DEFICITS, DEBT, AND INFLATION

Fiscal and Monetary Policy 2023

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BUDGET CONSTRAINT AGAIN

- To link deficits and debt with monetary policy we revisit the intertemporal government budget constraint.
- The static budget constraint of the fiscal branch of the government is

$$P_t G_t + i_{t-1} B_{t-1}^T = P_t T_t + \left(B_t^T - B_{t-1}^T \right) + RCB_t$$

where i_t is the nominal interest rate promised at t, B_t^T is total nominal debt issued in period t, G_t is real government purchases, T_t is real (net) tax revenue and RCB_t is direct receipts from the central bank.

BUDGET CONSTRAINT AGAIN

- The central bank has a similar budget constraint:

$$B_t^M - B_{t-1}^M + RCB_t = i_{t-1}B_{t-1}^M + (M_t - M_{t-1})\,.$$

  where B_t^M is the central bank's purchase s of government debt, and $M_t - M_{t-1}$ is an increase in nominal money supply in period t.
- M_t here is high-powered money, monetary base – stock of currency held by the nonbank public + bank reserves.

BUDGET CONSTRAINT AGAIN

- If we do not put any restriction on RCB_t, then we can add the two budget constraints to obtain

$$P_t G_t + i_{t-1} B_{t-1} = P_t T_t + (B_t - B_{t-1}) + (M_t - M_{t-1}) \,.$$

- It makes clear that the government can finance its spending needs by issuing debt or by printing money.
- Does the liability composition matter? The only difference is that debt pays interest.

BUDGET CONSTRAINT AGAIN

- In real terms:

$$G_t + \bar{r}_{t-1} \frac{B_{t-1}}{P_{t-1}} = T_t + \left(\frac{B_t}{P_t} - \frac{B_{t-1}}{P_{t-1}} \right) + \left(\frac{M_t}{P_t} - \frac{1}{1+\pi_t} \frac{M_{t-1}}{P_{t-1}} \right).$$

  where $1 + \pi_t \coloneqq \frac{P_t}{P_{t-1}}$ and $1 + \bar{r}_{t-1} \coloneqq \frac{1+i_{t-1}}{1+\pi_t}$.

- Here $\bar{r}_{t-1}$ is the ex post real interest rate on government debt.
- Unancitipated inflation reduces the real value of debt.

MONETARY FINANCING

- Real resources due to monetary financing are

$$S_t \coloneqq \frac{M_t}{P_t} - \frac{1}{1+\pi_t}\frac{M_{t-1}}{P_{t-1}}.$$

- We call this the seigniorage revenue.
- It can be rewritten as

$$\frac{M_t}{P_t} - \frac{M_{t-1}}{P_{t-1}} + \frac{\pi_t}{1+\pi_t}\frac{M_{t-1}}{P_{t-1}}.$$

- Two sources of seignorage:
    1. change in real money holdings;
    2. to maintain constant real money holdings the private sector needs to purchase more nominal money to offset the effects of inflation.

MONETARY FINANCING

- Are there limits to monetary financing?
- Study the formula in the steady state:

$$G + r\frac{B}{P} = T + \frac{M}{P}\frac{\pi}{1+\pi}.$$

- Is it possible to finance any real government purchases by printing money?
- The answer depends on $\frac{M}{P}\frac{\pi}{1+\pi}$
- In most models demand for real balances $\frac{M}{P}$ is decreasing in the nominal interest rate (so also in inflation).
- The other term is increasing in inflation, but bounded by 1.
- A Laffer curve for inflation?

Table P1 **Polish Receipts and Expenditures (in thousands of zloty)**

	1921	1922	1923	1924	1925
Receipts:					
Administration	261,676	467,979	—	—	1,491,743
State Enterprises	11,413	14,556	—	—	133,530
Monopolies	72,222	47,893	—	—	356,611
Total	345,311	530,428	426,000	1,703,000	1,981,884
Expenditures:					
Administration	765,263	734,310	—	—	1,830,231
State Enterprises	115,589	145,003	—	—	106,343
Monopolies	—	—	—	—	45,019
Total	880,852	879,313	1,119,800	1,629,000	1,981,593
Deficit	535,541	348,885	692,000	—	—
Surplus	—	—	—	74,000	251

Source: Young [36, vol. 2, p. 183].

