Monetary and Fiscal Policies: The Nominal Anchor and Seigniorage

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We may (for questions addressed in these notes) think of Classical / Neoclassical models of price-level determination in the long-run (with no nominal rigidity) as theories of how nominal GDP is pinned down.
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Nominal rigidities may link changes in nominal and real GDP in the short run.

But this does not interact in a fundamental way with our discussion of the nominal anchor.
Money Stock as Nominal Anchor

- The simplest modern analogue of the Quantity Theory of Money is a Cash-in-Advance (CIA) model in which households get an endowment ($Y_t$) of a perishable good.

In equilibrium, the price level depends on the current period's money supply and endowment. More general models of money demand (like the CIA model with production, or models with transactions costs) capture the effect of the nominal interest rate on demand for real money balances. According to these models, expected money growth and inflation affect the current price level.
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- According to these models, expected money growth and inflation affect the current price level.
A simple—and, for our purposes, harmless—way to capture the role of expectations is the ad-hoc specification

\[ m_t - p_t = y_t - \eta i_t, \quad \eta > 0, \]

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The left-hand side is the (logarithm of the) real money stock.

Expected inflation \((E_t \pi_t + 1)\) raises the nominal interest rate \(i_t\) via the Fisher equation,

\[ i_t = r_t + E_t \pi_t + 1 , \]

where \(r_t\) is the expected real interest rate; this reduces current demand for real money balances, which raises \(p_t\).
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For simplicity, we focus on a long-run equilibrium in which monetary policy does not affect real variables— so, \( r_t \) is exogenous
Nominal Indeterminacy

- Theoretical research – summarized and cited in Canzoneri, Cumby and Diba [CCD (2010)] – has demonstrated that the price level may not be uniquely determined under money supply targeting (in models that link money demand to the nominal interest rate).

\[ m_t p_t = y_t \eta_i^t \]

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- The prospect of nominal indeterminacy that does play a role in policy-oriented discussions pertains to interest-rate rules:
  - a policy that sets an exogenous path for the nominal interest rate (e.g., pegs the nominal rate) does not pin down the price level;
  - for example, given $i_t$,
    \[ m_t - p_t = y_t - \eta i_t \]
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More generally, the central bank’s feedback rule may also react to variables other than inflation, but the critical value of the reaction to inflation (satisfying the Taylor Principle) is very close to unity in most models.
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There is a general perception in this literature that avoiding nominal indeterminacy should be an important part of the central bank’s mandate.
The Taylor Principle

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For concreteness, suppose the central bank has a zero-inflation target in the long run and sets

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Using the Fisher equation, the dynamics of inflation are governed by

\[ E_t \pi_{t+1} = \phi \pi_t - (r_t - r) \]

which generates explosive dynamics if \( \phi > 1 \)
The Bounded Solution

- Assuming $\phi_{\pi} > 1$, and iterating

$$\pi_t = \phi_{\pi}^{-1} [E_t \pi_{t+1} + r_t - r]$$

forward, we get the unique bounded solution

$$\pi_t = \lim_{n \to +\infty} \phi_{\pi}^{-n} E_t \pi_{t+n} + E_t \sum_{j=0}^{+\infty} \phi_{\pi}^{-j} (r_{t+j} - r) = E_t \sum_{j=0}^{+\infty} \phi_{\pi}^{-j} (r_{t+j} - r)$$
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  - this makes the bounded solution unique
  - the bounded solution is forward looking
  - the effects of shocks in the distant future follow a geometric decay pattern
The dynamic equation for inflation has multiple bounded solutions if
\[ 0 \leq \phi_{\pi} < 1 \]
Departures from the Taylor Principle

- The dynamic equation for inflation has multiple bounded solutions if $0 \leq \phi_\pi < 1$
- An interest-rate rule that does not obey the Taylor Principle does not pin down actual inflation (and the price level)

What does this say about real-world episodes when monetary policy does not seem to satisfy the Taylor Principle?

- Pegged rates in the US before the Fed-Treasury Accord?
- Rates held essentially at zero in the aftermath of the financial crisis?
- Empirical estimates [cited in CCD (2010)] suggesting “passive” interest-rate rules (policies with $0 \leq \phi_\pi < 1$) in the 1960s and 1970s?

One prominent interpretation in the literature [discussed in CCD (2010)] invokes sunspot equilibria to explain such episodes. We will revisit these questions and alternative interpretations.
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Seigniorage

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The basic questions are about which policy is ultimately responsible for satisfying the public sector’s consolidated PVBC.
Another topic we will revisit, using alternative models, has to do with the role of seigniorage in the present-value budget constraint (PVBC) of the public sector. Sargent and Wallace (1981) highlighted a coordination problem between fiscal and monetary policies. The basic questions are about which policy is ultimately responsible for satisfying the public sector’s consolidated PVBC.

