Understanding Monetary-Fiscal Policy Interactions: Part I

Eric M. Leeper

University of Virginia

South African Modelling Network
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Why Policy Interactions?

- In extreme times—Covid-19, financial crisis—bring all your policy guns to the fight
  - MP: near ELB, LSAPs
  - FP: emergency transfers & spending
  - worry about long-run implications later
  - these interactions can be turned on or off—“optional”
- In normal times, interactions don’t disappear
  - basic economic reasoning requires policies to be consistent
  - “consistency” is a long-run notion
  - when policy cannot commit & people forward-looking, can have short-run bite
  - these interactions cannot be turned off—“ubiquitous”
- At a deep level, *monetary & fiscal policies can never be independent*

General Points About Inflation

- Inflation arises when government prints more currency than it eventually absorbs in taxes
  - people try to get rid of currency & buy things
  - pushes up prices & wages
- Government can soak up currency by selling bonds
  - does this when it spends more—handing out currency—than it taxes—soaking up currency
- Nominal bonds—like fiat currency—are promises to pay back more currency in future
- If government doesn't soak up bonds with taxes. . . inflation

General Points About Inflation

- Monetary policy gets its power from fiscal backing
- When fiscal backing is assured, MP operates as taught in textbooks
  - MP can control inflation
  - higher interest rates—open-market sale of bonds—reduce consumption & inflation
- But only if future taxes rise to soak up bonds
  - higher taxes eliminate the wealth effects of higher interest payments on government debt
- Otherwise, higher rates...
  - raise wealth, reduce value of bonds, increase aggregate demand & inflation
- It's all about fiscal backing

Two Kinds of Government Debt

- Distinction between real & nominal debt is critical

1. Real debt: denominated in “goods”
    - arises whenever debt is in units whose quantity the government *cannot* control
        - indexed to inflation; foreign currency; gold
        - in most countries today only small fraction of debt is real
        - indexed debt is like debt under the Gold Standard, where governments did not control the price level
    - a claim to goods in the future
    - government must acquire those goods to honor obligations
    - can acquire goods through taxes or money creation (seigniorage)
    - if it cannot acquire the goods, default only option

Two Kinds of Government Debt

2. Nominal debt: denominated in home currency ("dollars")
    - arises whenever debt is in units whose supply the government *can* control
        - vast majority of government debt is of this kind
    - a claim to "dollars" in the future
    - government need not be able to acquire goods
    - it can print new "dollars" to reduce market value of debt ("dollars" can be new debt instruments—not necessarily currency)
    - default less likely

- This distinction carries important policy implications

Game Plan: Part I

1. Establish what "consistent" policies means intuitively
2. Study policy interactions more formal model, introducing simple policy rules
3. Apply theory to examine two cases
   - How inconsistent policies may undermine inflation targeting
     - Europe's inability to reflate
   - How consistent policies can help achieve macroeconomic goals
     - America's recovery from Great Depression
4. Turn to broader implications

What Are "Consistent" Policies?

- A theoretical example: representative household
  - receive goods, y_t, each period
  - choose consumption, c_t, assets, M_t/P_t & B_t/P_t
  - pay taxes, τ_t
- Maximize discounted expected utility subject to budget constraint

$$c_t + \frac{M_t}{P_t} + \frac{Q_t B_t}{P_t} + \tau_t = y_t + \frac{M_{t-1}}{P_t} + \frac{B_{t-1}}{P_t}$$

or to intertemporal budget constraint

$$\sum_{j=0}^{\infty} E_t q_{t,t+j} \left(c_{t+j} + \frac{\Delta M_{t+j}}{P_{t+j}} \right) = \sum_{j=0}^{\infty} E_t q_{t,t+j} \left(y_{t+j} - \tau_{t+j} \right) + \frac{B_{t-1}}{P_t}$$

What Are "Consistent" Policies?

$$\sum_{j=0}^{\infty} E_t q_{t,t+j} \left(c_{t+j} + \frac{\Delta M_{t+j}}{P_{t+j}} \right) = \sum_{j=0}^{\infty} E_t q_{t,t+j} \left(y_{t+j} - \tau_{t+j} \right) + \frac{B_{t-1}}{P_t}$$

- Define surplus, $s_t \equiv \tau_t - g_t + \Delta M_t / P_t$, clear goods market, $c_t + g_t = y_t$
- Value of initial government bonds—"wealth"—is

$$\frac{B_{t-1}}{P_t} = \sum_{j=0}^{\infty} E_t q_{t,t+j} s_{t+j}$$

- Use this in budget constraint to get demand for bonds

$$B_t^d = P_t \frac{1}{Q_t} \sum_{j=1}^{\infty} E_t q_{t,t+j} s_{t+j}$$

- To go with conventional demand for money

$$M_t^d = P_t L(Q_t, c_t), \quad L_Q \geq 0, L_c > 0$$

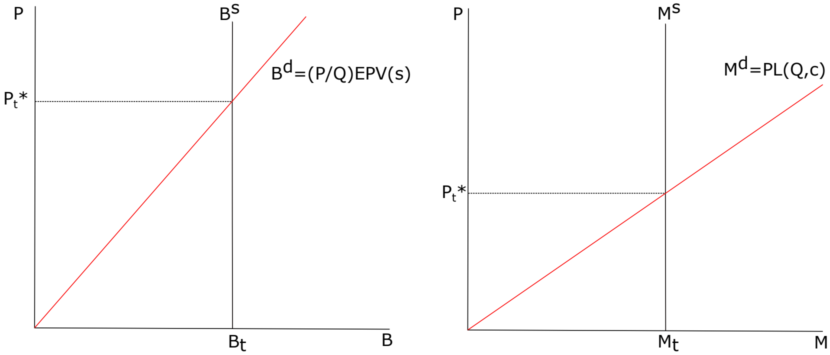
What Are "Consistent" Policies?

$$B_t^d = P_t \frac{1}{Q_t} \sum_{j=1}^{\infty} E_t q_{t,t+j} s_{t+j} = EPV(s)$$

$$M_t^d = P_t L(Q_t, c_t)$$

- *Consistent monetary & fiscal policies* deliver a price level, P_t, that...
    1. Clears both bond, $B_t^d = B_t^s$, and money, $M_t^d = M_t^s$, markets
    2. Ensures real government debt, B_t/P_t, is stable
- Use supply & demand analysis in markets for government liabilities to understand interactions

What Are “Consistent” Policies?



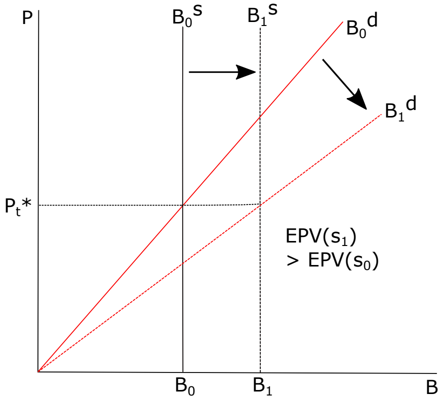
Bond Market

Money Market

- Consistent policies deliver the same equilibrium P_t^* in each market
- If shock to one market changes P, need validating adjustments in the other market

Monetary Models Trivialize Fiscal Policy

- Canonical new Keynesian: no discussion of B^d
  - Walras's law: clear $n-1$ markets, clear n^{th} market
  - Bond market developments irrelevant: Ricardian
  - Bond-financed tax cut $\Rightarrow$ higher future surpluses
  - *Assumes* validating fiscal changes: no wealth effects



A Ricardian experiment

What Are "Consistent" Policies?

