# Discussion on Takahashi and Takayama, "Does Unconventional Fiscal Policy Work at the Zero Bound? Evidence from Value-Added Tax Hikes in Japan"

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# This paper

- Showed empirical evidence against the standard NK model's predictions.

- **Model's prediction 1:** Anticipated $\tau^C$ hike raises current output and inflation.
  - ◇ Households expect higher output and inflation. Stimulative at ELB.

- **Model's prediction 2:** Delaying the hike strengthens the stimulative effect.
  - ◇ Forward guidance puzzle

- **Data:** Professional forecasts on inflation and C growth do not rise

# This discussion

- Provides a quick recap of the model's predictions

- Points out that the Euler equation is as important as the NKPC in generating a counter-factual implication.

# On Model's Predictions

# NK model's predictions

- Steady-state (SS) effect:
  - C tax encourages labor supply (leisure-consumption substitution)
    - Real wage increases
    - Upward pressure on inflation
  - Maintain zero inflation
    - Monetary policy tighter and C lower

- Transition effect:
  - Future C relatively more expensive (C tax and higher inflation)
    - C higher before the tax hike
    - Intertemporal substitution

# Domino effect through expectations

- C tax anticipated to rise in $T^*$. Nominal rate fixed.

- In $T^* - 1$,
  - Euler implies $C > 0$   Intertemporal substitution
  - NKPC implies $\pi > 0$   Response to current output

- In $T^* - 2$,
  - Euler implies $C > C(+1)$   Lower real rate $R - \pi(+1)$ & higher $C(+1)$
  - NKPC implies $\pi > \pi(+1)$   Response to current output&expected inflation

- Forward-looking NKPC and IS are key to obtain large effects.

- Forward guidance puzzle

# On the importance of the Euler equation

# The Phillips curve is not the only problem

▶ The paper suggested that "modeling the Phillips curve as backward-looking might be more appropriate."

▶ Forward-looking Phillips curve does play an important role.

◇ For fixed $T^*$, inflation keeps increasing and the real rate keeps falling as $t \downarrow 0$.

▶ However, the NKPC is not the only source of the problem here.

▶ **The Euler part is also problematic.**

# What would happen, in the absence of the price/inflation effects?

$$c_t = c_{t+1} - \frac{1}{\sigma}(R - \pi_{t+1} - \Delta\tau_{t+1}^C)$$

► If inflation is (hypothetically) held fixed (so that $R - \pi = 0$),

  ◇ Consumption boom (level is high) before the tax hike.

  ◇ After the hike, it jumps down to the steady state level.

► I.e. an anticipated tax hike has an immediate positive effect on consumption.

► As $T^* \to \infty$, the positive effect has an everlasting effect.

► Let's understand why.

# Consumption function with log utility

- Household budget constraint:

$$P_t(1 + \tau_t^C)C_t + B_t = P_t(E_t + T_t) + R_{t-1}B_{t-1}$$

- $E_t$: real earnings before transfer in $t$

- Intertemporal BC from $t$ onward:

$$\sum_{i=0}^{\infty} \frac{P_{t+i}(1 + \tau_{t+i}^C)C_{t+i}}{R_t \cdots R_{t+i-1}} = R_{t-1}B_{t-1} + \sum_{i=0}^{\infty} \frac{P_{t+i}(E_{t+i} + T_{t+i})}{R_t \cdots R_{t+i-1}}$$

- Consumption function with log utility:

$$C_t = \frac{1 - \beta}{P_t(1 + \tau_t^C)} \left\{ R_{t-1}B_{t-1} + \sum_{i=0}^{\infty} \frac{P_{t+i}(E_{t+i} + T_{t+i})}{R_t \cdots R_{t+i-1}} \right\}.$$

# RANK consumption function

▶ Substitute the government budget constraint

$$R_{t-1}B_{t-1} = \sum_{i=0}^{\infty} \frac{P_{t+i}}{R_t \cdots R_{t+i-1}}(\tau_{t+i}^C C_{t+i} - T_{t+i})$$

and the resource constraint

$$C_t = Y_t = E_t$$

into RHS of the consumption function to get:

$$C_t = \frac{1-\beta}{P_t(1+\tau_t^C)} \sum_{i=0}^{\infty} \frac{P_{t+i}(1+\tau_{t+i}^C)Y_{t+i}}{R_t \cdots R_{t+i-1}}.$$

▶ Intertemporal Keynesian cross: find $\{C_t, Y_t\}$ with $C_t = Y_t$ for all $t$.

# Wealth and price effects

$$C_t = \frac{1 - \beta}{P_t(1 + \tau_t^C)} \sum_{i=0}^{\infty} \frac{P_{t+i}(1 + \tau_{t+i}^C)\, Y_{t+i}}{R_t \cdots R_{t+i-1}}.$$

- Positive wealth effect: Households expect larger transfers from tax revenue.

- Negative price effect: After the tax hike, goods are effectively more expensive.

# Effect before and after the anticipated tax hike

Without changes in the real interest rates...

▶ **Before the hike, net effect is positive**:

$$C_t = \frac{1-\beta}{P_t} \sum_{i=0}^{\infty} \frac{P_{t+i} Y_{t+i}}{R_t \cdots R_{t+i-1}} \quad \underbrace{\frac{1 + \tau_{t+i}^C}{1 + \tau_{low}^C}}_{\geq 1 \& >1 \text{ for all } t \geq T^*} \quad .$$

▶ **After the hike, net effect is zero**:

$$C_t = \frac{1-\beta}{P_t (1 + \tau_{high}^C)} \sum_{i=0}^{\infty} \frac{P_{t+i} (1 + \tau_{high}^C) Y_{t+i}}{R_t \cdots R_{t+i-1}}.$$

# In the RANK model...

▶ Holding prices&nominal rates fixed, anticipated C tax hike generates C boom.

▶ NKPC merely strengthens the effect through higher inflation&lower real rates.

▶ To resolve the puzzle, one may need to generate a negative wealth effect.

▶ How? Through redistribution?

   ◇ HANK model with tax revenue rebated back to *low* MPC households

▶ Difficulty: revenue must go somewhere. Just not understood?

   ◇ Level-$k$ thinking, Belief disagreement

▶ Interesting to see people's perception about where the C tax revenue is going.