- Will the treasury deliver the requisite surpluses, given the path of inflation set by the central bank?
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- Or, will the central bank eventually deliver the seigniorage revenues needed to make up for a shortfall of fiscal surpluses?
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For now, following Sargent and Wallace, we assume that the government issues real (indexed) bonds to finance its deficit; we will see later how the results change in a model with nominal (domestic-currency) bonds.
A Simple Setup

The exposition is easier (and there is not much loss of substance) if we use the CIA model with a constant endowment $y$ and constant government purchases $G$. 

We get the PVBC $b_t = E_t \sum_{j=0}^{\infty} (1 + r)^j \tau_t + j + P_{t+j} + \frac{1}{P_{t+j}} y G$ where $b_t$ is the predetermined stock of real bonds, and $\tau_t + j g$ is the sequence of real tax revenues.
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- We get the PVBC
  \[ b_t = E_t \sum_{j=0}^{\infty} (1 + r)^{-j} \left\{ \tau_{t+j} + \left( \frac{P_{t+j} - P_{t+j-1}}{P_{t+j}} \right) y - G \right\} \]

where $b_t$ is the predetermined stock of real bonds, and $\{\tau_{t+j}\}$ is the sequence of real tax revenues
Satisfying the PVBC

- Defining the inflation rate (just for present purposes) as
  \[ \pi_t = \frac{P_t - P_{t-1}}{P_t}, \]
  the PVBC requires

  \[ b_t = E_t \sum_{j=0}^{\infty} (1 + r)^{-j} S_{t+j} + y E_t \sum_{j=0}^{\infty} (1 + r)^{-j} \pi_{t+j} \]

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  where \( S_t \equiv \tau_t - G \) is the primary surplus exclusive of seigniorage.
- The expected present-value of primary surpluses inclusive of seigniorage must equal the outstanding public debt.
- Sargent and Wallace highlight a policy coordination problem cast as a game over which authority (the treasury or the central bank) is ultimately responsible for satisfying the PVBC.
Suppose an independent central bank is the "leader" in the ensuing game and sets the present value of seigniorage revenues

\[ K_{m,t} \equiv yE_t \sum_{j=0}^{\infty} (1 + r)^{-j} \pi_{t+j} \]
A "Leading" Central Bank

- Suppose an independent central bank is the "leader" in the ensuing game and sets the present value of seigniorage revenues

\[ K_{m,t} \equiv y E_t \sum_{j=0}^{\infty} (1 + r)^{-j} \pi_{t+j} \]

- Then, the fiscal authority has to set the present value of its surpluses,

\[ K_{f,t} \equiv E_t \sum_{j=0}^{\infty} (1 + r)^{-j} S_{t+j} , \]

...to satisfy

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Then, the central bank has no choice and must deliver the present value of seigniorage revenues

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that satisfy the PVBC:

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A Game of Chicken

- There is nothing in this setup to pin down which policy leads and which one follows.
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  - In this case, the central bank can set the path of the money supply, and the CIA constraint determines the path of the price level.
  - But this entails an assumption that fiscal policy will adjust surpluses to satisfy the PVBC.
- Avoiding a solution with fiscal leadership has motivated arguments for fiscal constraints, like the ones in the Stability and Growth Pact.
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Given $K_{m,t} = b_t - K_{f,t}$ and

\[ K_{m,t} \equiv yE_t \sum_{j=0}^{\infty} (1 + r)^{-j} \pi_{t+j} \]

the changes in inflation must satisfy

\[ \Delta \pi_t + (1 + r)^{-T} E_t \Delta \pi_{t+T} = 0 \]
In our simple model implying

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we get

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We will revisit this and other implications of the Monetarist Arithmetic after we discuss the Fiscal Theory of the Price Level.
The Fiscal Theory of the Price Level (FTPL) filled a number of gaps in previous analyses of monetary equilibrium by addressing issues like

- the nominal anchor under passive interest-rate rules (or an interest-rate peg)
- the resolution of Sargent and Wallace's game of chicken
- our interpretation of the public sector's PVBC assumptions about fiscal policy that were left implicit in monetary theory

The FTPL emphasizes the role of nominal public-sector liabilities and their valuation.

Although the theory remains controversial, current concerns about the fiscal outlook have renewed interest in the FTPL.
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In our simple models, the government budget equation,

\[ M_{t+1} + \frac{B_{t+1}}{1 + i_t} = M_t + B_t + P_t (G_t - \tau_t), \]

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Nominal Liabilities

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- It will be convenient to rewrite this in terms of total public-sector liabilities (\( M + B \)):

\[ \frac{M_{t+1} + B_{t+1}}{(1 + i_t)} = M_t + B_t + P_t (G_t - \tau_t) - \frac{i_t M_{t+1}}{1 + i_t}, \] (2)
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- Define the \textbf{predetermined} level of \textbf{nominal} public-sector \textbf{liabilities} as \( L_t = M_t + B_t \)
Again, the exposition is easier (and gives the basic intuition for some results) if we use the CIA model with a constant endowment $y$ and constant government purchases $G$. 