- Consistent policies in terms of wealth effects
  - suppose monetary expansion raises P_t
  - bond holdings lose value: B_{t-1}/P_t falls
  - if expected surpluses unchanged: agents reduce demand for goods, offsetting higher P_t
  - if FP refuses to validate higher P_t, MP's desires thwarted
- FP can offset MP's negative wealth effects
  - FP backs MP by reducing expected surpluses
  - if $EPV(s)$ falls *exactly enough*, desired P_t validated
  - demand for bonds falls, demand for goods rises
  - higher equilibrium P validated
- Maintained assumption in canonical NK exercise
  - called "passive fiscal policy"
- Countervailing wealth effects come down to: how much does $EPV(s)$ respond to MP action?

The Model

- Endowment economy at the cashless limit; complete financial markets, one-period nominal debt
- Representative household maximizes

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t U\left(C_t\right) \right\}$$

subject to sequence of flow budget constraints

$$P_t C_t + P_t \tau_t + E_t[Q_{t,t+1} B_t] = P_t Y_t + P_t z_t + B_{t-1}$$

given $B_{-1} > 0$

  - $Q_{t,t+1}$: nominal price at t of an asset that pays \$1 at $t+1$
  - m_{t+1}: real contingent claims price
  - $Q_{t,t+1} = \frac{P_t}{P_{t+1}} m_{t,t+1}$: no-arbitrage condition
  - Nominal interest rate, R_t: $\frac{1}{R_t} = E_t[Q_{t,t+1}]$

The Model

- Can write HH's real intertemporal b.c. as

$$E_t \sum_{j=0}^{\infty} m_{t,t+j} C_{t+j} = \frac{B_{t-1}}{P_t} + E_t \sum_{j=0}^{\infty} m_{t,t+j} (Y_{t+j} - s_{t+j})$$

$s_t \equiv \tau_t - z_t$

- $m_{t,t+j} \equiv \prod_{k=0}^{j} m_{t,t+k}$ is real discount factor, $m_{t,t} = 1$
- HH choices also satisfy the transversality condition

$$\lim_{T\to\infty} E_t \left[m_{t,T} \frac{B_T}{P_T} \right] = 0$$

- It is not optimal for HHs to overaccumulate assets

The Model

- Impose equilibrium, $C_t = Y$, and TVC to get two eqm conditions

$$\frac{1}{R_t} = \beta E_t \frac{P_t}{P_{t+1}} \equiv \beta E_t \frac{1}{\pi_{t+1}} \qquad \text{(Fisher relation)}$$

$$\frac{B_{t-1}}{P_t} = \sum_{j=0}^{\infty} \beta^j E_t s_{t+j} \qquad \text{(Bond valuation)}$$

$s_t \equiv \tau_t - z_t$ (We assume $0 < E_t PV(s) < \infty$)

- Price sequence $\{P_t\}$ must satisfy these to be an eqm (markets clear & HH's optimization problem solved)
- Without additional restrictions from policy behavior, there are many possible eqm $\{P_t\}$ sequences

The Model

- Cashless economy: $1/P_t$ is goods price of nominal bond; $1/R_t$ is dollar price of bond
- Ad hoc policy rules

$$\text{MP:} \quad \frac{1}{R_t} = \frac{1}{R^*} + \alpha\left(\frac{1}{\pi_t} - \frac{1}{\pi^*}\right) + \varepsilon_t^M$$

$$\text{FP:} \quad s_t = s^* + \gamma\left(\frac{1}{R_{t-1}}\frac{B_{t-1}}{P_{t-1}} - \frac{b^*}{R^*}\right) + \varepsilon_t^F$$

- Combine rules with Euler equation & government budget constraint to yield dynamic equations in $\nu_t \equiv 1/\pi_t$ and $b_t \equiv B_t/P_t$

Separate Dynamics?

$$E_t(\nu_{t+1} - \nu^*) = \frac{\alpha}{\beta}(\nu_t - \nu^*) + \frac{1}{\beta}\varepsilon_t^M$$

$$E_t\left(\frac{b_{t+1}}{R_{t+1}} - \frac{b^*}{R^*}\right) = (\beta^{-1} - \gamma)\left(\frac{b_t}{R_t} - \frac{b^*}{R^*}\right) - E_t\varepsilon_{t+1}^F$$

- Appears as if
  - inflation dynamics driven only by MP through $(\alpha, \varepsilon_t^M)$
  - debt dynamics driven only by FP through $(\gamma, \varepsilon_t^F)$
- **Regime M:** $|\alpha/\beta| > 1$ & $|\beta^{-1} - \gamma| < 1$
- **Regime F:** $|\alpha/\beta| < 1$ & $|\beta^{-1} - \gamma| > 1$
- In either regime, *in equilibrium* policies interact to determine inflation & stabilize debt

Two Tasks of Policy

- Monetary & fiscal policy have two tasks: (1) control inflation; (2) stabilize debt
- Two different policy mixes that can accomplish these tasks

Regime M: conventional assignment—MP targets inflation; FP targets real debt (called active MP/passive FP)

Regime F: alternative assignment—MP maintains value of debt; FP controls inflation (called passive MP/active FP)

- **Regime M:** conventional "monetarist/new Keynesian"
- **Regime F:** alternative "fiscal theory"

Regime M

- Bounded solution: only MP shocks cause $\pi_t \neq \pi^*$

$$\nu_t = \nu^* - \frac{1}{\alpha} \sum_{j=0}^{\infty} \left(\frac{\beta}{\alpha} \right)^j E_t \varepsilon_{t+j}^M$$

$$\frac{1}{R_t} = \frac{1}{R^*} - \sum_{j=1}^{\infty} \left(\frac{\beta}{\alpha} \right)^j E_t \varepsilon_{t+j}^M$$

- Equilibrium inflation appears to depend only on monetary policy
  - policy parameter: α
  - policy shock: ε_t^M
- Fiscal policy does not seem to matter
- Delivers Friedman: “inflation is always and everywhere a monetary phenomenon”

Regime M

- What is the fiscal backing for monetary policy?
  - passive FP: $\gamma > \beta^{-1} - 1$ (net real interest rate) covers debt service & retires debt
  - assume $\varepsilon_t^M \sim i.i.d.$ and $\varepsilon_t^M > 0$
  - raises P_t, reduces real value of outstanding bonds, B_{t-1}/P_t, & market value of debt, B_t/R_tP_t
  - if s_{t+j} unchanged, reduced real debt gets passed into lower nominal debt growth
  - eventually, people will realize their wealth has declined and reduce their demand for goods
  - lower demand will reduce price level, counteracting MP
  - if lower real debt is backed by lower s_{t+j}, fiscal policy eliminates the negative wealth effect
  - this fiscal backing permits monetary policy to control inflation in the usual way
  - this is the definition of *passive fiscal policy*

