“A prince, who should enact that a certain proportion of his taxes be paid in a paper money of a certain kind, might thereby give a certain value to this paper money.” (Adam Smith, Wealth of Nations).

Also “Fiscal Histories,” “Expectations and the Neutrality of Interest Rates,” “Inflation Past, Present and Future,” “Fiscal Inflation.”
One Period Fiscal Theory

AM: Redeem $B_0$ for $M$. PM: Pay net taxes $P_1s_1$.

$B_0 + M_0 = P_1s_1 (+M_1)$

Equilibrium: Money has no value to consumer ex post $M_1 = 0$.

We determine the price level. Flexible prices, no money demand, gold, Phillips curve, frictions. Can add frictions, but not necessary.

May feel like “aggregate demand” or $MV = PY$. 
Two-period fiscal theory

\[
\begin{align*}
\frac{B_0}{P_1} &= s_1 \\
B_{-1} &= P_0 s_0 + Q_0 B_0 \\
Q_0 &= \frac{1}{1 + i_0} = \beta E_0 \left( \frac{P_0}{P_1} \right) \\
\frac{B_{-1}}{P_0} &= s_0 + \beta E_0 \left( \frac{1}{P_1} \right) B_0
\end{align*}
\]

- **Present value of surpluses** matters for today’s inflation.
- Governments often borrow \( s_0 < 0 \), repay \( s_1 > 0 \), no inflation.
- *No* strong correlation of debt, deficits, inflation.
- Expectations matter, inflation seems to come from nowhere.
- Discount rates matter (a lot).
- “Money as stock.”
Monetary policy – $B_0$? $i$ target?

Time 1: \( \frac{B_0}{P_1} = s_1. \)

Time 0: \( \frac{B^{-1}}{P_0} = s_0 + \frac{1}{1 + i_0} \frac{B_0}{P_0} = s_0 + \beta E_0 \left( \frac{P_0}{P_1} \right) \frac{B_0}{P_0} = s_0 + \beta E_0(s_1) \)

- More $B_0$ with no change in $s_0$, $s_1$? Raise $P_1$, $i_0$. No change in $P_0$. Share split, currency reform.
- Interest rate target $i_0$? (Holding $\{s_t\}$ fixed). Monetary policy can set a nominal interest rate target, by selling government debt at a fixed rate with no change in surpluses.
- Interest rate target (Fed) sets expected inflation. $i_t = E_t \pi_{t+1}$.
- Fiscal policy sets unexpected inflation.

\[
\frac{B_0}{P_0} (E_1 - E_0) \left( \frac{P_0}{P_1} \right) = (E_1 - E_0)s_1.
\]

- Inflation is stable and determinate under an interest rate target, even a peg! (Contra Friedman 1968, ISLM, Sargent Wallace 1975).
- Inflation is not always and everywhere monetary policy. Nor all fiscal.
- “Fiscal theory of monetary policy.”
To FTMP

Intertemporal

\[
\frac{B_t}{P_{t+1}} = E_{t+1} \sum_{j=0}^{\infty} \beta^j s_{t+1+j}
\]

Linearized model for data, FTMP.

\[
\frac{1}{1 + i_t} = \beta E_t \left( \frac{P_t}{P_{t+1}} \right)
\]

\[
i_t \approx E_t \pi_{t+1}
\]

\[
\frac{B_t}{P_t} (E_{t+1} - E_t) \left( \frac{P_t}{P_{t+1}} \right) = (E_{t+1} - E_t) \sum_{j=0}^{\infty} \beta^j s_{t+1+j}.
\]

\[
\Delta E_{t+1} \pi_{t+1} \approx -\Delta E_{t+1} \sum_{j=0}^{\infty} \rho^j \tilde{s}_{t+1+j}; \quad \tilde{s}_t \equiv \frac{s_t}{B/P}
\]

Interest rate sets expected inflation, fiscal sets unexpected inflation.
Inflation response to fiscal, monetary shocks?