Sargent (1982)

Table P3 **Polish Index Numbers of Wholesale Prices, 1921–25**

Year	Month	Wholesale Price Index[1]
1921	January	25,139
	February	31,827
	March	32,882
	April	31,710
	May	32,639
	June	35,392
	July	45,654
	August	53,100
	September	60,203
	October	65,539
	November	58,583
	December	57,046
1922	January	59,231
	February	63,445
	March	73,465
	April	75,106
	May	78,634
	June	87,694
	July	101,587
	August	135,786
	September	152,365
	October	201,326
	November	275,647
	December	346,353
1923	January	544,690
	February	859,110
	March	988,500
1923	April	1,058,920
	May	1,125,350
	June	1,881,410
	July	3,069,970
	August	5,294,680
	September	7,302,200
	October	27,380,680
	November	67,943,700
	December	142,300,700
1924	January	242,167,700
	February	248,429,600
	March	245,277,900
	April	242,321,800
	May	
	June	
	July	
	August	
	September	
	October	
	November	
	December	
1925	January	
	February	
	March	
	April	
	May	

Source: Young [36, vol. 2, p. 349].

[1]1914 = 100.

MONETARY FINANCING

- Can the government boost demand for real balances?
- Restrictions on the rights of banks and other intermediaries to issue close substitutes for government issued currency.
- Limitations on trading assets that are close substitutes for government issued currency.
- Reserve requirements.
- At the end of the day it amounts to a transfer of real resources from the private sector to the government – is it any different from taxation?

MONETARY FINANCING

- What is the optimal level of seignorage?
- Without a fully specified model it is hard to say, but we can think about the tradeoffs.
- Note that inflation is like a distortionary tax on money holdings.
- But other taxes (consumption, capital, labor) are usually distortionary too.
- This is an argument for some positive inflation – distortion smoothing.

DETOUR: OPTIMAL QUANTITY OF MONEY?

- Friedman's (1969) discussion of the optimal quantity of money are related to this.
- Suppose the government can levy a non-distortionary tax on the private sector. How much money should it print?
- In this case fiscal considerations are irrelevant.
- The optimum calls for the government to print money until the marginal benefit of money equals the marginal cost.

DETOUR: OPTIMAL QUANTITY OF MONEY?

- The opportunity cost of holding money is the nominal interest rate.
- At the optimum money and bonds should be perfect substitutes: nominal interest rate should be zero.
- Because $i = r + \pi$, this implies that inflation should be constant and equal to the negative of the real interest rate.
- If $r > 0$ then the optimal inflation rate is negative.
- Friedman's rule: satiate the demand for money.

LIMITS OF MONETARY POLICY?

To state the general conclusion still differently, the monetary authority controls nominal quantities—directly, the quantity of its own liabilities. In principle, it can use this control to peg a nominal quantity—an exchange rate, the price level, the nominal level of national income, the quantity of money by one or another definition—or to peg the rate of change in a nominal quantity—the rate of inflation or deflation, the rate of growth or decline in nominal national income, the rate of growth of the quantity of money. It cannot use its control over nominal quantities to peg a real quantity—the real rate of interest, the rate of unemployment, the level of real national income, the real quantity of money, the rate of growth of real national income, or the rate of growth of the real quantity of money.

Friedman (1968)

LIMITS OF MONETARY POLICY?

- Friedman (1968) warned not to expect too much from monetary policy.
- He argued that a monetary authority could exert substantial control over the inflation rate, especially in the long run.
- Is it really true? What assumptions are needed to ensure that?
- Recall that there is an equation that links debt, deficits, and inflation.
- We will tackle this question in two ways:
  1. first illustrate the idea in an environment with money (Sargent and Wallace, 1981);
  2. then reconsider the role of the government budget "constraint"

SOME UNPLEASANT MONETARIST ARITHMETIC

- Sargent and Wallace (1981) warn us about thinking about monetary policy and fiscal policy separately.
- They study a simple endowment economy with money.
- The nominal government budget constraint is

$$B_t + M_t = P_t\left(G_t - T_t\right) + \left(1 + i_{t-1}\right) B_{t-1} + M_{t-1}.$$

- Demand for real balances decreases in the nominal rate

$$\frac{M_t}{P_t} = L(i_t)$$

- The Fisher equation is

$$1 + i_t = \left(1 + r_t\right)\left(1 + \pi_{t+1}\right)$$

SOME UNPLEASANT MONETARIST ARITHMETIC

- Let B_{-1}, M_{-1} and i_{-1} be given and assume that $r_t = r$.
- Assume the IGBC is satisfied to obtain

$$\sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t \frac{M_t - M_{t-1}}{P_t} = \sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t (G_t - T_t) + \frac{B_{-1}}{P_0}(1 + i_{-1})$$

- The left hand side is the present value of seignorage. It can be written as

$$\sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t \frac{i_{t-1}}{1+i_{t-1}} L(i_t) - \omega L(i_0)$$

where ω is a constant.