Regime M

- Friedman's adage requires an addendum: "inflation is always and everywhere a monetary phenomenon, so long as FP eliminates wealth effects of policy"
- As Tobin put it: "Ricardian equivalence is fundamental, perhaps indispensable, to monetarism"
- Consider an $i.i.d.$ tax cut: $\varepsilon_t^F < 0$
  - has no effect on inflation or nominal interest rate
  - financed by higher $B_t \Rightarrow$ higher b_t
  - passive FP: higher future $\{s_{t+j}\}$
  - $b_t \rightarrow b^*$
  - delivers neutrality of tax-debt swaps
- Passive FP achieves two things:
  1. Stabilizes real debt
  2. Provides appropriate fiscal backing to MP

Regime M Equilibrium

- Unique *bounded* equilibrium inflation rate
- Stable process for government debt
- But. . . also a continuum of equilibria with

$$\lim_{T\to\infty} \pi_T = \infty$$

- Neither MP nor private behavior rules out equilibria with $\pi_t = \infty$
- This (minor?) anomaly or embarrassment can be resolved only by fiscal policy

Regime M's Explosive Solutions

- Examine perfect foresight; generalize policy rule

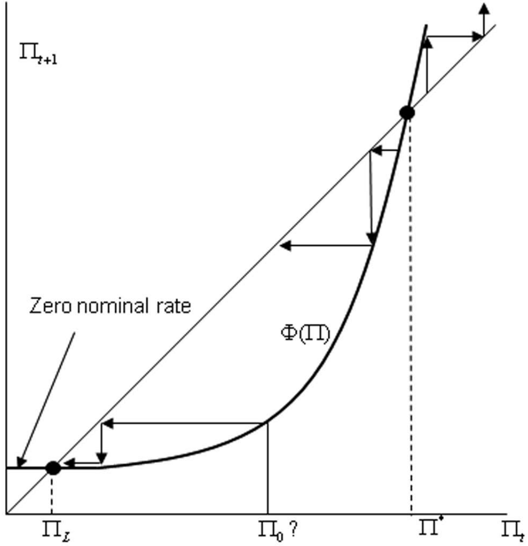
$$R_t = \beta^{-1}\pi_{t+1}$$
$$R_t = \tilde{\Phi}(\pi_t)$$

- Solution satisfies non-linear difference equation

$$\pi_{t+1} = \Phi(\pi_t)$$

- Two steady states: π^* and π_L
- π_L are zero lower bound for nominal interest rate

Regime M's Explosive Solutions



Indeterminacy of steady state and dynamic path

Regime F

- Take case of exogenous surpluses, $\gamma = 0$
- Solve for market value of debt, b_t/R_t, & use GBC

$$P_t = \frac{B_{t-1}}{(1-\beta)^{-1}s^* + \sum_{j=0}^{\infty} \beta^j E_t \varepsilon^F_{t+j}}$$

  - only FP—including B_{t-1}—appears to matter
- Increase in current or expected transfers
  - no offsetting taxes expected, household wealth rises
  - lower expected path of surpluses reduces “cash flows,” lowers value of debt
  - individuals shed debt in favor of consumption, raising aggregate demand
  - higher current & future inflation and economic activity
  - long bonds shift inflation into future
- Demand for debt $\Leftrightarrow$ aggregate demand

Regime F

- How does monetary policy stabilize debt?

$$E_t\left(\frac{b_{t+1}}{R_{t+1}} - \frac{b^*}{R^*}\right) = \frac{1}{\beta}\left(\frac{b_t}{R_t} - \frac{b^*}{R^*}\right)$$

  - debt dynamics: b_t/R_t *expected* to grow at β^{-1}
  - this appears to violate the transversality condition, which implies cannot be an equilibrium
  - MP stabilizes b_t/R_t by preventing interest payments from exploding
  - appears as surprises in P_t that revalue debt
  - MP accomplishes this through its interest-rate policy
- Show this for $i.i.d.\ \varepsilon^F \Rightarrow b_{t+j}/R_{t+j}$ constant

Regime F

- Use expression for ν_t in MP rule

$$\frac{1}{R_t} - \frac{1}{R^*} = \frac{\alpha}{\beta}\left(\frac{\beta(1-\beta)^{-1}s^* + \beta\varepsilon_t^F}{b_{t-1}} - \frac{1}{R^*}\right) + \varepsilon_t^M$$

- Fiscal expansion: $\varepsilon_t^F < 0$
  - MP reduces $1/R_t$ by $(\alpha/b_{t-1})\varepsilon_t^F$ to fight inflation
  - $i.i.d.$ shock $\Rightarrow b_t/R_t = b^*/R^*$
  - at $t+1$, interest rate obeys

$$\frac{1}{R_{t+1}} - \frac{1}{R^*} = \frac{\alpha}{\beta}\left(\frac{1}{R_t} - \frac{1}{R^*}\right)$$

  - if MP were active, $\alpha/\beta > 1$, $1/R_t$ diverges
  - exploding paths due to wealth effects from ever-growing interest payments to bond holders
  - higher wealth $\Rightarrow$ higher $\pi_{t+1} \Rightarrow$ higher R_{t+1} etc.
  - active MP converts stable fiscal inflation into explosive inflation

Regime F

- Monetary policy rule implies

$$\frac{1}{R_t} - \frac{1}{R^*} = \frac{\alpha}{\beta}\left(\frac{\beta(1-\beta)^{-1}s^* + \beta\varepsilon_t^F}{b_{t-1}} - \frac{1}{R^*}\right) + \varepsilon_t^M$$

  - fiscal expansion, $\varepsilon_t^F < 0$, financed with higher B_t
  - if MP pegs $R_t = R^*$, it fixes future inflation by fixing interest payments that fiscal expansion would raise
- MP contraction, $\varepsilon_t^M < 0$, lowers $1/R_t$, raises interest payments
  - FP does not raise surpluses to eliminate this wealth effect
  - if future inflation were *not* to rise, nominal debt would grow
  - raises wealth still more, so eventually inflation must increase
  - these different MP impacts arise from the different “fiscal backing” of MP

What Are “Inconsistent” Policies?

- Inconsistent policies arise whenever MP & FP imply different P_t’s
  - this generally implies no equilibrium exists
- Instead, consider degrees of fiscal validation of MP
  - larger $EPV(s)$ response, larger shift in B^d
- Fiscal backing: fiscal wealth effects counter monetary wealth effects
  1. fully backed (canonical NK exercise)
     - fiscal & monetary wealth effects exactly offset
  2. partially backed
     - smaller fiscal wealth effect offset: negative monetary wealth effects remain
  3. unbacked
     - only negative monetary wealth effects present

Standard New Keynesian Model

- Basic equations

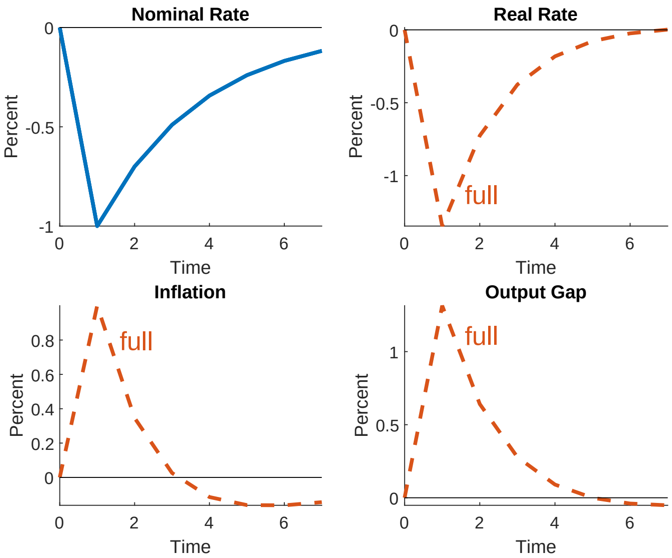
$$x_t = E_t x_{t+1} - \sigma(i_t - E_t \pi_{t+1})$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$$

