Understanding Policy in the Great Recession: 
Some Unpleasant Fiscal Arithmetic

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Fiscal + monetary policy analysis

- Two conditions in all monetary models.

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{\Lambda_{t+\tau}}{\Lambda_t} \left[ T_{t+\tau} - G_{t+\tau} \left( +i_{t+\tau} \frac{M_{t+\tau}}{P_{t+\tau}} \right) \right] d\tau
\]
\[
M_t V(\cdot_t) = P_t Y_t
\]

- Simpler,

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t\to t+\tau}} s_{t+\tau} d\tau
\]

- Mechanism: Low \( s_{t+\tau} \), will inflate \( \to \) sell \( M, B \) now \( \to \) inflation now. “Aggregate demand.” (Rolling over is the warning)

- Now: monetary policy in an era of fiscal constraints.

- Note: \( s \) is endogenous! No “test”
What surpluses??

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{\Delta_{t+\tau}}{\Delta_t} s_{t+\tau} d\tau
\]
Fiscal review – classic doctrines

\[ \frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{\Lambda_{t+\tau}}{\Lambda_t} s_{t+\tau} d\tau \]

- M vs. B has (almost) no effect.
- Inside money does not matter.
- Determinate \( P \) with \( i = \text{constant} \), passive \( M \), “real bills.”
- \( M_t = 0 \) works too!
- Future deficits, money can cause inflation now. “Flight from dollar" inflation that the Fed cannot control.
- Real (foreign) debt is debt – must default.
- Nominal debt is equity, “Stock in government.” Other forms for Greece?
2008-2009 – Money?

- Why did GDP fall so much?
- $MV(\cdot) = PY$, $V(\cdot)$ falls, no accommodation? I don’t think so…
2008-2009 – Money?

Money stock
Balance sheet

Federal Reserve Assets

Federal Reserve Liabilities
Money and Debt

- Money Demand / Monetary policy: More money, less bonds.
- In fact, a huge demand for and supply of both $M$, $B$. “Flight to quality.”

1. All Government rates decline, large liquidity spread, Dollar rises. (next)
2. The *distinction* between $M$, $B$ is meaningless. (especially at $i = 0$) Banks, financial institutions *wanted more of both.*
3. “Special?” Demand for “liquidity,” “transparency” “collateral” “no credit risk,” *not* “transactions services”
Interest rates. Moody’s BAA and AAA; 10 year Treasury constant maturity and 3 month Treasury bill; 3 month nonfinancial and financial commercial paper
Model flight to quality / less AD?

- $R$ decreased. “Liquidity” “special” demand for all US government debt = less “AD.”

$$
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}} s_{t+\tau}
$$

- Distinguish $R$ relative to private (2008), vs all $R$ lower (2010)
- + Choose your favorite non-neutrality $\rightarrow$ lower $Y$ as well as lower $P$.
- US “Reserve debt,” makes more sense than “reserve currency.”
- Understand “aggregate demand” fluctuations as demand for US debt, unrelated to $E_t s_{t+j}$?
M and B Accommodation

More of both $M$, $B$.

1. “Open market debt operations” (“Treasury” in next graph)
2. More of both” raises “AD” by lowering the liquidity premium.

\[
D_t = \text{Private debt owned by the Government}
\]

\[
\frac{M_t + B_t - D_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}(M + B)} s_{t+\tau} d\tau
\]

4. Government guarantees change private to public debt.
5. Massive $B$ issue even if accompanied by more $s$.
6. Friedman/Schwartz advice applied to debt
7. Fed: segmented markets, interest rates, “demand” via frictions
Inflation vs. deflation worries
Long rates, TIPS, inflation and expected inflation
Fiscal/Monetary stimulus/fighting deflation?

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}} s_{t+\tau} d\tau.
\]

\[
M_t V_t(i_t, \cdot) = P_t Y_t
\]

Tools?

