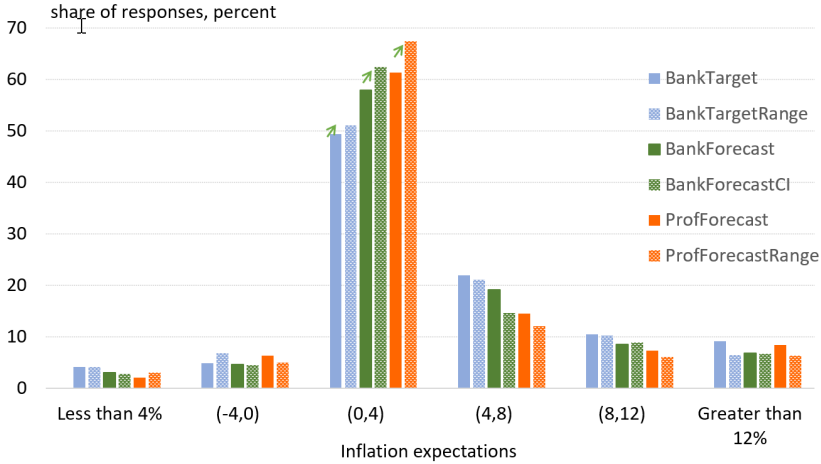


Figure 10: Point one-year-ahead inflation, posteriors in treatments with and without ranges

No statistically significant difference in the effects of communication with/without ranges.

Impact of information interventions dissipates over time

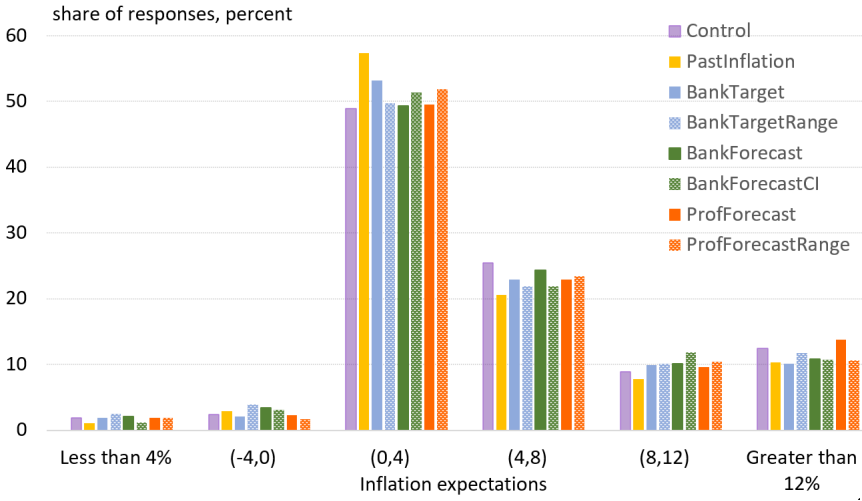


Figure 11: Point one-year-ahead inflation, Wave 2 by treatment

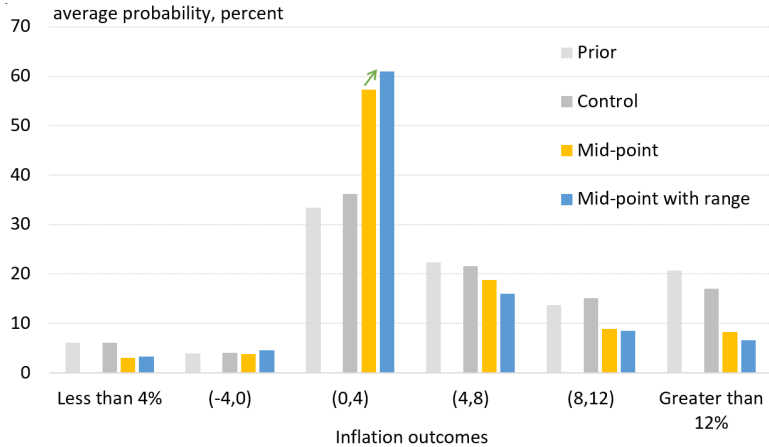
Survey question about probabilistic expectations of inflation

Now we would like you to think about the different things that may happen to inflation over the next 12 months. We realize that this question may take a little more effort.