- Append to this linearized flow budget identity

$$\rho v_{t+1} = v_t + i_t - \pi_{t+1} - s_{t+1}$$

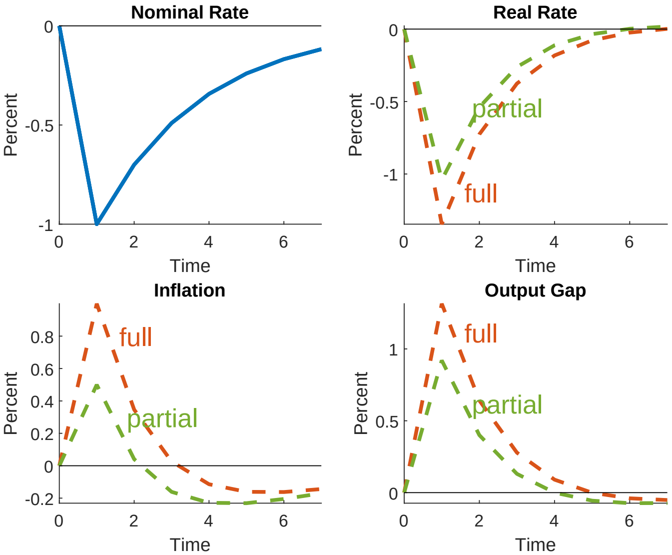
- Ask...
  1. What are impacts of correlated i_t shock and how do they vary with fiscal response?
  2. What are impacts of correlated s_t shock and how do they vary with fiscal response?
- "Fiscal response" refers to how future surpluses back the shock

Monetary Expansion: Full Backing



New Keynesian model

Monetary Expansion: Partial Backing



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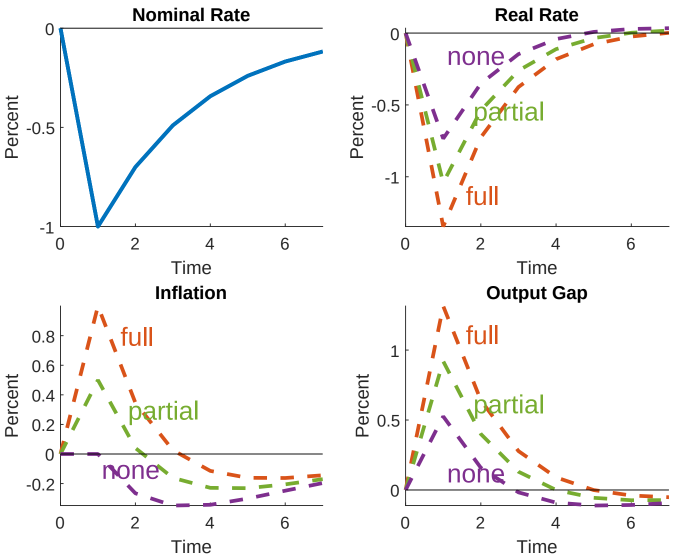

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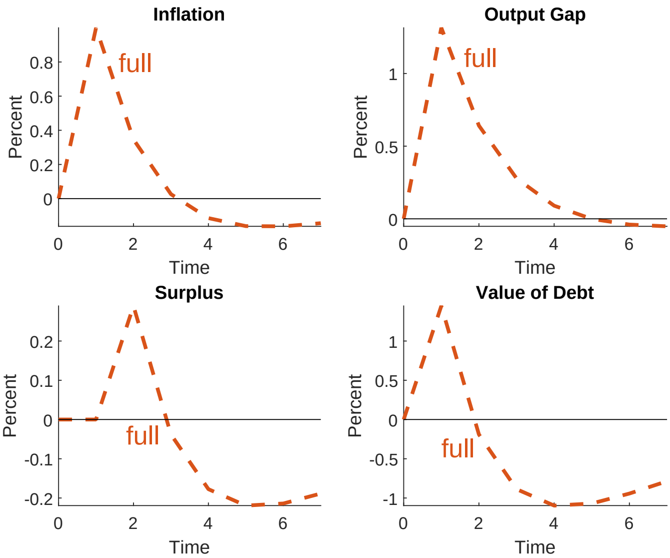

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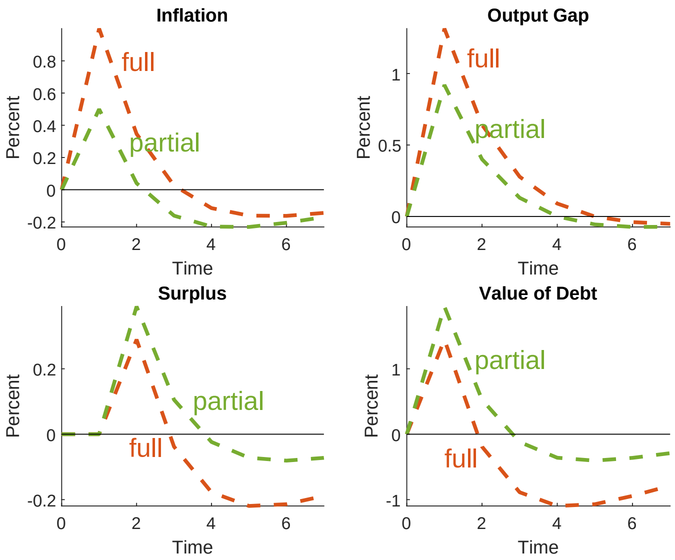

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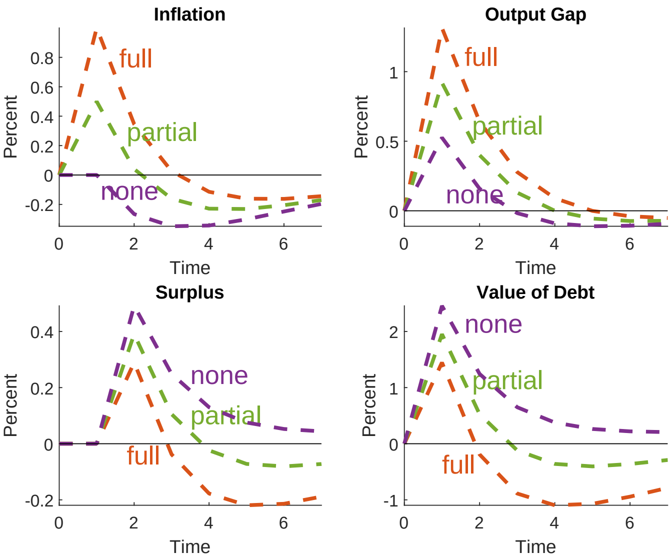
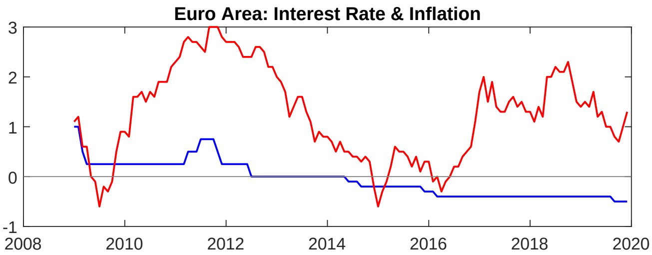


