

# The Effects of Forward Guidance: Theory with Measured Expectations

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November 12, 2021

# Introduction

- Question: What are the effects of forward guidance?
- To address this question, we propose a novel approach, which is inspired by the following methodological question: How can one compute counterfactuals with measured expectations?

## Main idea illustrated with a simple example

- Many macro models imply equations of the form

$$Y = \gamma E [X (Z)]$$

- $Y$ : outcome variable (e.g. consumption)
  - $X$ : endogenous variable (e.g. permanent income)
  - $Z$ : structural shock (e.g. policy shock)
- The effect of the structural shock on the outcome variable is

$$\frac{\partial Y}{\partial Z} = \gamma \frac{\partial E [X (Z)]}{\partial Z}$$

- To compute the derivative  $\frac{\partial E[X(Z)]}{\partial Z}$ , one usually makes assumptions about expectation formation.
- We elicit directly the expectation  $E [X (Z)]$  for alternative policies and can thereby compute the effect of the shock  $Z$  on the outcome variable  $Y$  without making assumptions about expectation formation.

# Literature

- Literature on the effects of forward guidance using models: e.g. Eggertsson and Woodford (2003), Del Negro et al. (2012), McKay et al. (2016), Wiederholt (2015), Andrade et al. (2016), Angeletos and Lian (2018), García-Schmidt and Woodford (2019), Farhi and Werning (2019), Gabaix (2020).
- Growing empirical literature studying the way households form expectations about macroeconomic variables: e.g. Andre et al. (2021), Roth and Wohlfart (2020), Roth et al. (2021), Armona et al. (2019), Cavallo et al. (2017), Bailey et al. (2018), Coibion et al. (2018), Coibion et al. (2020), Coibion et al. (2019), Kuchler and Zafar (2019), Bachmann et al. (2015), Fuster et al. (2020).

## Model

- In period  $t$ , each household chooses consumption  $C_{i,t}$  so as to maximize

$$E_{i,t} \left[ \sum_{s=t}^{\infty} \beta^{s-t} \left( \frac{C_{i,s}^{1-\gamma}}{1-\gamma} - v_i(N_{i,s}) \right) \right]$$

subject to

$$P_t C_{i,t} + B_{i,t} = R_{t-1} B_{i,t-1} + W_{i,t} N_{i,t} + D_{i,t} - T_{i,t}$$

and

$$B_{i,t} \geq -L_{i,t}$$

given its subjective beliefs about the future paths of all relevant variables.

# Terminology

- In period  $t$ , each household belongs to one of three groups:
  - Group 1: Borrowing constraint is binding.
  - Group 2: Borrowing constraint is not binding AND subjective probability of a binding borrowing constraint in the future = 0.
  - Group 3: Borrowing constraint is not binding AND subjective probability of a binding borrowing constraint in the future  $> 0$ .

## Consumption functions

- The log-linearized consumption function of a household in group 2:

$$c_{it} = \frac{1}{\bar{C}_i} (1 - \beta) E_{it} \left[ \sum_{s=t}^{\infty} \beta^{s-t} \tilde{y}_{is} \right] - \frac{1}{\bar{Y}_i} \frac{1}{\gamma} \beta E_{it} \left[ \sum_{s=t}^{\infty} \beta^{s-t} (r_s - \pi_{s+1}) \right] + \frac{1}{\bar{C}_i} (1 - \beta) \frac{1}{\bar{B}_i} E_{it} \left[ \tilde{b}_{i,t-1} \right]$$

- Difference consumption across policies ( $\Delta c_{it} = c_{it}^{PolicyA} - c_{it}^{PolicyB}$ ):

$$\Delta c_{it} = \frac{1}{\bar{C}_i} (1 - \beta) \Delta E_{it} \left[ \sum_{s=t}^{\infty} \beta^{s-t} \tilde{y}_{is} \right] - \frac{1}{\bar{Y}_i} \frac{1}{\gamma} \beta \Delta E_{it} \left[ \sum_{s=t}^{\infty} \beta^{s-t} (r_s - \pi_{s+1}) \right] + \frac{1}{\bar{C}_i} (1 - \beta) \frac{1}{\bar{B}_i} \Delta E_{it} \left[ \tilde{b}_{i,t-1} \right]$$

- Note: Expectation differences across policies are sufficient statistics for consumption differences across policies!