In your view, what would you say is the percent chance that, over the next 12 months...
(Please note: The numbers need to add up to 100.)

the rate of inflation will be 12% or higher	___ percent chance
the rate of inflation will be between 8% and 12%	___ percent chance
the rate of inflation will be between 4% and 8%	___ percent chance
the rate of inflation will be between 2% and 4%	___ percent chance
the rate of inflation will be between 0% and 2%	___ percent chance
the rate of deflation (opposite of inflation) will be between 0% and 2%	___ percent chance
the rate of deflation (opposite of inflation) will be between 2% and 4%	___ percent chance
the rate of deflation (opposite of inflation) will be between 4% and 8%	___ percent chance
the rate of deflation (opposite of inflation) will be between 8% and 12%	___ percent chance
the rate of deflation (opposite of inflation) will be 12% or higher	___ percent chance
TOTAL	100

Stronger impact of communication with ranges on probabilistic expectations



Forecasts of the Bank of Canada and professional forecasters with ranges are more effective (statistically significant) than without ranges.

Communication with ranges: no detrimental effect on inflation expectations and uncertainty; more effective for probabilistic expectations

$$E_i Y_{1yr}^{post} - E_i Y_{1yr}^{prior} = a + b_0 Range_i^T + b_1 X_i + error_i$$

	$E_i \pi_{1yr}^{post}$ (1)	$E_i \pi_{1yr}^{Wave2}$ (2)	$E_i \text{iqr}_{1yr}^{post}$ (3)	$E_i \text{iqr}_{1yr}^{Wave2}$ (4)	$E_i \text{prob}_{1yr}^{target,post}$ (5)	$E_i \text{prob}_{1yr}^{target,Wave2}$ (6)
Range, all	-0.059	0.291	-0.040	0.005	**1.753*** **	-0.317
	(0.06)	(0.20)	(0.05)	(0.14)	(0.57)	(1.41)
N	3742	2544	3696	2477	3758	2569
R^2	0.0159	0.0163	0.00707	0.00806	0.0190	0.0143
Range, **Bank Target**	-0.102	-0.021	-0.016	-0.039	0.489	0.174
	(0.08)	(0.35)	(0.07)	(0.26)	(0.61)	(2.50)
N	1244	857	1224	832	1246	863
R^2	0.0152	0.0367	0.00873	0.0305	0.0255	0.0293
Range, **Bank Forecast**	-0.097	0.423	-0.089	0.436	**2.848** **	-3.858
	(0.13)	(0.34)	(0.09)	(0.27)	(1.17)	(2.41)
N	1258	849	1243	822	1260	857
r2	0.0244	0.0222	0.0129	0.0243	0.0290	0.0292
Range, **Prof Forecast**	0.030	0.646*	0.050	-0.299	**3.419***	1.292
	(0.14)	(0.35)	(0.11)	(0.24)	(1.86)	(2.49)
N	1240	838	1229	823	1252	849
R^2	0.0411	0.0320	0.0343	0.0161	0.0429	0.0406

Communication with ranges is more effective with more uncertain respondents

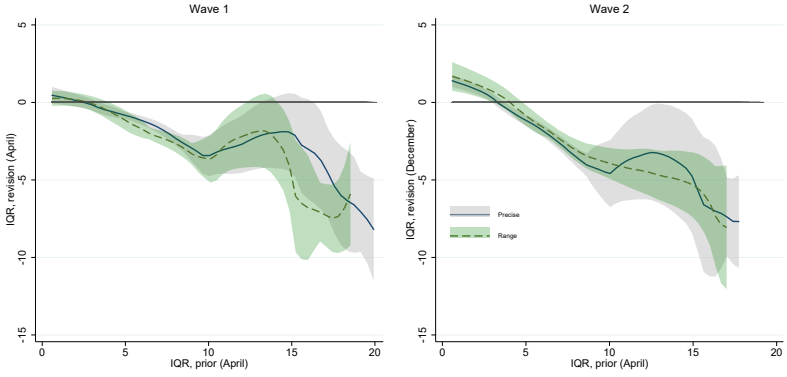


Figure 12: Revisions of uncertainty and prior uncertainty

Statistically significant effect from communicating the forecasts of the Bank of Canada and professional forecasters.