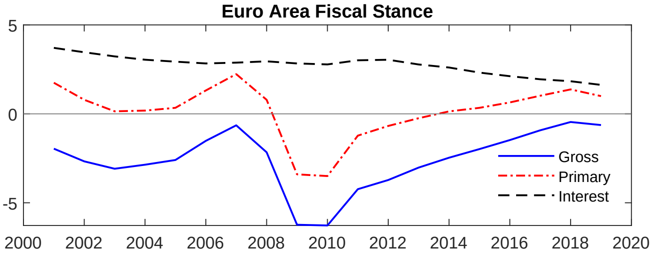
New Keynesian model

Europe Has Backing Problems

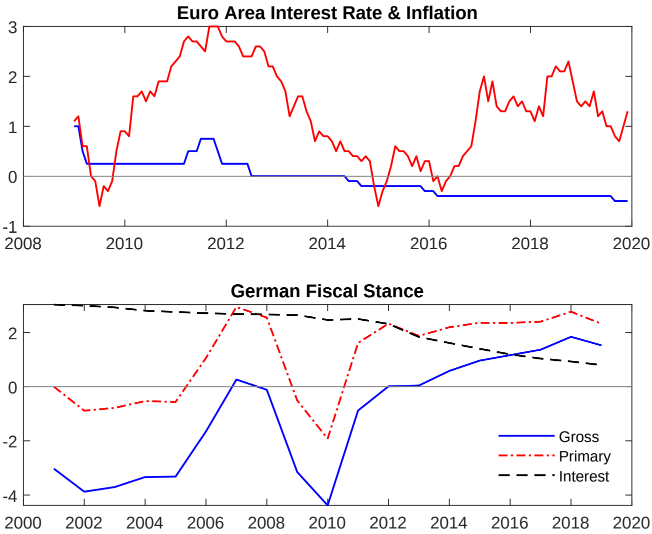
- Before Covid, ECB and other CBs were massively expansionary
  - negative policy interest rates
  - even *negative* long-term nominal bond yields
  - large balance sheet expansions
  - create negative monetary wealth effects
- Inflation remained stubbornly below target
- Why?
  - many possible explanations offered
  - none consider insufficient fiscal backing to offset monetary wealth effects
- Some data

Euro Area: Policies & Inflation

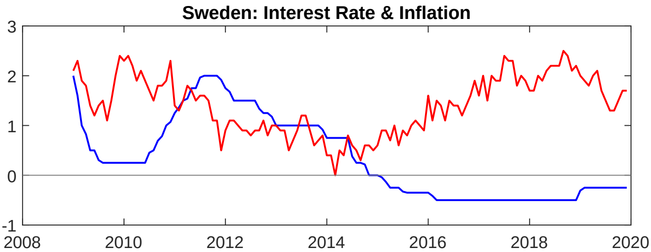


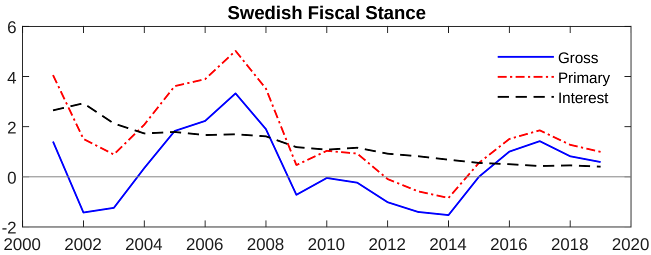


Germany: Policies & Inflation



Sweden: Policies & Inflation

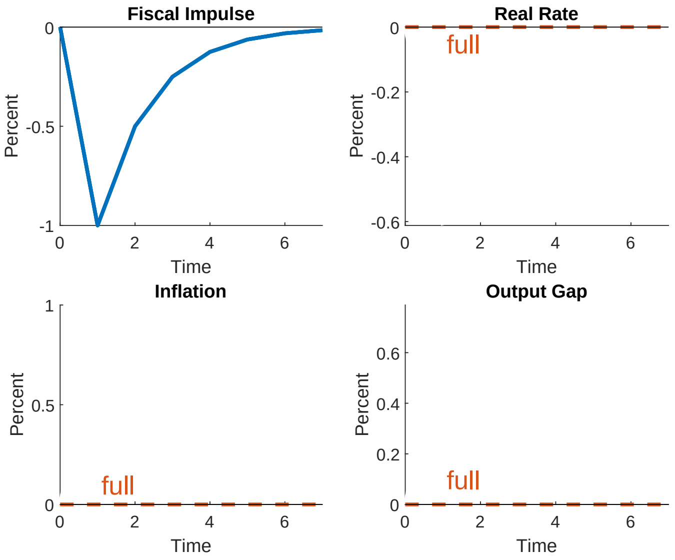




Models & Outcomes

- New Keynesian models’ predictions at odds with data
- Prolonged low—negative!—policy rates generate substantial inflation
- Led to a “search for the missing inflation”
- Won’t find it in the usual monetary policy box
- Try looking at wealth effects

Fiscal Expansion: Full Backing



New Keynesian model

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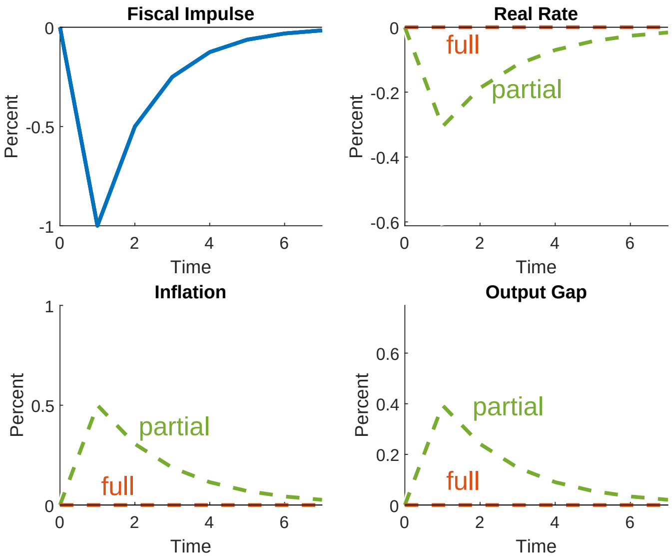