1. Rates? = 0
2. Quantitative Easing I – short bonds. V adapts
5. Announcements: Desperation? (Higher $E\pi =$ extreme desperation!)
Announcements
Fiscal / Monetary stimulus

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}} s_{t+\tau} d\tau.
\]

\[M_t V_t(i_t, \cdot) = P_t Y_t\]

- Helicopters? A *fiscal* operation, a brilliant way to communicate its intentions.

- You can’t *inflate* (especially at \(i = 0\)) without (lack of) fiscal backing, changing long term inflation expectations (Japan?)

- Fiscal-monetary stimulus is really hard to do.
  1. Bond sales are *set up* to convey \(E_t s_{t+\tau}\), raise revenue.
  2. Contrast with a currency reform – \(E_t s_{t+\tau}\) is the only difference!

- Commodity standard / CPI futures or TIPS spread?
Inflation and fiscal limits?

\[
\frac{\text{Money} + \text{Gov't Debt}}{\text{Price level}} = \text{Expected discounted surpluses}
\]

Federal Debt Held by the Public Under CBO’s Long-Term Budget Scenarios
Real primary surplus / GDP again
Inflation and the fiscal limit

When and how will debt lead to inflation?

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}} s_{t+\tau} d\tau.
\]

Fiscal limit novelties

1. Debt/GDP is no guarantee
2. "The Government will monetize debt, and then we'll get inflation." P does not wait for seigniorage (all)
3. R can change too!
4. Flight happens quickly, unpredictably, without warning signs for the Fed. (Rollover, "speculators?")
5. Credit guarantees and the dynamic Laffer limit...
Credit guarantees and nominal commitments

- **Credit guarantees + looming bailouts mean**
  1. Defaults/state bailouts may give big shocks to $s$ (sovereign?)
  2. Guarantees, pensions, etc are “nominal debt”
  3. Temptation to inflate is larger

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau = t}^{\infty} \frac{\Lambda_{\tau}}{\Lambda_t} s_\tau(P_\tau); \quad s'(P) > 0
\]

4. Size of inflation is smaller.

- **Note.** US debt is “small”. Even $P = \infty$ is not enough!
Dynamic Laffer curve

1. Static Laffer curve

\[
\frac{\partial \log (\tau Y)}{\partial \log \tau} = 1 + \frac{\partial \log Y}{\partial \log \tau} < 1 \quad (< 0?)
\]

If \( \tau = 0.30 \) to \( \tau = 0.35 \) lowers \( Y \) by 15%, at the limit.

2. Dynamic – if taxes lower growth it’s much worse –

\[
PV = \int e^{-r\tau} (\tau Y_0 e^{gt}) \, dt = \frac{\tau Y_0}{r - g}
\]

\[
\frac{\partial \log PV}{\partial \log \tau} = 1 + \frac{\partial \log Y_0}{\partial \log \tau} + \frac{1}{(r - g)} \frac{\partial g}{\partial \log \tau}
\]

\( r - g = 0.02 \); if \( \tau = 30\% \) to \( \tau = 35\% \) lowers growth by 0.3%, we’re at the limit.

\[
\log(0.35/0.30) = 0.15; \quad 0.02 \times 0.15 = 0.003
\]

\( \Rightarrow \text{Slow Growth is the big danger} \)
What will fiscal inflation look like?

- Long term debt affects dynamics a lot – no price level jump. Bond prices
- Government (Fed) can affect the timing of inflation with bond sales.
- Selling more of outstanding long term debt devalues that debt as a claim to eventual surpluses, postpones inflation. And vice versa (QEII 2008/2010).
- Outstanding debt gives the “budget constraint” for inflation tradeoffs.

\[
\int_{j=0}^{\infty} \frac{Q_t^{(j)} B_t^{(j)}}{P_t} dj = \int_{j=0}^{\infty} E_t \left( \frac{1}{P_{t+j}} \right) e^{-rj} B_t^{(j)} dj = E_t \int_{\tau=0}^{\infty} e^{-r\tau} s_{t+\tau} d\tau
\]
Inflation scenario with long-term debt