Pros and cons of communicating with uncertainty

Heterogeneity in the persistence of effects

✓ Lower inflation expectations for respondents with higher levels of education and women
- Bank target with a range
- Inflation forecast of professional forecasters

✓ Better anchoring of probabilistic expectations in targeted range and lower uncertainty
- Bank target (higher education)
- inflation forecasts of professional forecasters (women, young)

✗ Higher inflation expectations for respondents with lower levels of education

Impact on household spending

We use transaction data from NielsenIQ Homescan Panel which tracks expenditures on different categories of goods.

- Compute monthly expenditures on *durable* and *non-durable* goods from over 180 products.
- Evaluate effects of information interventions on subsequent spending

Transmission of information interventions to spending through expectations

Following Coibion-Gorodnichenko-Weber (2022),

$$log(spending)^{J}_{i,t+h} = \beta E_i \pi^{posterior}_{1yr,i} + \gamma E_i \pi^{prior}_{1yr,i} + \kappa log(spending)^{J}_{it} + \theta X_i + \epsilon_{i,t+h}$$

J= horizon: cumulative 1 mo., 3 mo., 6 mo. spending

where $E_i \pi^{posterior}_{1yr}$ is instrumented using the treatment dummies, priors, and log spending.

Coefficient β provides an estimate of the causal estimate of changes in inflation expectations on household spending.

Inflation expectations have a negative effect on spending

	Cumulative spending after treatment		
	1 month	3 months	6 months
	(1)	(2)	(3)
Total spending			
$E_i \pi_{1yr}^{posterior}$	-0.018	-0.043***	-0.020
	(0.02)	(0.01)	(0.01)
Observations	3913	3915	3808
R-squared	0.496	0.562	0.605
First-stage F-statistic	17.35	19.09	18.85
Durables			
$E_i \pi_{1yr}^{posterior}$	-0.129***	-0.120***	-0.140***
	(0.04)	(0.04)	(0.05)
Observations	1039	2191	2804
R-squared	0.0533	0.0164	0.0258
First-stage F-statistic	8.08	14.98	12.65
Nondurables			
$E_i \pi_{1yr}^{posterior}$	-0.009	-0.037**	-0.017
	(0.02)	(0.01)	(0.01)
Observations	3907	3912	3819
R-squared	0.497	0.570	0.615
First-stage F-statistic	17.70	18.91	18.58

Inflation uncertainty has a negative effect on spending

	Cumulative spending after treatment		
	1 month	3 months	6 months
	(1)	(2)	(3)
Total spending			
$E_i iqr^{posterior}$	-0.069	-0.133***	-0.065*
	(0.04)	(0.04)	(0.04)
Observations	3720	3717	3625
R-squared	0.473	0.523	0.572
First-stage F-statistic	11.47	11.12	9.789
Durables			
$E_i iqr^{posterior}$	0.029	-0.153	-0.452***
	(0.13)	(0.13)	(0.16)
Observations	975	2020	2646
R-squared	0.0393	0.0543	-0.0661
First-stage F-statistic	4.179	6.380	5.574
Nondurables			
$E_i iqr^{posterior}$	-0.076*	-0.114***	-0.050
	(0.04)	(0.04)	(0.04)
Observations	3721	3714	3641
R-squared	0.468	0.532	0.577
First-stage F-statistic	11.55	10.85	10.09

Negative impact of inflation uncertainty on household spending

	Kostyshyna and Petersen (2024)	Georgarakos et al. (2024)	Fischer et al. (2024)
Data	**Transaction** data Nielsen Household Panel on *durables* and *non-durables*	**Self-reported** spending on *durables* and *non-durables* **Intentions** for spending on durables	**Expected** nominal consumption over the next 12 months
Impact of inflation uncertainty	— All, D, ND	— D	— All