New Keynesian model

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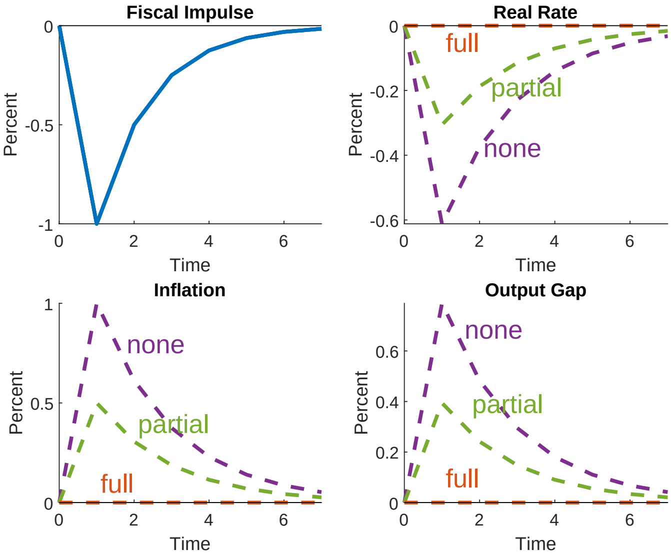

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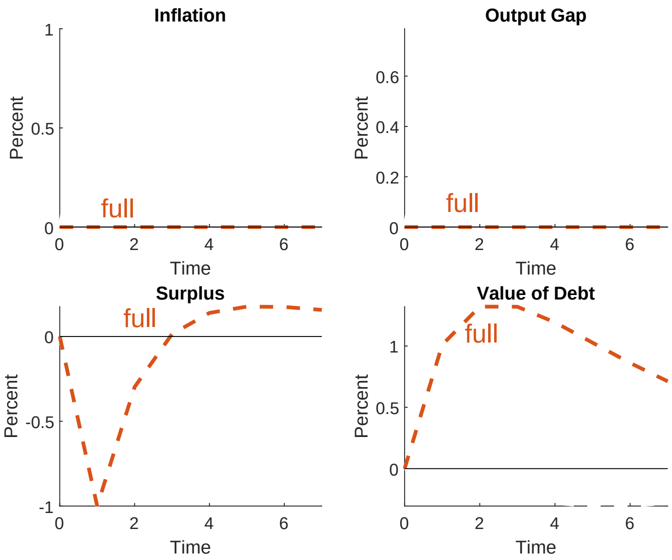

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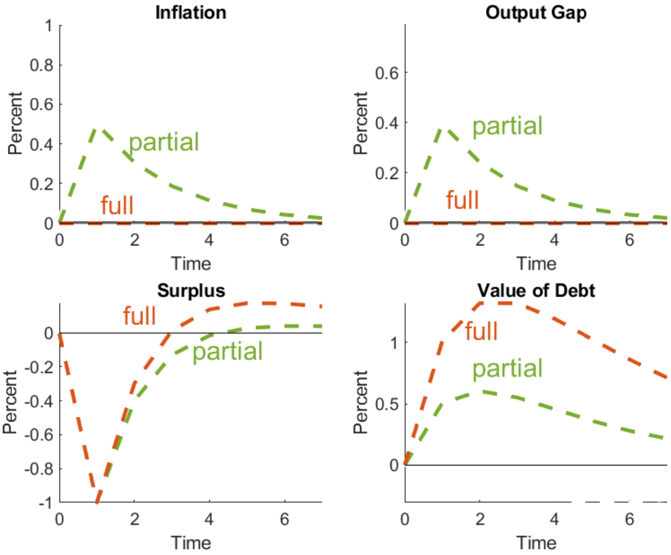

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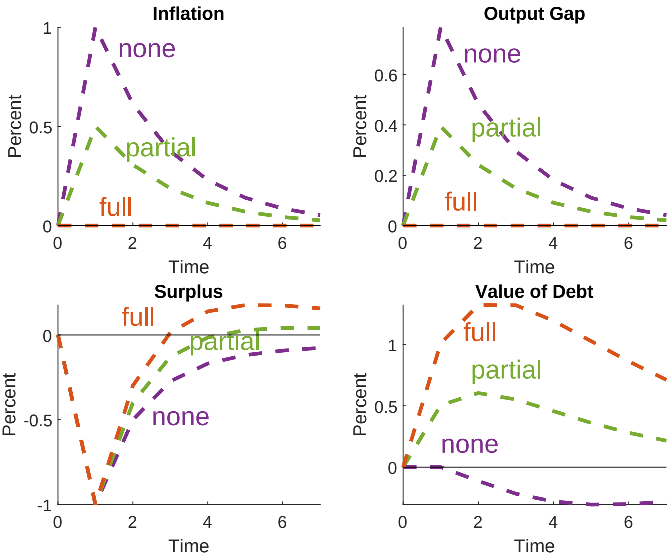


New Keynesian model

Consistent & Effective Policies

- April 1933 Roosevelt launched a successful reflation
- Key aspects of his strategy. . .

1. revoked convertibility of $ to gold
2. made government debt *genuinely nominal*
3. short-term nominal rate at ELB
4. clear objective: reflate economy
5. "emergency" vs. "ordinary" budget
    - emergency spending unbacked by taxes
    - ordinary spending backed, as usual
6. emphasized state-contingent & temporary nature
7. built political consensus for policies
    - described crisis as more severe than World War I
    - established extremely high stakes of success
    - communicated to anchor fiscal expectations

Roosevelt's Fiscal Policy

- Differentiate s_t^o (ordinary) from s_t^e (emergency) budgets
- Financed by B_t^o and B_t^e
- Equilibrium condition

$$\frac{B_{t-1}^o + B_{t-1}^e}{P_t} = s_t^o + s_t^e + q_{t,t+1} E_t PV(s^o + s^e)$$

Ordinary	**Emergency**
$ds_t^o = -q_{t,t+1} dPV(s^o)$	$ds_t^e < 0$ & $d[q_{t,t+1} PV(s^e)] = 0$
fully backed	unbacked
no wealth effect	positive wealth effect

Roosevelt's Fiscal Policy

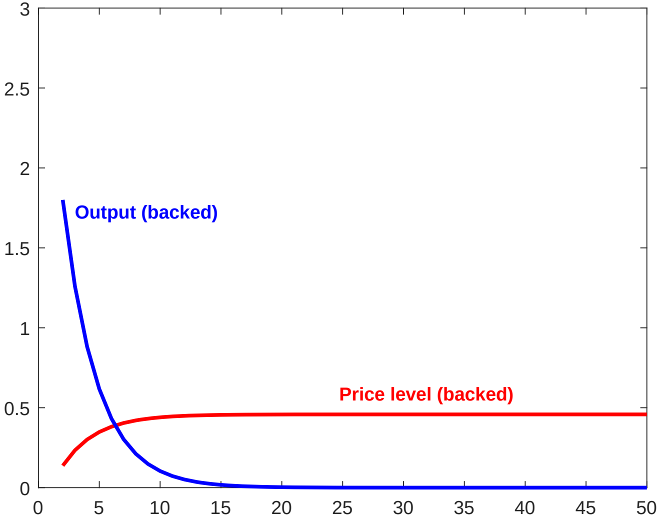
- Differentiate s_t^o (ordinary) from s_t^e (emergency) budgets
- Financed by B_t^o and B_t^e
- Equilibrium condition

$$\frac{B_{t-1}^o + B_{t-1}^e}{P_t} = \cancel{s_t^o} + s_t^e + q_{t,t+1}E_t PV(\cancel{s^o} + s^e)$$