What if

$$\Delta S_t \equiv (E_t - E_{t-\Delta}) \int_{\tau=0}^{\infty} e^{-r_\tau} s_{t+\tau} d\tau.$$

Price level jump?

$$\frac{B_t}{P_t} (E_t - E_{t-\Delta}) \left( \frac{1}{P_t} \right) = \Delta S_t$$

Paths with delayed inflation, obey

$$\int_{j=0}^{\infty} dj \; e^{-r_j} B_t^{(j)} (E_t - E_{t-\Delta}) \left( \frac{1}{P_{t+j}} \right) = \Delta S_t$$

Use US Federal debt, 10% S shock,.....
Possible reactions to a 10% PV shock in 2009 ("Fiscal Arithmetic")
Interest rates and inflation respond to 10% PV shock
Will fiscal inflation “stimulate,” or “stagflate?”

- Many: “a little inflation would be a good thing” (Phillips boom, cancel nominal debts.)
- Many more: (FOMC) Don’t worry, "slack"

> “With substantial resource slack continuing to restrain cost pressures and longer-term inflation expectations stable, inflation is likely to be subdued for some time.

- Recall, stagflation is possible! – Phillips curves shift!
CPI inflation and unemployment, 1966-1984
CPI inflation and unemployment, 1984-2009
Will fiscal inflation “stimulate,” or “stagflate?”

- Inflation does not always come with a boom!
  1. 70s.

- Fiscal inflation = “loss of anchoring”? “Expectations” “Phillips shift?”
\[ \pi_t = \beta E_t \pi_{t+1} + \gamma y_t; \quad y_t = E_t y_{t+1} - \sigma r_t; \quad i_t = r_t + E_t \pi_{t+1} \]
The End

- The end
\[ JC \quad \frac{B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{\Lambda_{t+\tau}}{\Lambda_t} \left( T_{t+\tau} - G_{t+\tau} + \frac{dM_{t+\tau}}{P_{t+\tau}} \right) d\tau, \]

\[ SW \quad b_t = E_t \int_{\tau=0}^{\infty} \frac{\Lambda_{t+\tau}}{\Lambda_t} \left( T_{t+\tau} - G_{t+\tau} + \frac{dM_{t+\tau}}{P_{t+\tau}} \right) d\tau, \]

- **SW**: \( T < G \) means \( dM/P \) at some point, and \( MV(dP/dt) = PY \) can mean \( P_t \) (real debt).
- **JC**: \( T < G \) can mean \( P_t \) rise even with no \( M \).
Fiscal stimulus

\[ \frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}} s_{t+\tau} d\tau \]

- Can “fiscal policy stimulate aggregate demand?” (Past $R$)
  1. If expected future $s_{t+\tau}$ rises with higher $B_t$, lower $s_t$, no.
  2. If expected future $s_{\tau}$ does not rise, yes.
  3. It’s ok to have “non-Ricardian” expectations for nominal debt.
  4. It does not matter that “spending will come too late.”

- Be careful when you read history / estimate multipliers.
- Explains long term debt projections in 2008? “spend it now or else?”
- Of course frictions add channels.
Exit strategy

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}} s_{t+\tau} d\tau
\]

  1. Open market operations are easy.
  2. Illiquid assets? The Treasury can issue more debt
  3. Pay more interest on reserves
  4. Fiscal limit, no one wants to buy B? They’re already holding M.

- Will the Fed soak up the extra cash? – Trade M for B, raise rates?

- Will doing so make any difference? A: Not at the fiscal limit.
Bottom line

\[
\frac{M_t + B_t}{P_t} = E_t \int_{\tau=0}^{\infty} \frac{1}{R_{t,t+\tau}} s_{t+\tau} d\tau \\
M_t V_t(\cdot) = P_t Y_t \\
\pi_t = \beta E_t \pi_{t+1} + \gamma(y_t - \bar{y})
\]

(1) is surely at the center of events right now.

