The Fiscal Theory of the Price Level

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“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).
Part I: Central points in a simple two-period model
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 $M_1 = 0$.

\[ \frac{B_0 + M_0}{P_1} = s_1 \]

- 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 $MV = PY$.

- A “backing” theory of money.
Two periods

Changes in $B_0$?

Time 1: \[ \frac{B_0}{P_1} = s_1 \]

Time 0: \[ B_{-1} = P_0 s_0 + Q_0 B_0 \]

Bond price: \[ Q_0 = \frac{1}{1 + i_0} = \beta E_0 \left( \frac{P_0}{P_1} \right) \]

Time 0: \[ \frac{B_{-1}}{P_0} = s_0 + \beta E_0 \left( \frac{1}{P_1} \right) B_0 \]

FTPL: \[ \frac{B_{-1}}{P_0} = s_0 + \beta E_0 (s_1) \]

- Present value of surpluses.
- Future surpluses/deficits matter for today's inflation, not today's. 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 $\Delta s$

- 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).

- “Fiscal theory of monetary policy.”
Fiscal policy

Debt sales $B_0$ that do come with changed surpluses $s_0, s_1$.

$$\frac{B_{-1}}{P_0} = s_0 + Q_0 \frac{B_0}{P_0} = s_0 + \beta E_0 s_1$$

Run a deficit $s_0 < 0$, or reduce surpluses $s_0$?

1. Borrow. Raise $\Delta s_1 = -R \Delta s_0$. No change in $P_0$. Value of debt $Q_0 B_0 / P_0$ rises. Higher $B_0$ with higher $s_1$ is like a share offering, not share split. Raises revenue does not change price.

2. Inflate away debt. No change in $s_1$. $P_0$ rises. Value of debt $Q_0 B_0 / P_0$ unchanged.

3. Big inflation. Lower $s_1$. (AR(1)). $P_0$ rises a lot. Debt $Q_0 B_0 / P_0$ falls.

Reality: Deficits raise the value of debt, and surpluses pay down debt. Inflation is much less volatile than and poorly correlated (US) with surpluses/deficits. Hence borrowing dominates the data. “s-shaped” surplus process (less now, more later), not an AR(1). “Money as bonds.”

Debt and deficits can vary a lot, with no inflation at all, despite full frictionless FTPL.
Fiscal theory of monetary policy

\[
\frac{1}{1 + i_0} = \beta E_0 \left( \frac{P_0}{P_1} \right)
\]

\[
\frac{B_0}{P_1} = s_1; \quad \frac{B_{-1}}{P_0} = s_0 + \beta E_0 (s_1)
\]

Higher \( i \) raises \( \Pi_1, B_0, P_1 \), no effect on \( P_0 \).

\[\text{Overcome } i \text{ raises } \pi? \text{ Contemporary fiscal tightening!}\]

\[\text{Surplus repays debt, at a price level target } P^*.\]

\[
s_1 = \frac{B_0}{P_1^*} \cdot \frac{B_0}{P_1} = s_1. \rightarrow P_1 = P_1^*
\]

\[
\frac{B_{-1}}{P_0} = s_0 + \beta E_0 s_1 = s_0 + \beta E_0 \frac{B_0}{P_1^*}
\]

Higher \( i_0 \) lowers \( P_0 \), no effect on \( P_1 \). (More \( B_0 \), induces higher \( s_1 \).)

\[\text{The effect of monetary policy depends crucially on fiscal policy rule.}\]

\[\text{(Policy: for higher } i \text{ to lower } \pi \text{ there must be a fiscal contraction.)}\]
Active and Passive

- What if
  \[ s_1 = \frac{B_0}{P_1} \]  
  \[ (1) \]

- Then,
  \[ \frac{B_0}{P_1} = s_1 \]

  no longer determines \( P_1 \). Must rule out this “passive” policy.

- \( s \) set in real terms is not unrealistic. Proportional tax gives
  \[ P_t s_t = \tau P_t y_t, \ s_t = \tau y_t \]

- We can still have
  \[ \frac{B_0}{P_1} = s_1(P_1) \]
  just not one-for-one of (1).