Notes: D = durables, ND = non-durables

Communication of ranges leads to larger spending responses

$$log(spending)^J_{i,t+h} = a + b_0 Range^T_i + b_1 log(spending)^J_{it} + b_2 X_i + \epsilon_{i,t+h}$$

	Cumulative spending after treatment		
	1 month	3 months	6 months
	(1)	(2)	(3)
Total spending			
$Range^T_i$	0.037**	0.038***	0.037***
	(0.02)	(0.01)	(0.01)
Observations	3436	3457	3377
R-squared	0.601	0.652	0.651
F-statistic	260.9	276.7	278.0
Durable spending			
$Range^T_i$	0.058	0.132**	0.091*
	(0.07)	(0.05)	(0.05)
Observations	1128	2065	2569
R-squared	0.0660	0.0776	0.0998
F-statistic	4.956	10.42	17.32
Nondurable spending			
$Range^T_i$	0.034**	0.032**	0.031**
	(0.01)	(0.01)	(0.01)
Observations	3433	3456	3379
R-squared	0.605	0.658	0.653
F-statistic	266.7	279.1	283.6

The impact of communication during the period of heightened uncertainty

During **high-uncertainty** periods, communication about inflation and inflation uncertainty **lowers inflation uncertainty** of households on average

$=>$ We find **stimulating** effects on consumer spending by lowering inflation uncertainty.

Policy implications

For monetary policy:
Negative impact of uncertainty about future inflation on consumer spending underscores the importance of **low and stable inflation**.

For communication about uncertainty:
During high-uncertainty periods, communication about inflation and inflation uncertainty has **reduced** people's uncertainty about inflation.

- People's **prior uncertainty is much higher** than uncertainty communicated in our survey.
- Communication about uncertainty can be beneficial.

Background slides

Inflation uncertainty has a negative effect on durables

	Cumulative spending after treatment		
	1 month	3 months	6 months
	(1)	(2)	(3)
Total spending			
$E_i\pi_{1yr}^{posterior}$	-0.03**	-0.01	-0.01
	(0.01)	(0.01)	(0.01)
$E_i iqr^{posterior}$	0.07	0.04	0.04
	(0.06)	(0.06)	(0.07)
Observations	3,745	3,604	3,773
R-squared	0.54	0.57	0.46
First-stage F-statistic (iqr)	3.543	4.533	3.149
Durables			
$E_i\pi_{1yr}^{posterior}$	0.04	-0.04	-0.01
	(0.06)	(0.05)	(0.04)
$E_i iqr^{posterior}$	-0.44**	-0.06	0.07
	(0.21)	(0.22)	(0.17)
Observations	1,001	2,045	2,719
R-squared	0.02	0.06	0.07
First-stage F-statistic (iqr)	1.677	1.828	3.010
Nondurables			
$E_i\pi_{1yr}^{posterior}$	-0.01	-0.03**	-0.00
	(0.01)	(0.01)	(0.01)
$E_i iqr^{posterior}$	0.02	0.04	0.02
	(0.06)	(0.06)	(0.06)
Observations	3,769	3,761	3,587
R-squared	0.47	0.55	0.58
First-stage F-statistic (iqr)	3.126	4.214	3.476

Econometric strategy

$$E_i Y_{1yr}^{post} - E_i Y_{1yr}^{prior} = a + b_0 Treatment_i + b_1 X_i + error_i \quad (1)$$

where $E_i Y$ are different variables characterizing inflation expectations:

- point 1-year-ahead inflation expectations, $E_i \pi_{1yr}$
- estimated uncertainty about expected inflation, $E_i \text{iqr}_{1yr}$ of the estimated density functions (Engelberg, Manski and Williams 2009, Armantier et al. 2017)
- probability assigned to inflation between 0 and 4%, $E_i \text{prob}_{1yr}^{target}$

X_i is demographic controls (age, gender, education, income, province, knowledge of inflation, ease expressing inflation as a number).