# The survey

- The survey was conducted as an online survey shortly before the FOMC meeting on March 16/17 2021 in collaboration with the panel data provider Luc.id.
- $N = 2,218$ . Respondents are representative of the US population in terms of education, gender, age, region, and household net income.
- Structure of the survey:
  - Demographics, introduction and definitions
  - Baseline scenario
  - Alternative scenario
  - Hand-to-mouth status
  - Perceived probability of becoming credit constrained in the future



# Baseline scenario

## Baseline scenario: Projected federal funds rate stays constant

We now would like to ask you to imagine the following hypothetical scenario.

Please imagine that at the next meeting of the Fed on March 16/17 2021, the Fed announces that the **current** federal funds rate will remain **unchanged at 0.1 percent**.

Moreover, the Fed announces that its projection about the **future** federal funds rate at the **end of 2023** remains **unchanged at 0.1 percent**.

Note: Further, imagine that the Fed's projection of the federal funds rate at the end of 2030 remains **unchanged** at 2.5 percent.

## Your predictions

Imagine that on March 18 2021, i.e. **on the day after the Fed meeting**, you learn about the Fed's announcement. Imagine that we would then ask you about **your own expectations** regarding the federal funds rate, the inflation rate, and your net household income.

- Subsequently elicit expectations of own income, federal funds rate, and inflation.

# Alternative scenario

## Hypothetical scenario: Federal funds rate projection for 2023 increases

We will now ask you to consider the following alternative hypothetical scenario. Please imagine that at their next meeting on March 16/17 2021, the Fed announces that the **current** federal funds rate will remain **unchanged at 0.1 percent**.

However, the Fed announces that its projection about the **future** federal funds rate at the **end of 2023 increases from 0.1 percent to 0.5 percent**.

Note: Further, imagine that the Fed's projection of the federal funds rate at the end of 2030 remains **unchanged** at 2.5 percent.

- We cross-randomize whether the change is endogenous or exogenous or whether no reason was mentioned.
- Subsequently elicit expectations of own income, federal funds rate, and inflation.

## The effect of forward guidance on consumption on impact

- Assumption parameters:  $\beta = 0.99, \gamma = 2$
- Assumption attention: All households hear FG announcement.
- Assumption hand-to-mouth households: Reductions in income occur later.
- Substituting each agent's subjective beliefs into her consumption function and aggregating yields

$$\begin{aligned}\Delta c_t = & \underbrace{0.27}_{\text{Fraction HTM}} \times 0 + \underbrace{0.48}_{\substack{\text{Fraction} \\ \text{non-HTM} \\ 0\% \text{ constr.}}} \times (-0.394) \\ & + \underbrace{0.25}_{\substack{\text{Fraction} \\ \text{non-HTM} \\ > 0\% \text{ constr.}}} \times (-0.021) = -0.194\end{aligned}$$

## The effect of FG on policy rate expectations

	$\Delta$ Expected federal funds rate (percentage points)				
	(1)	(2)	(3)	(4)	(5)
	2021	2022	2023	2026	2030
Mean expectation adjustment	0.049*** (0.012)	0.076*** (0.014)	0.189*** (0.018)	0.032 (0.024)	0.001 (0.027)
SD expectation adjustment	0.45	0.51	0.68	0.87	1.01
Observations	1357	1357	1357	1357	1357

*Notes:* The sample is restricted to non-hand to mouth households. Robust standard errors are in parentheses. \* denotes significance at 10 pct., \*\* at 5 pct., and \*\*\* at 1 pct. level.