Inflation? No forecast but a scenario

1. More bailouts, spending, no entitlement resolution.
2. Slow growth, distorting taxes.
3. Fairly sudden flight from long bonds, dollar, followed by \( \pi \), stagflation
4. Fed: “models don’t work” “shifting Phillips curve” like the 70s.
Mechanisms and guides

- **Interest rates, Fed view**

  Fed→short r→long, other r→"demand"→"gaps"→→inflation
  other shocks→expectations

- **New Keynesian**

  \[ \pi_t \uparrow \implies i_t \uparrow \uparrow \implies \pi_{t+1} \uparrow \uparrow \]

  “Coordinate expectations on unique local equilibrium”

- **Money**

  \[ MV = PY \]

- **Deficits**

  \[ \frac{\text{Money} + \text{Govt Debt}}{\text{Price level}} = \text{Present value } [\text{Real primary surpluses }] \]

  primary surplus = tax - spending (not interest)

- Fed: More money, less debt. It is powerless here.

- Inflation? Be scared, be very scared
Fiscal constraints in NK models – IR functions

- Fiscal constraint

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

\[\implies (E_{t+1} - E_t) \sum_{j=0}^{\infty} \beta^j s_{t+j} \text{ gives } \pi_{t+1} - E_t \pi_{t+1}\]

- Simplest model

\[
i_t = r + E_t \pi_{t+1} \text{ (IS, Fisher, FOC)}
\]

\[
i_t = r + \phi \pi_t + x_t \text{ (Taylor rule)}
\]

\[
x_t = \rho x_{t-1} + \varepsilon_t
\]

- Equilibrium

\[
E_t \pi_{t+1} = \phi \pi_t + x_t
\]

\[
\pi_{t+1} = \phi \pi_t + x_t + \delta_{t+1}
\]

- \(\delta_{t+1}\) must correspond to a fiscal shock
Impulse-response functions with fiscal constraints

- Simplest model

\[ i_t = r + E_t \pi_{t+1} \]
\[ i_t = r + \phi \pi_t + x_t \]

- Equilibrium

\[ \pi_{t+1} = \phi \pi_t + x_t + \delta_{t+1} \]

- NK solution (needs $\phi > 1$).

\[ \pi_t = - \sum_{j=0}^{\infty} \frac{1}{\phi^{j+1}} E_t x_{t+j} = - \frac{x_t}{\phi - \rho} \quad \text{Inflation jumps} \]
\[ \delta_t = - \frac{\varepsilon_t}{\phi - \rho} \quad \text{Fed induces fiscal change} \]

- Fiscally-constrained solution: $\delta_t = 0$ in response to $x$ shock. (Needs $\phi < 1$).
Response to m policy shock

New-Keynesian response to monetary tightening \( \rho = 0.80 \) \( \phi = 1.20 \)

Response to monetary tightening with no fiscal change \( \rho = 0.80 \) \( \phi = 0.90 \)
3-Equation model with fiscal constraints

Model

\[
\begin{align*}
    y_t &= E_t y_{t+1} - \sigma r_t + x_{dt} \\
    i_t &= r_t + E_t \pi_{t+1} \\
    \pi_t &= \beta E_t \pi_{t+1} + \gamma y_t + x_{\pi t} \\
    \pi_t &= \phi \pi_t + x_{\pi t}
\end{align*}
\]

NK solution: $\phi > 1$, solve forward, $\pi$ jumps in response to an $x_i$ shock

Fiscal solution: $\phi < 1$, calculate the response to an $x_i$ shock with no contemporaneous shock to $\pi$. 
3 Equation model with fiscal constraints – response to monetary policy shock

New-Keynesian response to monetary tightening – 3 equation model

Response to monetary tightening without fiscal change – 3 equation model
Fiscal foundations for the Euro (again)

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

1. Does it apply, and how? A: Yes, ECB transforms sovereign debt + some credit guarantees.

2. The choice: Common fiscal policy, Default, or “Government equity.”

3. Livres vs. ecus, a 300 year old idea.