All information interventions anchor inflation expectations

$$E_i Y_{1yr}^{post} - E_i Y_{1yr}^{prior} = a + b_0 Treatment_i + b_1 X_i + error_i$$

	$E_i \pi_{1yr}^{post}$ (1)	$E_i \pi_{1yr}^{Wave2}$ (2)	$E_i \text{iqr}_{1yr}^{post}$ (3)	$E_i \text{iqr}_{1yr}^{Wave2}$ (4)	$E_i \text{prob}_{1yr}^{target,post}$ (5)	$E_i \text{prob}_{1yr}^{target,Wave2}$ (6)
PastInflation	-0.241***	-0.178	-0.269***	-0.221	2.755***	3.414
	(0.08)	(0.32)	(0.08)	(0.24)	(0.79)	(2.46)
BankTarget	-0.218***	-0.037	-0.213***	-0.231	2.227***	0.976
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.47)
BankTargetRange	-0.328***	-0.124	-0.249***	-0.290	2.885***	1.042
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.48)
BankForecast	-0.469***	-0.564*	-0.369***	-0.402*	3.988***	1.811
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.47)
BankForecastCI	-0.571***	-0.237	-0.455***	0.051	6.103***	-1.145
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.49)
ProfForecast	-0.732***	-0.654**	-0.489***	-0.112	4.637***	2.099
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.49)
ProfForecastRange	-0.794***	0.023	-0.477***	-0.464*	6.296***	4.023
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.49)
constant	-0.198	-0.883	-0.059	-0.684	-0.036	7.684
	(0.15)	(0.63)	(0.15)	(0.47)	(1.52)	(4.79)
N	4985	3403	4915	3309	4997	3432
R^2	0.0448	0.0153	0.0194	0.0123	0.0292	0.0164

The effects of information interventions do not persist

$$E_i Y_{1yr}^{Wave2} - E_i Y_{1yr}^{prior} = a + b_0 Treatment_i + b_1 X_i + error_i$$

	$E_i \pi_{1yr}^{post}$ (1)	$E_i \pi_{1yr}^{Wave2}$ (2)	$E_i \text{iqr}_{1yr}^{post}$ (3)	$E_i \text{iqr}_{1yr}^{Wave2}$ (4)	$E_i \text{prob}_{1yr}^{target,post}$ (5)	$E_i \text{prob}_{1yr}^{target,Wave2}$ (6)
PastInflation	-0.241***	-0.178	-0.269***	-0.221	2.755***	3.414
	(0.08)	(0.32)	(0.08)	(0.24)	(0.79)	(2.46)
BankTarget	-0.218***	-0.037	-0.213***	-0.231	2.227***	0.976
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.47)
BankTargetRange	-0.328***	-0.124	-0.249***	-0.290	2.885***	1.042
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.48)
BankForecast	-0.469***	**-0.564***	-0.369***	**-0.402***	3.988***	1.811
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.47)
BankForecastCI	-0.571***	-0.237	-0.455***	0.051	6.103***	-1.145
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.49)
ProfForecast	-0.732***	**-0.654****	-0.489***	-0.112	4.637***	2.099
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.49)
ProfForecastRange	-0.794***	0.023	-0.477***	**-0.464***	6.296***	4.023
	(0.08)	(0.33)	(0.08)	(0.24)	(0.79)	(2.49)
constant	-0.198	-0.883	-0.059	-0.684	-0.036	7.684
	(0.15)	(0.63)	(0.15)	(0.47)	(1.52)	(4.79)
N	4985	3403	4915	3309	4997	3432
R^2	0.0448	0.0153	0.0194	0.0123	0.0292	0.0164

Information interventions

KP: According to Canadian professional forecasters, inflation is forecasted to be around 1.7% over the next year, with forecasts ranging from 1.2% to 2.1%.

GGCK: The average prediction among professional forecasters is that inflation in the euro area will be at 2.5% over the next 12 months. At the same time, professional forecasters are exceptionally uncertain right now about inflation compared to recent years. As a result, there is a significant difference of 3.1 percentage points between the lowest and the highest predictions about inflation in the euro area over the next 12 months.

FHS: Professional forecasters expect lower inflation than one year ago. The average forecast for inflation over the next year is 2 percent. Professional forecasters are also less uncertain about inflation than one year ago. The highest forecast for inflation over the next year is 2.1 percentage points higher than the lowest forecast.