

A Monetary/Fiscal Theory of Sudden Inflations

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Unpleasant Monetarist Arithmetic

- Deficits have a lot to do with historical high-inflation episodes
- Fiscal imbalances threaten CB independence
- Liz Truss and the UK

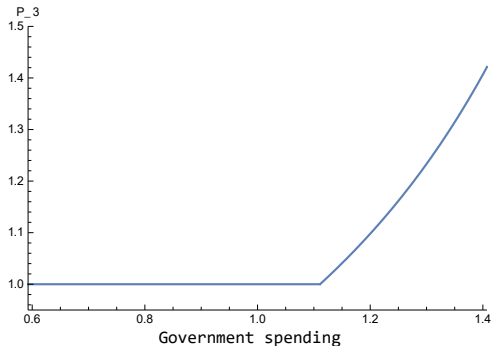
Unpleasant Monetarist Arithmetic

- Deficits have a lot to do with historical high-inflation episodes
- Fiscal imbalances threaten CB independence
- Liz Truss and the UK
- Evidence of relationship between fiscal deficits and inflation somewhat weak
- A Monetary and Fiscal History of Latin America, 1960–2017 (Kehoe and Nicolini eds., 2022)
- Lots of episodes of large deficits with no inflationary consequences (Bassetto and Butters, 2010)
- Postwar U.S., real return on debt very weakly related to deficits (Berndt, Lustig, and Yeltekin, 2012)
- Bianchi-Melosi: regime changes, mostly identified indirectly

Nominal Debt as an Option-like Payoff

- In normal times, CB independence prevails, fiscal policy in charge of balancing the budget
- In times of crisis, fiscal policy is hamstrung, monetary policy steps in
 - ▶ How long before a crisis spills over into inflation?

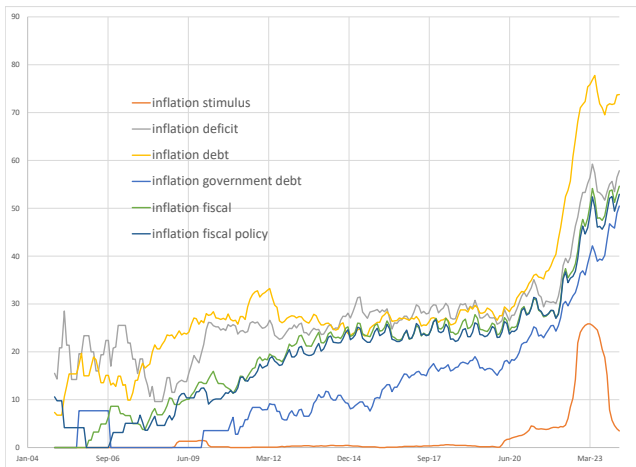
“Long-run” relationship between prices and government spending



Government debt as an information-insensitive asset

- Gorton-Ordoñez (2014), Holmstrom (2015) , Caballero-Farhi (2017)
- When in the quiet regime, little incentive to acquire information about deficits (rational inattention)
- Compounds reasons why prices do not respond to deficits
- As bad news pile up, a regime change is triggered
- (Also, prominent irresponsible fiscal policy announcements may trigger it)

Google Trends: 12-month MA)



What we do

- ① Model with exogenous information, but two regimes
 - ▶ At low deficits, taxes react to fiscal needs, deficits not predictive of future inflation
 - ▶ At higher deficits, taxes do not respond, deficits start predicting inflation
 - ▶ Model predicts smooth transition in inflation sensitivity to deficits
- ② With endogenous information:
 - ▶ At low deficits, no incentive to acquire information/pay attention to deficits \implies little response
 - ▶ At higher deficits, incentive to acquire information kicks in, inflation responds to deficit news
 - ▶ Transition from one regime to the other more abrupt, may be discontinuous

The model: timing

3 periods:

- Period 1: baseline
- Period 2: deficit news arrive
- Period 3: “The long run” (all deficits are realized)

Where we are going with the model

- Exogenous information: could keep things simple, rely purely on competitive model
- Endogenous information: need somebody to set prices and somebody to set quantities (see e.g. Mackowiak and Wiederholt, 2015)

