# On the Mechanics of Fiscal Inflations

Marco Bassetto[1] Luca Benzoni[2] Jason Hall[3]

[1]Federal Reserve Bank of Minneapolis

[2]Federal Reserve bank of Chicago

[3]University of Minnesota and Federal Reserve Bank of Minneapolis

# Two Big Themes

- Relationship among:
  - Quantity theory of money
  - Unpleasant monetarist arithmetic
  - Fiscal theory of the price level (FTPL)
- Did financial markets see inflation coming?
  - No.
  - I **really** mean no.

- Identical households
- A fiscal/monetary authority (the "government")
- Household preferences:

$$E_0 \sum_{t=0}^{\infty} \beta^t [u(c_t) + v(x_t) - \ell_t]$$

  - $c_t$: "credit good"
  - $x_t$ "cash good"
  - $\ell_t$: labor supply
- Technology: 1 unit of time $\Longrightarrow$ 1 unit of either good

# Assets

- Private state-contingent $B_{t+1}$ (buy at $t$, redeem at $t+1$)
  - Zero net supply, not traded by the government
- Nominal Long-term government debt $D_t$ (buy at $t$)
  - perpetuity with coupons decaying at rate $\delta$
- Money (used for cash goods)

# Household constraints

- Budget constraint:

$$
\begin{aligned}
&B_t + P_t \ell_t + D_{t-1}(1+\delta Q_t) + M_{t-1} \\
\geq &M_t + P_t(c_t + x_t) + E_t[z_{t+1} B_{t+1}] + D_t Q_t + T_t
\end{aligned}
$$

  - $z_{t+1}$: one-period stochastic discount factor
  - $Q_t$ price of government debt
  - $P_t$: price of goods
- (no-Ponzi, limits debt)
- Cash-in-advance

$$
M_{t-1} \geq P_t x_t
$$

# Government flow budget constraint

$$D_{t-1}^{g}(1+\delta Q_t) + M_{t-1}^{g} = M_t^{g} + D_t^{g} Q_t + T_t - P_t G_t$$

$G_t$: government spending

# Government balance equation

Get it from:

- Household present-value budget constraint
- Optimality (substitute out asset prices)
- Market clearing

$$D_{t-1} E_t \sum_{s=0}^{\infty} \frac{(\beta\delta)^s}{P_{t+s}} + \frac{M_{t-1}}{P_t} = E_t \sum_{s=t}^{\infty} \beta^{s-t} \left[ \frac{T_s}{P_s} - G_s + \frac{M_s}{P_s} \left( 1 - \frac{1}{R_s} \right) \right]$$

# Experiment: steady state + 1-time shock to $G_S$

- Steady state (assume that parameters, policy such that it holds):

$$\frac{\bar{d}}{\bar{\pi} - \beta\delta} + \frac{\bar{m}}{\bar{\pi}} = \frac{1}{1-\beta}\left[\bar{T} - \bar{G} + \bar{m}\left(1 - \frac{1}{\bar{R}}\right)\right]$$
$$\equiv \frac{1}{1-\beta}\left[\bar{T} - \bar{G} + L(\bar{\pi})\right]$$

  $d, m$: real debt

- In period $S$, $G_S = \bar{G} + \hat{G}$, $E_{S-1}\hat{G} = 0$

# Shock to $G_S$+ no response of real taxes

$$\bar{d} P_{S-1} \sum_{s=0}^{\infty} \frac{(\beta\delta)^s}{P_{S+s}} + \bar{m} \frac{P_{S-1}}{P_S} = \frac{1}{1-\beta} \left[ \bar{T} - \bar{G} \right] - \hat{G} + \sum_{s=S}^{\infty} \beta^{s-S} L(\pi_{s+1})$$

Need prices to go up sooner or later

# Example with permanent response of inflation (up/down by factor $\psi^L$)

$$\frac{\bar{d}}{\psi^L \bar{\pi} - \beta\delta} + \frac{\bar{m}}{\psi^L \bar{\pi}} = \frac{1}{1-\beta}\left[\bar{T} - \bar{G} + L(\psi^L \bar{\pi})\right] - \hat{G}$$

- Is this... quantity theory?
  - Yes, nominal balances grow at $\psi^L \bar{\pi}$ after first period

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- Bottom line: they are all at work, emphasize different aspects

# Did the Markets See Inflation Coming?

Hilscher, Raviv, and Reis (2021):

- Use inflation options, data as of end 2017
- Expected inflation over 3 years (under risk-neutral measure): 2.2%
- Probability of annualized inflation over 4% at any point over the next 10 years: 1.7%
- Realized annualized inflation 12/20-12/23: 5.6%

Table: Maturity structure of U.S. government securities as of December 2020

| Maturity | Private Holdings of Public Debt |
|---|---|
| Less than 1 Year | 6,356,589 |
| 1-5 Years | 5,716,708 |
| 5-10 Years | 2,454,885 |
| 10 Years or More | 1,751,078 |
| Inflation Protected | 1,721,420 |

Conservative estimate of redistribution from bondholders: 1.3%-3.2% of GDP

# More Data on Inflation Expectations

- Want to update estimates to 12/2020
- Want richer data by maturity
- Market for options has dried up
- Use statistical model in Ajello, Benzoni, and Chyruk (2020)
  - Predictions under physical measure, not risk-neutral measure
  - Based on both macro data and interest rates across maturity structure

# Inflation Predictions as of Dec 2020

Table: Annualized cumulative inflation at different horizons

| Horizon | Mean Forecast | 95% Forecast | Realized Inflation |
|---|---|---|---|
| 6 months | 1.65% | 3.41% | 8.8% |
| 1 year | 1.57% | 2.85% | 7.0% |
| 1.5 years | 1.54% | 2.6% | 8.97% |
| 2 years | 1.52% | 2.45% | 6.75% |
| 3 years | 1.50% | 2.29% | 5.6% |

Table: Dilution as a percentage of 2020 GDP under different assumptions: Tail forecast

| $\kappa, H_s$ | 1 year | 1.5 years | 2 years |
|---|---|---|---|
| 0.1 | 2.1% | 3.2% | 3.0% |
| 0.3 | 2.4% | 3.2% | 3.1% |
| 0.5 | 2.6% | 3.2% | 3.1% |

- $\kappa$ : fraction of 1-5 yr maturity debt diluted for the entire 3 years
- $H_s$ : period over which the balance of 1-5yr debt is exposed to inflation

Table: Dilution as a percentage of exposed holdings under different assumptions: Tail forecast

| $\kappa, H_s$ | 1 year | 1.5 years | 2 years |
|---|---|---|---|
| 0.1 | 5.6% | 8.4% | 7.9% |
| 0.3 | 6.2% | 8.4% | 8.0% |
| 0.5 | 6.9% | 8.4% | 8.2% |