- We can still have
  \[ s_1 = \frac{B_0}{P_1^*} \]

  Respond to debt (past deficits), not validate arbitrary inflation.
  Deflation: austerity or stimulus?
Part II: Long-term debt, sticky prices, fiscal and monetary policy rules. Interpreting data, fiscal theory of monetary policy models.
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.
Toward realism

- Monetary shocks \((i, \text{no}\ s)\): Fisherian. \(i\) raises \(\pi\) with one-period lag.
- Fiscal shocks \((s, \text{no}\ i)\): one period inflation (price jump). Mix?
- Long-term debt, sticky prices, discount rates, policy rules.
Ingredients: Long term debt and discount rates

Add long term debt, discount rates. Generalizes to Algebra

\[ \sum_{j=0}^{\infty} \omega^j \Delta E_{t+1} \pi_{t+1+j} = -\sum_{j=0}^{\infty} \rho^j \Delta E_{t+1} \tilde{s}_{t+1+j} + \sum_{j=1}^{\infty} (\rho^j - \omega^j) \Delta E_{t+1} r_{t+1+j}. \]

\[ \frac{\sum_{j=0}^{\infty} Q_t^{(t+j)} B_{t-1}^{(t+j)}}{P_t} = E_t \sum_{j=0}^{\infty} \frac{1}{R_{t,t+j}} s_{t+j}. \]

- Higher discount rate lowers PV, causes inflation. (= Interest cost)
- Fiscal shock → 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 \( \pi \! \)
- For higher \( i \) to lower all \( \pi \) there must be a contemporaneous (present value) fiscal tightening to 1) pay a windfall to bondholders 2) pay interest costs on the debt 3) overcome lost seigniorage. 1 & 2 far outweigh 3, and are large right now.
Primary surplus/GDP inferred from Hall and Sargent value of debt data.

\[ \rho \nu_{t+1} = \nu_t + r_{t+1}^n - \pi_{t+1} - g_{t+1} - s_{t+1}. \]
Little correlation of debt, deficit, inflation. (-?). Deficits raise debt.
Fiscal roots of inflation

Discount rates, not deficits! S-shaped surplus

$$\sum_{j=0}^{\infty} \omega^j \Delta E_1 \pi_{1+j} = - \sum_{j=0}^{\infty} \Delta E_1 \tilde{s}_{1+j} - \sum_{j=0}^{\infty} \Delta E_1 g_{1+j} + \sum_{j=1}^{\infty} (1 - \omega^j) \Delta E_1 \left( r_{1+j}^n - \pi_{1+j} \right)$$
Aggregate demand shock – 2008?

\[ \sum_{j=0}^{\infty} \omega^j \Delta E_1 \pi_{1+j} = - \sum_{j=0}^{\infty} \Delta E_1 \xi_{1+j} - \sum_{j=0}^{\infty} \Delta E_1 g_{1+j} + \sum_{j=1}^{\infty} (1 - \omega^j) \Delta E_1 \left( r_1^\eta_{1+j} - \pi_{1+j} \right) \]

Disinflation in recession comes from discount rates!
Aggregate demand shock – details

Looks like a recession
Surplus process

Need a surplus process that

▶ Allows “s-shaped” MA, but also some unexpected inflation.
▶ Expressible as a VAR(1).
▶ Is still active-fiscal – does not repay all inflation-induced change in the value of debt.

\[
\tilde{s}_{t+1} = \alpha v^*_t + u_{s,t+1} \\
\rho v^*_{t+1} = v^*_t + \Delta E_{t+1} \pi^*_{t+1} - \tilde{s}_{t+1} \\
\rho v_{t+1} = v_t + \Delta E_{t+1} \pi_{t+1} - \tilde{s}_{t+1} \\
u_{s,t+1} = \eta_s u_{s,t} + \varepsilon_{s,t+1} \\
\Delta E_{t+1} \pi^*_{t+1} = -\beta_s \varepsilon_{s,t+1}.
\]