Agents, technology and goods

- Continuum of families $i \in [0, 1]$
- Each family has a continuum of entrepreneurs running firms $j \in [0, 1]$ producing differentiated variety
- A family also has a shopper that buys consumption
- Set of goods: indexed by kj

Preferences and technology

- Over aggregates:

$$E \left[\sum_{t=1}^3 \beta^{t-1} \left(u(c_{it}) - \int_0^1 \ell_{ijt} \right) \right]$$



$$c_{it} = \left(\int_0^1 \int_0^1 c_{kjt,i}^{\frac{\theta-1}{\theta}} djdk \right)^{\frac{\theta}{\theta-1}},$$

$$\theta > 1$$

- Government spending: aggregate value exogenous, varieties aggregated with the same price elasticity
- One unit of kj time produces one unit of kj good

Government

- Starts period 0 with B_0 nominal liabilities (one period)
- Gov't bonds are numeraire
- No spending in periods 1 and 2. Uncertain spending in period 3: G_3
- Taxes: to be described below

Timing within each period

- Monetary-fiscal policy is set;
- Producers choose information (if allowed) and set prices;
- Shoppers observe prices, choose quantities, allocate residual resources to buying bonds

Monetary-fiscal policy in period 3 (the “long run”)

- Gov't starts owing B_2 (nominal)
- G_3 realized
- Two monetary-fiscal regimes:
 - ▶ Regime M : gov't sets real taxes $G_3 + B_2/P_3^*$, uses surpluses to withdraw debt
 - ▶ Regime F : gov't sets real taxes \hat{T} (fixed and exogenous)

Monetary-fiscal policy and information in period 2

- Gov't starts with nominal debt B_1
- Fixed nominal interest rate $i (= 1/\beta)$
- $P_2 T_2 = \frac{i}{1+i} B_1$ (implies $B_2 = B_1$)
- Everybody gets signal about fiscal regime:
 - ▶ Posterior probability of regime F : π
 - ▶ Mean of the posterior for G_3 conditional on F : \tilde{G}_3
 - ▶ Note: regime and spending **not** independent
 - ▶ **Assumption** (F regime associated with higher prices):

$$\frac{[\hat{T} - \tilde{G}_3]}{B_2} < \frac{1}{P_3^*}$$

- **Under endogenous information**: producers can pay a utility cost K , observe future regime and spending realization
- Producers set prices, shoppers (may) learn from prices, choose quantities

Period 1

- Gov't starts with nominal debt B_0
- Fixed nominal interest rate $i (= 1/\beta)$
- $P_1 T_1 = \frac{i}{1+i} B_0$ (implies $B_1 = B_0$)
- No information beyond a prior π_0 on the regime and a distribution on spending G_3
- (Not much action, serves to establish a base price level)

Computing Equilibrium - Period 3, regime M (“Ricardian policy”)

- Gov't has B_2/P_3^* units of the good, hhs redeem $B_2 \implies P_3 = P_3^*$
- Producer:
 - Marginal revenue (in utility terms):

$$\frac{(1 - \theta)u'(c_{i3})(C_3 + G_3)}{P_3} \left(\frac{p_{ij3}}{P_3} \right)^{-\theta}$$

- Marginal cost (in utility terms):

$$\frac{\theta(C_3 + G_3)}{P_3} \left(\frac{p_{ij3}}{P_3} \right)^{-\theta-1},$$

- Equilibrium requires (usual Dixit-Stiglitz distortion):

$$u'(c_{i3}) = \frac{\theta}{\theta - 1}, \quad p_{ij3} = P_3$$

- Shopper: exhausts budget constraint, with c_{i3} given as above,
 $c_{ij3} = c_{i3} = C_3$

Computing Equilibrium - Period 3, regime F

- Taxes are \hat{T} , primary surplus $\hat{T} - G_3$
- FTPL determination of the price level: $P_3 = B_2/(\hat{T} - G_3)$
- Other than that, everything the same as in regime M :

$$u'(C_3) = \frac{\theta}{\theta - 1}, \quad p_{ij3} = P_3$$

- Prices and consumption of all varieties the same

Computing equilibrium - Period 2, exogenous information only

- Euler equation of the shopper:

$$\frac{u'(C_2)}{P_2 \beta u'(C_3)(1+i)} = \frac{1-\pi}{P_3^*} + \frac{\pi[\hat{T} - E_2(G_3|F)]}{B_2},$$