⇒ FG affects households' policy rate expectations at different horizons.

# The effect of FG on inflation expectations

	$\Delta$ Expected inflation rate (percentage points)			
	(1) 2021	(2) 2022	(3) 2023	(4) 2024-26
Mean expectation adjustment	-0.250*** (0.024)	-0.184*** (0.028)	-0.044 (0.036)	-0.139*** (0.040)
SD expectation adjustment	0.88	1.03	1.33	1.46
Observations	1357	1357	1357	1357

*Notes:* The sample is restricted to non-hand to mouth households. Robust standard errors are in parentheses. \* denotes significance at 10 pct., \*\* at 5 pct., and \*\*\* at 1 pct. level.

⇒ FG moderately affects households' inflation expectations.

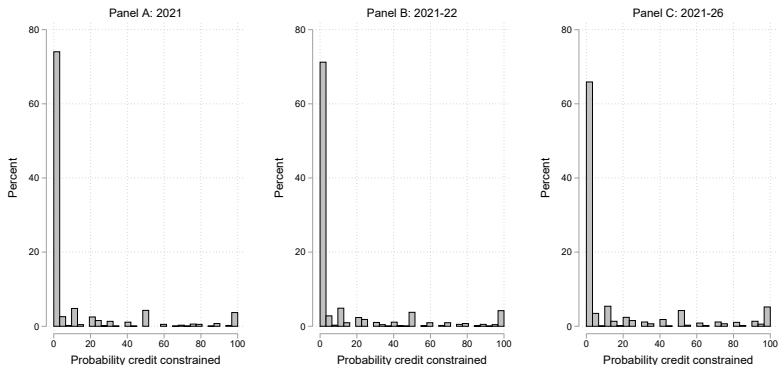
# The effect of FG on nominal income growth expectations

	$\Delta$ Expected cumulative income growth (percentage points)		
	(1) 2021	(2) 2022-23	(3) 2024-26
Mean expectation adjustment	-0.057 (0.163)	0.062 (0.173)	-0.157 (0.198)
SD expectation adjustment	5.99	6.36	7.30
Observations	1357	1357	1357

*Notes:* The sample is restricted to non-hand to mouth households. Robust standard errors are in parentheses. \* denotes significance at 10 pct., \*\* at 5 pct., and \*\*\* at 1 pct. level.

⇒ FG has no effect on own nominal income expectations (at any horizon).

# Subjective probability of being borrowing constrained



*Notes:* The sample is restricted to non-hand-to-mouth households.

## The effect of forward guidance on consumption on impact

- Assumption parameters:  $\beta = 0.99, \gamma = 2$
- Assumption attention: All households hear FG announcement.
- Assumption hand-to-mouth households: Reductions in income occur later.
- Substituting each agent's subjective beliefs into her consumption function and aggregating yields

$$\begin{aligned}\Delta c_t = & \underbrace{0.27}_{\text{Fraction HTM}} \times 0 + \underbrace{0.48}_{\substack{\text{Fraction} \\ \text{non-HTM} \\ 0\% \text{ constr.}}} \times (-0.394) \\ & + \underbrace{0.25}_{\substack{\text{Fraction} \\ \text{non-HTM} \\ > 0\% \text{ constr.}}} \times (-0.021) = -0.194\end{aligned}$$



# Robustness

Robustness of effects on expectations:

- Different reasons for policy change (exogenous, endogenous, no reason).
- Additional provision of information about stock market reaction to the Fed announcement.

Robustness of effects on consumption:

- Different assumed rates at which changes in expectations converge to zero.
- Different assumptions on behavior of those assigning positive probability to being constrained.

# Conclusion

- We study the effects of forward guidance by combining theory with experimentally estimated adjustments of expectations.
- We find that an announcement that the Fed's projection for the federal funds rate at the end of 2023 has increased from 0.1 percent to 0.5 percent has an effect on consumption on impact of about -0.2 percent.

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