▶ Interpretation 1: s-shaped MA via latent variable in VAR(1).
▶ Interpretation 2: Surplus reacts to changes in debt from past deficits, but not arbitrary values of unexpected inflation. Example: big deflation: Austerity or Stimulus?
A sticky-price FTMP model

\[ x_t = E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1}) \] (2)

\[ \pi_t = \beta E_t \pi_{t+1} + \kappa x_t \] (3)

\[ i_t = \theta_i \pi_t + \theta_i x_t + u_{i,t} \] (4)

\[ \tilde{s}_{t+1} = \theta_s \pi_{t+1} + \theta_s x_{t+1} + \alpha v_t^* + u_{s,t+1} \] (5)

\[ \rho v_{t+1} = v_t^* + r_{t+1}^n - \pi_{t+1}^* - \tilde{s}_{t+1} \] (6)

\[ \rho v_{t+1} = v_t + r_{t+1}^n - \pi_{t+1} - \tilde{s}_{t+1} \] (7)

\[ E_t \pi_{t+1}^* = E_t \pi_{t+1} \] (8)

\[ \Delta E_{t+1} \pi_{t+1}^* = -\beta_s \epsilon_{s,t+1} - \beta_i \epsilon_{i,t+1} \] (9)

\[ E_t r_{t+1}^n = i_t \] (10)

\[ r_{t+1}^n = \omega q_{t+1} - q_t \] (11)

\[ u_{i,t+1} = \eta_i u_{i,t} + \epsilon_{i,t+1} \] (12)

\[ u_{s,t+1} = \eta_s u_{s,t} + \epsilon_{s,t+1} \] (13)

Key: \( s \) responds to deficits, \( r \), but not to arbitrary \( \pi \). Then

\[ \rho(v_{t+1} - v_{t+1}^*) = (v_t - v_t^*) - (\pi_{t+1} - \pi_{t+1}^*) \]

so in equilibrium \( v = v^* \), \( \pi = \pi^* \). FTPL just picks \( \Delta E_{t+1} \pi_{t+1} \)
Deficit shocks without policy rules

\[
\rho = 1, \sigma = 0.5, \kappa = 0.5, \alpha = 0.2, \omega = 0.7, \rho_i = 0.7, \rho_s = 0.4, \theta = 0.
\]
Deficit shocks with policy rules

\[ i_t = 0.80 \pi_t + 0.50 x_t + u_{i,t}; \]
\[ s_{t+1} = 0.25 \pi_{t+1} + 1.0 x_{t+1} + 0.2 v_t^* + u_{s,t+1} \]
Monetary policy shocks without policy rules

\[ \sum_{j=0}^{\infty} \omega^j \Delta E_{t+1} \pi_{t+1+j} = - \sum_{j=0}^{\infty} \rho^j \Delta E_{t+1} s_{t+1+j} + \sum_{j=1}^{\infty} (\rho^j - \omega^j) \Delta E_{t+1} r_{t+1+j}. \]
Monetary policy shocks with policy rules

\[ i_t = 0.80 \pi_t + 0.50 x_t + u_{i,t}; \]
\[ s_{t+1} = 0.25 \pi_{t+1} + 1.0 x_{t+1} + 0.2 v^*_t + u_{s,t+1} \]

Rules smooth shocks! (Even if unwanted!)
Summary so far

- Simple model

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

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

- Added sticky prices, long term debt, \( i \) and \( s \) policy rules, discount rates, s-shaped s process $\rightarrow$ realistic.
NK models and observational equivalence

\[ i_t = E_t \pi_{t+1} \]
\[ i_t = \theta \pi_t^* + \phi (\pi_t - \pi_t^*) + u_{i,t} \quad (= \phi \pi_t + \hat{u}_t) \]
\[ s_{t+1} = \alpha \nu_t^* + \gamma (\nu_t - \nu_t^*) + u_{s,t+1} \]
\[ \rho \nu_{t+1}^* = \nu_t^* - \Delta E_{t+1} \pi_{t+1}^* - s_{t+1} \]
\[ \rho \nu_{t+1} = \nu_t - \Delta E_{t+1} \pi_{t+1} - s_{t+1} \]