Ordinary	**Emergency**
$ds_t^o = -q_{t,t+1}dPV(s^o)$	$ds_t^e < 0$ & $d[q_{t,t+1}PV(s^e)] = 0$
fully backed	unbacked
no wealth effect	positive wealth effect

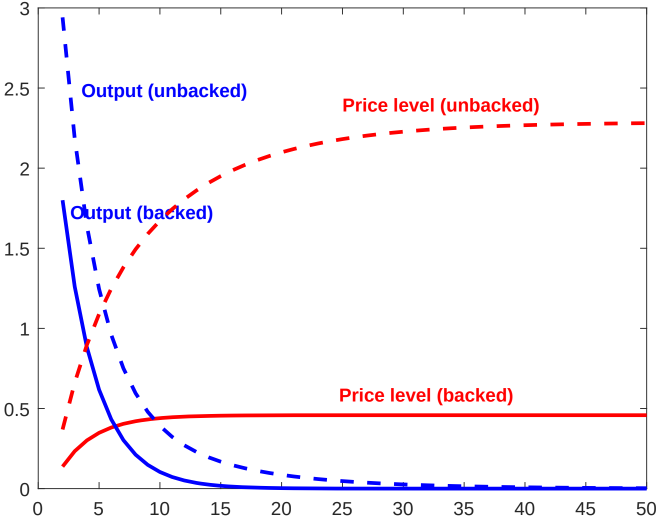
- Additional demand stimulus comes from unbacked emergency spending that raises wealth

Backed vs. Unbacked Fiscal Expansion



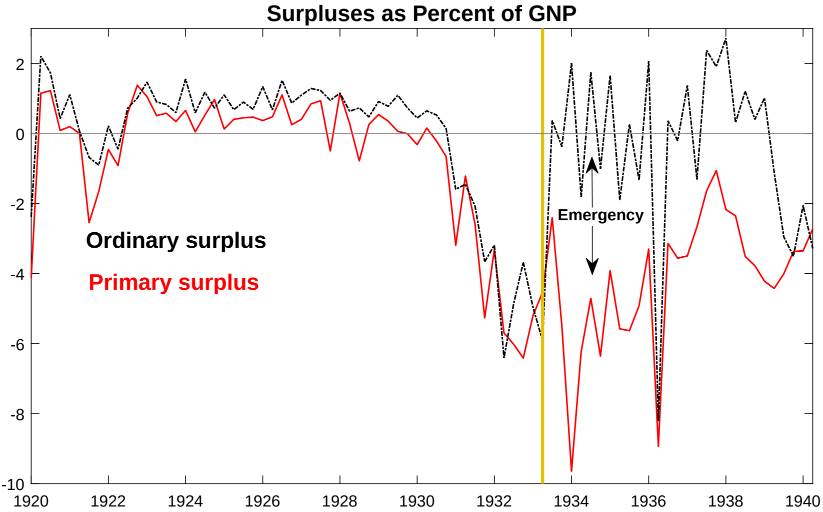
New Keynesian model, serially correlated increase in government purchases

Backed vs. Unbacked Fiscal Expansion



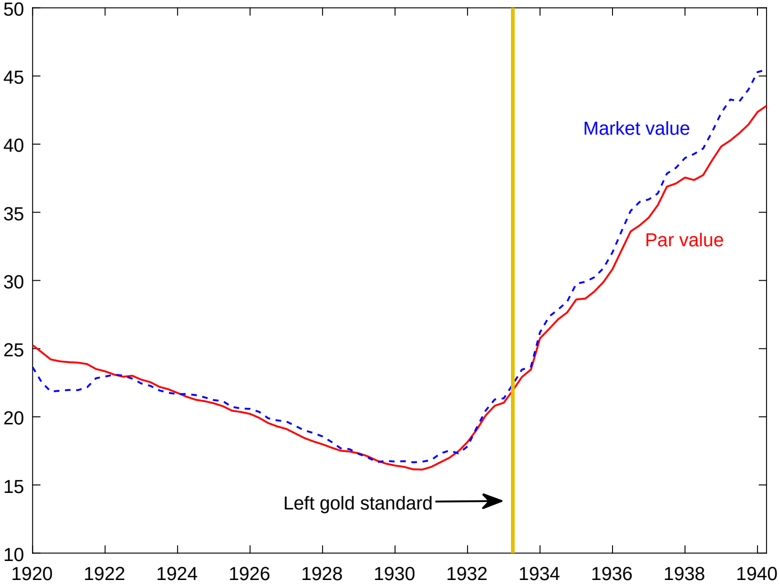
New Keynesian model, serially correlated increase in government purchases

Large “Emergency” Deficits



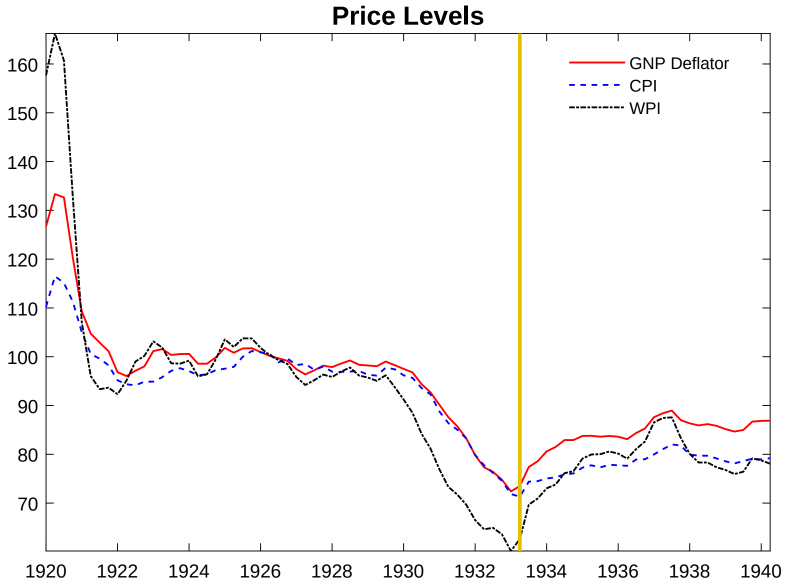
Deficits due to “emergency” spending. Source: Treasury Annual Reports.

Steady Growth in Nominal Debt



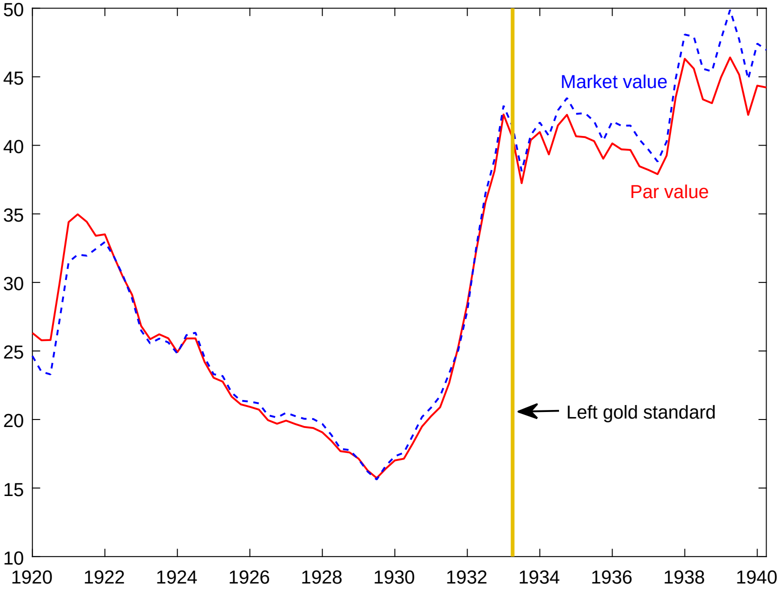
Debt driven by emergency spending. Source: Treasury Annual Reports.