\[ i_t = E_t \pi_{t+1}; \quad \Delta E_{t+1} \pi_{t+1} = -\Delta E_{t+1} \sum_{j=0}^{\infty} \rho^j s_{t+1+j} \]

- Monetary shocks \((i, \text{ no } s)\): Fisherian. Neutral. Stable. \(i_t\) raises \(\pi_{t+1}\).
- Fiscal shocks \((s, \text{ no } i)\): one period inflation (price jump).
- → Long-term debt, sticky prices, discount rates, policy rules.
Ingredients: Long term debt and discount rates

Was
\[ \Delta E_{t+1} \pi_{t+1} = - \sum_{j=0}^{\infty} \rho^j \Delta E_{t+1} \hat{\pi}_{t+1+j} \]

Add long term debt, discount rates. Generalizes to
\[ \sum_{j=0}^{\infty} \omega^j \Delta E_{t+1} \pi_{t+1+j} = - \sum_{j=0}^{\infty} \rho^j \Delta E_{t+1} \hat{\pi}_{t+1+j} + \sum_{j=1}^{\infty} (\rho^j - \omega^j) \Delta E_{t+1} r_{t+1+j} \cdot \]

- Higher discount rate lowers PV, raises inflation. (= Interest cost)
- Fiscal shock \( \rightarrow \) persistent inflation not 1-time jump.
- \( i_t = E_t \pi_{t+1} \) monetary policy can smooth fiscal shocks.
- Higher future \( \pi \) \( \rightarrow \) less current \( \pi \). Higher \( i \) \( \rightarrow \) lower \( \pi \)! 

▶ Higher discount rate lowers PV, raises inflation. (= Interest cost)
▶ Fiscal shock \( \rightarrow \) persistent inflation not 1-time jump.
▶ \( i_t = E_t \pi_{t+1} \) monetary policy can smooth fiscal shocks.
▶ Higher future \( \pi \) \( \rightarrow \) less current \( \pi \). Higher \( i \) \( \rightarrow \) lower \( \pi \)!
Current events: unexpected inflation

- Where did inflation come from?
- The Fed is very slow to react. Still thinks inflation will go away with 2.5% interest rate ("neutral"), no period of interest rate $\gg$ inflation.
- Many economists think we need $i \gg \pi$, e.g. 10% or more to keep inflation from spiraling away.
Current events: fiscal shock!

- 30% of GDP/debt helicopter drop!
- $\Delta E_{t+1} \pi_{t+1} \approx -\Delta E_{t+1} \sum_{j=0}^{\infty} \rho^j \tilde{s}_{t+1+j}$. Future s? Why now?
Towards sticky-price FTMP model

Add: Sticky prices, Long-term debt. (Higher $i$ can lower $\pi$.)

\[
\begin{align*}
\chi_t &= E_t\chi_{t+1} - \sigma(i_t - E_t\pi_{t+1}) \\
\pi_t &= \beta E_t\pi_{t+1} + \kappa \chi_t \\
i_t &= \theta_i\pi_t + \theta_i\chi_t + u_{i,t} \\
\rho v_{t+1} &= v_t + r_{t+1}^n - \pi_{t+1} - \tilde{s}_{t+1} \\
E_t r_{t+1}^n &= i_t \\
r_{t+1}^n &= \omega q_{t+1} - q_t
\end{align*}
\]

Explanation:

\[
\begin{align*}
v_t &= \sum_{j=1}^{\infty} \rho^{j-1}(\tilde{s}_{t+j} - r_{t+j}^n - \pi_{t+j}) \\
q_t &= \sum_{j=1}^{\infty} \omega^j r_{t+j}^n
\end{align*}
\]

hence inflation identity.
Fiscal shock with sticky prices

Response to a deficit shock equal to 1% of outstanding debt; no \( i \) change.

- Persistent inflation. Devaluation from low real rates. (PV all discount rate).
Fiscal shock in continuous time

- No P jump! Fiscal theory of inflation. Inflation eventually goes away.
Monetary shock with sticky prices

Response to a monetary policy shock with no change in \( s \); no policy rule.