- (Equivalent to generalized processes for \( u_{i,t}, u_{s,t}. \))
- AM/PF \( \phi > 1, \gamma > 0. \) AF/PM \( \phi < 1, \gamma = 0. \)
- Either way, \( \pi_t = \pi_t^*, \nu_t = \nu_t^* \) in equilibrium.
- *Time series drawn from AM/PF and AF/PM equilibrium are observationally equivalent.*
- *Parameters \( \phi \) and \( \gamma \) are not identified from equilibrium time series.*
- Identification restrictions \( \theta = \phi, \alpha = \gamma, u \sim \text{AR}(1). \) don’t make sense.
Observational equivalence is good news

AM/PF and AF/PM are observationally equivalent. Same observed \(\{i_t, \pi_t, x_t, \ldots\}\). Don’t see \(\pi \neq \pi^*, \nu \neq \nu^*, \phi, \gamma, \pi \leftrightarrow \bar{s}\) in equilibrium.

Implications

▶ Can instantly translate any NK model to FTMP.
▶ Trivial? No, look at fiscal foundations, ask much different questions.
▶ Testing for regimes, 1970s is PM (AF) and 1980s AM (PF), labeling “fiscal dominance” vs. “monetary dominance” is a dead end.
▶ Can’t reject fiscal theory vs. NK for the whole sample! Agenda!
▶ Can’t reject NK vs. fiscal either. Must tell regimes based on other information not formal tests. AM: \(\phi > 0\)? AF: Is it reasonable that governments largely raise surpluses to repay debts resulting from past deficits, but refuse to raise surpluses in response to any deflation that comes along?
    ▶ Gold standard, currency pegs. 1933.
    ▶ Inflation targets bind on treasury.
    ▶ Why no deflation at the zero bound?
FTPL vs. money

\[
\frac{B_{t-1} + M_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j \left[ s_{t+j} + (i_{t+j} - i^m_{t+j}) \frac{M_{t+j}}{P_{t+j}} \right]
\]

\[
(M_t + M^i_t)V_t(i_t - i^m_t) = P_t Y_t
\]

- AM/PF Fed sets \( M \rightarrow P \), \( s \) must follow.
- AF/PM FTPL sets \( s \). \( i \) policy sets \( B + M \rightarrow P \), \( M \) must follow.
- Observational equivalence! Think...
- Our central banks do not control \( M \). \( V \) is mush.
- FTPL: Inside money \( M^i \) does not matter. \textit{Composition} of \( M \) vs. \( B \) does not matter to first order, esp. as \( i^m \rightarrow i \). Worry about overall quantity of debt vs. ability to repay, not \( M \) vs. \( B \).
- Seigniorage is tiny. (This might change!)
FTPL solves zero bound puzzles

- NK: Big deflation. Gets worse as prices less sticky. Small promises in the far future have big effects.
- FTPL: No big deflation. Smooth frictionless limit. Promises in the far future have small effects.
- Example of analysis that distinguishes theories despite OE.
Takeaway points

\[
\frac{B_{t-1}}{P_t} = E_t \sum_{j=0}^{\infty} \beta^j s_{t+j}
\]

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

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

- FTPL: Short term government debt is numeraire. It is valuable because the government accepts it for tax payments. Net taxes soak up, back, cash.
- Alternatives: New Keynesian, old-Keynesian, MV=PY, OLG? The FTPL is the only coherent, economic model of the price level we have, that is vaguely consistent with current institutions: interest rate targets, fiat money, rampant financial innovation. No point to “test.” How does it work?
- Useful for understanding data/events, thinking of the effects of policies, thinking about better monetary institutions/commitments.
- Much (Much!) more in *The Fiscal Theory of the Price Level* johnhcochrane.com