Iterating forward and imposing the household’s transversality condition (which is just an equilibrium condition stating that households satisfy their own PVBC), we get

$$L_t P_t = E_t \infty \sum_{j=0} \left( 1 + r \right)^j S_t + j + it + j + y(3)$$

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- these assumptions imply a constant real interest rate, and we can write (2) as

$$\frac{L_t}{P_t} = \tau_t + \left( \frac{i_t}{1 + i_t} \right) y - G + (1 + r)^{-1} E_t \left( \frac{L_{t+1}}{P_{t+1}} \right)$$
Real Liabilities in Equilibrium

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In our simple CIA model, with constant values of \( y \) and \( r \), (3) relates real public-sector liabilities to the sequences \( \{S_t\} \) and \( \{i_t\} \), which we may specify as policy instruments
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CIA Model

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This also offers a resolution of Sargent and Wallace’s game of chicken: \( P_t \) can adjust to satisfy the PVBC even if \( \{S_t\} \) and \( \{i_t\} \) are both set exogenously.
The FTPL’s formal contribution to Monetary Theory is in clarifying the role of fiscal policy in monetary equilibrium.
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The equilibrium price level $P_t$ in a monetary model must satisfy two conditions: a condition like (3) as well as an equilibrium condition in the market for money, like the CIA constraint

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Which (if any) of the two equations "determines" the price level depends on how we specify the fiscal and monetary policy regime and the rest of the model.
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Which (if any) of the two equations "determines" the price level depends on how we specify the fiscal and monetary policy regime and the rest of the model.

More generally (in other models), the analogue of (3) is one restriction on the equilibrium time paths of several variables.
Woodford (2001) defines a Ricardian policy regime as one in which the fiscal authority adjusts \( \{ S_t \} \) to satisfy the "PVBC" (3) for any path that the other variables (in particular, the price level) may take in equilibrium.
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For example, if a monetary contraction reduces $P_t$ (holding other variables constant for concreteness), a Ricardian fiscal policy increases the primary surplus (at some point in time) to satisfy (3).
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Ricardian Equivalence propositions implicitly presume a Ricardian policy regime as well.
Woodford (2001) discusses equilibrium dynamics under Non-Ricardian (NR) policy regimes.
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For example, in our simple CIA model (with exogenous consumption), we may consider a monetary policy that pegs the nominal interest rate and a fiscal policy that sets an exogenous sequence \( \{S_t\} \).
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- monetary policy still controls expected inflation (through the Fisher equation) but fiscal shocks can lead to inflation volatility.
- since nominal liabilities \( (L_t) \) are predetermined, a fiscal expansion (a decrease in current or expected surpluses) increases the price level.
Non-Ricardian Policy Regimes

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  - monetary policy still controls expected inflation (through the Fisher equation) but fiscal shocks can lead to inflation volatility.
  - since nominal liabilities \( (L_t) \) are predetermined, a fiscal expansion (a decrease in current or expected surpluses) increases the price level.
- More generally, Ricardian Equivalence will not hold if we introduce production in this setup.
Intuition

How does a deficit shock raise the price level in the NR example above?

Consider (3)

\[ L_t P_t = E_t \sum_{j=0}^{\infty} \left( 1 + r \right)^j S_{t+j} + \Delta_{t+j} y \]

and suppose the expected present value of surpluses falls at time \( t \) (say, there is bad news about the political prospects of a future retrenchment) the right-hand side of (3) falls, and the equilibrium condition is not satisfied at the old price level: real liabilities are too high, this means the households' PVBC is not satisfied (using Walras' Law) at the old price level: real assets are too high households increase their expenditures and \( P_t \) rises to its new equilibrium value.
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Coordination in Policy Regimes

- The possibility of NR regimes offers a resolution of Sargent and Wallace’s policy coordination problem (game of chicken): given the surpluses set by the fiscal authority and the transfers from the central bank, $P_t$ can adjust to satisfy (3)

As we saw, the FTPL also offers a potentially interesting answer to how the nominal anchor was set during some historical episodes [e.g., the US in the 1950s or 1970s] with passive monetary policy. But this raises questions about how fiscal and monetary policies may be coordinated so that one (and only one) policy sets the nominal anchor. Was US fiscal policy NR before 1979 and fortuitously change once the Fed switched to an active policy? There is still a policy coordination problem in the model (with potential solutions that we will discuss later).
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What if monetary policy is active (obeys the Taylor Principle or sets the money supply in our simple CIA model) and fiscal policy is NR?

Application: Loyo (1999), cited in CCD (2010), argues that Brazilian monetary policy switched from passive to active in 1980, while fiscal policy was NR before and after the switch as the FTPL would predict, the economy was reasonably stable in the 1970s after the switch to active monetary policy, inflation and interest rates began to grow rapidly.
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