SOME UNPLEASANT MONETARIST ARITHMETIC

- We can write the IGBC as

$$\sum_{t=0}^{\infty} \left(\frac{1}{1+r}\right)^t \frac{i_{t-1}}{1+i_{t-1}} L(i_t) - \omega L(i_0) = D$$

- Key assumption: the fiscal authority commits to a particular D. It will not adjust.
- The monetary authority has to provide financing such that the IGBC holds.
- This means that the monetary authority can only change the timing of i_t and thus of seignorage revenue.

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SOME UNPLEASANT MONETARIST ARITHMETIC

- Example: the central bank reduces the growth rate of money in early periods to "control inflation".
- But it will have to compensate for it with a higher growth rate of money and inflation later on.
- Note: as usually in frictionless models, here higher inflation is associated with higher nominal rates.
- Conclusion: monetary policy ultimately cannot control inflation, if it is forced to finance deficits.

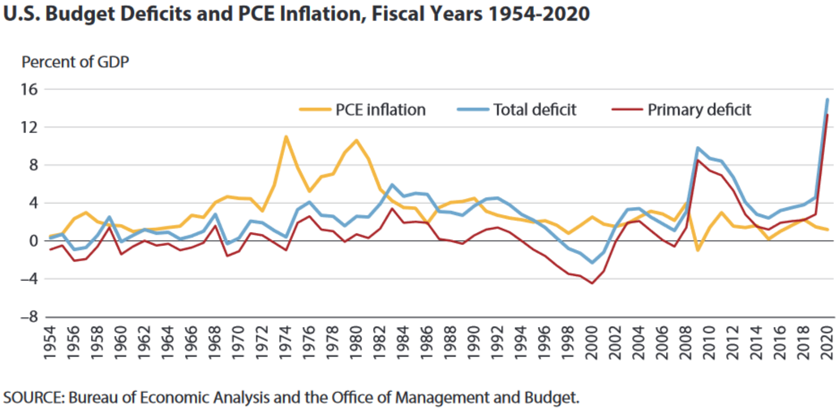
SOME UNPLEASANT MONETARIST ARITHMETIC

- Sargent and Wallace (1981) provide an even more drastic example.
- Suppose MP is tight initially. It is expected it will be loosened to finance a deficit in the future.
- This means high inflation in the future.
- This means high nominal rates in the future.
- High nominal interest rates in the future lower demand for real balances today
- Given nominal money supply, this means high price level today.
- Conclusion: MP tries to control inflation, but actually causes it!

SOME UNPLEASANT MONETARIST ARITHMETIC?

- Andolfatto (2021) uses a similar logic to question conventional wisdom about Volcker Disinflation.
- Standard narrative: after prolonged inflation in the 1970s, Volcker tightened monetary policy to reduce inflation. This demonstrated that MP can control inflation.
- Andolfatto suggests it was the fiscal policy that was responsible for the disinflation.
- By increasing interest expenses on the debt, Volcker forced the Treasury to reduce deficits.

SOME UNPLEASANT MONETARIST ARITHMETIC?



Andolfatto (2021)

BUDGET CONSTRAINT?

- So far we have seen that fiscal policy can affect inflation / price levels by affecting supply / demand of money.
- Is there any other link? In particular, what if the economy is cashless?
- Depends on how we interpret the government budget "constraint".

BUDGET CONSTRAINT?

- Example: simple static economy.
- In the morning, bondholders wake up and own B_0 units of zero coupon bonds that promise to pay one unit of account ("dollar") each.
- The government pays bondholders by printing "money".
- In the evening, the government collects taxes $P_1 T_1$. Taxes are paid in "money".
- The world ends aferwards.

BUDGET CONSTRAINT?

- In equilibrium

$$B_0 = P_1 T_1.$$

- "Money" printed up in the morning must be all soaked up by taxes at the end of the day.
- B_0 is predetermined. We assume T_1 is exogenous.
- The price level P_1 adjusts to ensure this equality.
- This is an equilibrium condition.
- It looks a bit like a budget constraint, but it is not.

BUDGET CONSTRAINT?

- In the example above we did not require the government to "collect enough taxes to pay its debt".
- This is the fiscal theory of the price level.
- Let’s tell more stories about how P_1 adjusts to ensure $B_0 = P_1 T_1$.
- If P_1 is too low, more money was printed that will be collected in taxes. People will try to get rid of money by buying goods. This will push up the price level.
- "Too much money chasing too few goods".
- Too much government debt relative to fiscal surpluses is like net wealth – people will try to spend more.