It Worked! Prices Rose



Source: Balke-Gordon, NBER Macrohistory Database, authors' calculations.

Stabilized Debt



Source: Balke-Gordon, Hall-Sargent, authors' calculations.

Some Broader Implications

- Finish by contrasting fiscal theory with unpleasant arithmetic
  - some macroeconomists confuse the two
- Establish importance of maturity structure for inflation dynamics
  - longer-term bonds spread inflation over time

Why Fiscal Theory $\neq$ Unpleasant Arithmetic

- Equilibrium conditions for nominal and real debt

  Nominal: $B_{t-1} = P_t \sum_{j=0}^{\infty} \beta^j E_t \left[\tau_{t+j} - z_{t+j} + \frac{M_{t+j} - M_{t+j-1}}{P_{t+j}} \right]$

  Real: $v_{t-1} = \sum_{j=0}^{\infty} \beta^j E_t \left[\tau_{t+j} - z_{t+j} + \frac{M_{t+j} - M_{t+j-1}}{P_{t+j}} \right]$

- Hypothetical increase in P_t, all else fixed
  - raises *nominal* backing: support more nominal debt with no change in surpluses or seigniorage
  - lowers *real* backing: reduces seigniorage revenues
- Fiscal Theory is *not* about seigniorage: if M/P tiny, higher P_t raises backing of nominal debt but not of real debt
- Unpleasant Arithmetic *is* about seigniorage: growing real debt requires growing seigniorage & inflation

Role of Debt Maturity Structure: I

- Allow one- and two-period zero-coupon nominal bonds: $B_t(t+1), B_t(t+2)$; equilibrium condition is

$$\frac{B_{t-1}(t)}{P_t} + \beta B_{t-1}(t+1) E_t \frac{1}{P_{t+1}} = \sum_{j=0}^{\infty} \beta^j E_t s_{t+j}$$

- MP determines the timing of inflation
  - stabilize expected inflation: forces adjustment in P_t
  - lean against current inflation: forces adjustment in $E_t(1/P_{t+1})$
  - tradeoff depends on maturity structure, $B_{t-1}(t+1)/B_{t-1}(t)$
  - shorter average maturity $\Rightarrow$ need larger $\Delta E_t(1/P_{t+1})$ to compensate for given $\Delta(1/P_t)$
- Message: MP not impotent, but it cannot control both actual & expected inflation

Role of Debt Maturity Structure: II

- Allow a consol: perpetuity that pays $1 each period
- Government budget constraint

$$\frac{Q_t B_t}{P_t} + s_t = \frac{(1+Q_t)B_{t-1}}{P_t}$$

- Asset-pricing relation, in equilibrium

$$Q_t = \beta E_t \frac{P_t}{P_{t+1}}(1+Q_{t+1}) = \sum_{j=1}^{\infty} \beta^j E_t \frac{P_t}{P_{t+j}}$$

- Central bank controls R_t: $1/R_t = P_{St} = \beta E_t(P_t/P_{t+1})$
- Intertemporal equilibrium condition

$$\frac{(1+Q_t)B_{t-1}}{P_t} = \sum_{j=0}^{\infty} \beta^j E_t s_{t+j}$$

- FP determines the *present value* of inflation; MP determines the *timing* of inflation

Role of Debt Maturity Structure: II

$$Q_t = E_t \sum_{j=0}^{\infty} \left(\frac{1}{\prod_{i=0}^{j} R_{t+i}} \right) = E_t \sum_{j=1}^{\infty} \beta^j \left(\frac{1}{\prod_{i=1}^{j} \pi_{t+i}} \right)$$

$$\frac{(1+Q_t)B_{t-1}}{P_t} = \sum_{j=0}^{\infty} \beta^j E_t s_{t+j}$$

- Any path of $\{P_t\}$ consistent with these conditions is an equilibrium
- By choosing a (constrained) path for $\{R_t\}$, MP determines when inflation occurs
- Consider two pegged paths for R_t—$\dagger$ & $*$—with $R^\dagger > R^* \Rightarrow Q^\dagger < Q^*$
  - $\pi_t^\dagger < \pi_t^*$ but *future* $\pi^\dagger >$ *future* π^*
  - a higher nominal rate lowers *current* inflation, but raises *future* inflation

Role of Debt Maturity Structure: III

- Zero-coupon bonds
- Write government's flow constraint as

$$B_{t-1}(t) - \sum_{j=1}^{\infty} Q_t(t+j)[B_t(t+j) - B_{t-1}(t+j)] = P_t s_t$$

- Impose equilibrium on asset-pricing relation

$$Q_t(t+j) = \beta^j E_t \frac{P_t}{P_{t+j}}$$

- Combine these

$$\frac{B_{t-1}(t)}{P_t} - \sum_{j=1}^{\infty} \beta^j E_t \frac{1}{P_{t+j}} [B_t(t+j) - B_{t-1}(t+j)] = s_t$$

Role of Debt Maturity Structure: III

$$\frac{B_{t-1}(t)}{P_t} - \sum_{j=1}^{\infty} \beta^j E_t \frac{1}{P_{t+j}} [B_t(t+j) - B_{t-1}(t+j)] = s_t$$

- Suppose govt neither issues new debt nor repurchases outstanding debt, so $B_{t-1}(t+j) = B_t(t+j) = B_{t-1}(t), j > 0$

$$P_t = \frac{B_{t-1}(t)}{s_t}$$

- Future deficits don't matter (constant debt $\Rightarrow$ no link between value of debt today & future surpluses)
- Inflation occurs only when surplus realized
- Bond prices reflect $E_t s_{t+j}$ which changes $E_t(1/P_{t+j})$

$$Q_t(t+j) = \beta^j E_t \frac{P_t}{P_{t+j}}$$

Take Aways

- In a world where FP cannot be relied on to adjust surpluses as needed to stabilize debt. . .
  1. it is impossible for MP to stabilize the economy
  2. fiscal disturbances will always affect output, inflation & interest rates
  3. more aggressive MP will exacerbate the instability
  4. fluctuations in “confidence” that affect real interest rates will transmit into fluctuations in output & inflation
  5. sudden flights to quality or away from junk can have real effects
  6. tighter MP raises debt service, wealth, aggregate demand, and inflation

Take Aways

1. Conventional perceptions of inflation miss a channel for fiscal inflation
   - channel may be important in times of fiscal stress
2. Perception that MP can always stop an inflation that breaks out *assumes* the necessary fiscal backing will always be forthcoming
   - when fiscal limit possible, the assumption breaks down
3. If inflation has fiscal roots, MP cannot offset it
4. Two policy options:
   i. impose enforceable rules on fiscal behavior
   ii. give different mandates to central banks