- Sticky prices just smooth Fisherian response. Negative short run?
- Long-term debt can produce a negative response. Better model?
- Smooths, not eliminate a fiscal shock. Unpleasant arithmetic.
- In the long run monetary policy completely controls \( P \)
Monetary shock in continuous time

[Graph showing the effects of a monetary shock on nominal rate, inflation, output, and price level over time.]

Nominal rate $i$

Inflation $\pi$

Output $x$

Price level

$\pi, \omega = 0.6$
Price level response in continuous time
Response with policy rule

Response to a 1% deficit shock, with a monetary policy rule. \( i_t = 0.9 \pi_t \).

Old and new Keynesian vs. FTPL

\[
\begin{align*}
\chi_t &= E_t \chi_{t+1} - \sigma (i_t - \pi^e_t) \\
\pi_t &= \pi^e_t + \kappa \chi_t \\
\pi_t &= (1 + \sigma \kappa) \pi^e_t - \sigma \kappa i_t
\end{align*}
\]

Adaptive expectations $\pi^e_t = \pi_{t-1}$:

- Inflation is \textit{unstable} under an interest rate peg (Friedman 1968). Higher $i$ lowers $\pi$.
  \[
  \pi_t = (1 + \sigma \kappa) \pi_{t-1} - \sigma \kappa i_t
  \]

- Current affairs: Inflation will spiral until $i \gg \pi$.
- Taylor rule $i_t = \phi \pi_t$, $\phi > 1$ \textit{Stabilizes} inflation
  \[
  \pi_t = \frac{1 + \sigma \kappa}{1 + \sigma \kappa \phi} \pi_{t-1}
  \]

![Diagram of Inflation vs Interest Rate](image)
Old and new Keynesian vs. FTPL

\[ \pi_t = (1 + \sigma \kappa) \pi_t^e - \sigma \kappa i_t \]

Rational expectations \( \pi_t^e = E_t \pi_{t+1} \):

- Inflation is *stable, indeterminate* (volatile) under an interest rate peg (Sargent and Wallace 1975).
  \[
  E_t \pi_{t+1} = \frac{1}{1 + \sigma \kappa} \pi_t + \frac{\sigma \kappa}{1 + \sigma \kappa} i_t
  \]

- NK \( i_t = \phi \pi_t, \phi > 1 \) Fed de-stabilizes to select (?) one equilibrium
  \[
  E_t \pi_{t+1} = \frac{1 + \sigma \kappa \phi}{1 + \sigma \kappa} \pi_t
  \]

- FTPL \( \pi_{t+1} - E_t \pi_{t+1} = \Delta E_{t+1} \sum_{j=0}^{\infty} \rho^j \tilde{s}_{t+j} \) solves indeterminacy.

![Graph showing interest rate and inflation with NK and FTPL paths]

Stable

Interest rate

NK

FTPL
Facts? Which stylized history do we believe? 70s or long quiet zero bound?

1-1 or more even in 70s, never waited a whole year

No deflation spiral!
The current situation is the mirror image of the zero bond. *Deflation* spiral prediction was wrong.
Closing comments

Bottom line:

▶ Inflation is both fiscal and monetary!
▶ FTPL is the only economically coherent theory of the price level that we have, consistent with current institutions – interest rate targets, no money supply control. Use it!

Fertile research area! Good things to do:

▶ Mix FTPL with the rest of DSGE; including heterogeneity, financial frictions, imperfect expectations. Technically easy. Novel answers!
▶ Better Phillips curve! Better short-run negative effect. (Or is the negative effect there, controlling for fiscal shocks?)
▶ Better monetary/fiscal institutions.
▶ International, exchange rates. (Latin America Book).

Wastes of time:

▶ “Test” fiscal theory. Estimate active-money vs. active fiscal regimes. (Observational equivalence).
▶ Form surplus estimates, discount rate model, predict debt value.