FTPL INTRO

- Contrast this with the quantity theory of money.
- In the quantity theory of money, inflation results from more money than needed to settle transations or to satisfy other money demand for other reasons. All money supply matters.
- Here only outside money – government liabilities – matter. It is also irrelevant whether it is debt or currency.
- In the example it is not essential that the government "prints" money: people could pay taxes directly with bonds.

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FTPL INTRO

- The government issues the currency and nominal debt that define the price level.
- In this sense it is like corporate *equity*: its price adjusts to make a valuation equation hold.
- This does not hold for real or foreign currency government debt.
- This does not hold for personal or corporate debt.

FTPL INTRO

- Note that the government could choose to set taxes T_1 such that $T_1 = \frac{B_0}{P_1}$ for all possible P_1, this means $T_1 = f(P_1)$.
- In this case the price level is indeterminate.
- We call such a fiscal policy passive or Ricardian.
- The point is that the government does not have to follow such a policy. Fiscal policy might be active or non-Ricardian.

AN INTERTEMPORAL MODEL

- We now consider the most basic fully-specified version of the FTPL.
- A representative households maximizes

$$\sum_{t=0}^{\infty} \beta^t u(c_t)$$

in a complete asset market economy, with restriction $B_t \geq 0$ and $M_t \geq 0$.

- The household has a constant endowment every period, y
- The budget constraint of the household is

$$M_{t-1} + B_{t-1} + P_t y = P_t c_t + P_t s_t + M_t + Q_t B_t$$

where $Q_t \coloneqq \frac{1}{1+i_t}$ is the price of bonds in terms of money and s_t is real taxes net of transfers.

AN INTERTEMPORAL MODEL

- Notice that if $Q_t < 1$, then the household does not hold any money, $M_t = 0$.
- If $Q_t = 1$, then money and bonds are perfect substitutes and we can use B_t to denote their sum.
- $Q_t > 1$ not possible.
- Drop M_t from the budget constraint and use market clearing $c_t = y$ to obtain

$$B_{t-1} = P_t s_t + Q_t B_t$$

AN INTERTEMPORAL MODEL

- Household optimality together with the market clearing implies

$$Q_t = \beta\, \mathbb{E}_t \frac{P_t}{P_{t+1}}.$$

- There is also the transversality condition

$$\lim_{T\to\infty} \beta^T\, \mathbb{E}_t \frac{B_{T-1}}{P_T} = 0.$$

- We obtain

$$\frac{B_{t-1}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j s_{t+j}.$$

- The government debt valuation equation

$$\frac{B_{t-1}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j s_{t+j} .$$

  determines the price level P_t.
- It does so in every period.
- This is a standard asset pricing formula!
- The government debt is like a stock. Price per share $1/P_t$ times number of shares B_{t-1} equals the present value of dividends $\{s_{t+j}\}$.

AN INTERTEMPORAL MODEL

- What if the government changes nominal debt without changing surpluses?
- What if the government changes surpluses without changing nominal debt?
- It is useful to rewrite the equation as

$$\frac{B_t}{P_{t+1}} = \mathbb{E}_{t+1} \sum_{j=0}^{\infty} \beta^j s_{t+j+1}.$$

- Define $\Delta \mathbb{E}_{t+1} \coloneqq \mathbb{E}_{t+1} - \mathbb{E}_t$ to write

$$\frac{B_t}{P_t} \Delta \mathbb{E}_{t+1} \frac{P_{t+1}}{P_t} = \Delta \mathbb{E}_{t+1} \sum_{j=0}^{\infty} \beta^j s_{t+j+1}.$$

AN INTERTEMPORAL MODEL

- At time $t+1$ both B_t and P_t are predetermined.
- Unexpected inflation is determined by changing expectations of the present value of surpluses.
- Bad fiscal news affect inflation for one period only.
- This is because we assumed one-period debt only.

AN INTERTEMPORAL MODEL

- We can also rewrite the equation as

$$\frac{B_t}{P_t} \mathbb{E}_t \frac{P_{t+1}}{P_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j s_{t+j+1}.$$

- It is the same as

$$\frac{B_t}{P_t} \frac{1}{1+i_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \beta^j s_{t+j+1}.$$

- The left hand side is the real revenue the government gets from selling debt B_t at the end of period t.
- The price level P_t is already determined at the beginning of period t.
- The revenue from bonds sales is fully determined by the PDV of surpluses.

AN INTERTEMPORAL MODEL

- The government can target nominal interest rates by changing B_t without affecting surpluses.
- By standard arguments the expected inflation rate depends on the nominal interest rate.
- Monetary policy: changing i_t / changing B_t without adjusting surpluses.
- Fiscal policy: changing surpluses without adjusting i_t / B_t.