- Optimality of the producers

$$u'(C_2) = \frac{\theta}{\theta - 1}$$

•

$$\Rightarrow \frac{1}{P_2} = \frac{1-\pi}{P_3^*} + \frac{\pi[\hat{T} - \tilde{G}_3]}{B_2}$$

Characterizing period 2 under exogenous information

- By assumption

$$\frac{\partial P_2}{\partial \pi} > 0$$

- We then get

$$\frac{\partial^2 P_2}{\partial \pi \partial \tilde{G}_3} > 0$$

- \implies Signals of fiscal stress (higher π) make the price level respond more to G_3

Endogenous information: Learning by shoppers

- Shoppers have same info as producers that do not pay K
- \implies can compute optimal price charged by them
- If they observe other prices, can infer information from price
- (Neglect prices charged by measure zero of agents)
- Look at pure-strategy equilibria:
 - ▶ When no producers pay K , equilibrium same as under exo info
 - ▶ When all producers pay K , shoppers are fully informed too (learning from prices)

Prices and quantities when producers are fully informed

- Same as under exo info, but now $\pi = 0$ or $\pi = 1$ and G_3 known.
- Get $P_2 = P_3$, same sensitivity to G_3 as in period 3
- If regime F known to prevail, sensitivity to G_3 is higher than under exo info ($\pi = 1$ vs $\pi \in [0, 1]$)

When do producers pay K ?

- Assume all producers acquire information
- Check incentive for single producer to deviate and not pay K

When do producers pay K ?

- Assume all producers acquire information
- Check incentive for single producer to deviate and not pay K
- Shoppers fully informed (learn from prices of informed producers)
 $\implies u'(c_{i2}) = \theta/(\theta - 1)$
- $P_2 = P_3$ but uninformed producer does not know P_3
- Optimal price for uninformed producer:

$$p_{ij2} = \frac{E_{ij2}^P [P_2^\theta]}{E_{ij2}^P [P_2^{\theta-1}]}.$$

Determination of cost threshold

- Profits of informed producers:

$$u'^{-1} \left(\frac{\theta}{\theta - 1} \right) \frac{1}{\theta - 1}$$

- Profits of single uninformed producer in utility terms:

$$u'^{-1} \left(\frac{\theta}{\theta - 1} \right) \frac{1}{\theta - 1} \left[E_{ij2}^P \left(P_2^\theta \right) \right]^{1-\theta} \left[E_{ij2}^P \left(P_2^{\theta-1} \right) \right]^\theta$$

- Red term < 1 (Jensen's inequality)
- Cost threshold dictated by uncertainty
- Particularly sensitive to **right-tail** risk
- Worst-case scenario: P_3 really high, uninformed sets low P_2 sells a ton of goods at a loss

When do producers not pay K ?

- Check unilateral deviation again
- Producer ij pays cost, learns future price P_3
- Complication: now shoppers do not know P_3
- Euler equation of shoppers

$$\frac{u'(C_2)}{P_2 \beta u'(C_3)(1+i)} = \frac{1-\pi}{P_3^*} + \frac{\pi[\hat{T} - E_2(G_3|F)]}{B_2},$$

- From perspective of informed producer, shoppers off the Euler equation
- \implies envelope condition fails
- It matters when the extra resources are consumed

When are extra resources consumed

- If price of deviating producer is observed by the family's shoppers, could spread over the two periods
- Otherwise, in period 3
- Assume the latter (algebra simpler)
- Results robust, region of multiplicity expands when some resources consumed in period 2

Optimal choice for single informed producer

- Marginal revenue (in utility terms):

$$\frac{\frac{\theta}{\theta-1} u'^{-1} \left(\frac{\theta}{\theta-1} \right)}{P_3} \left(\frac{p_{ij2}}{P_2} \right)^{-\theta}. \quad (1)$$

- Marginal cost (in utility terms):

$$\frac{\theta C_2}{P_2} \left(\frac{p_{ij2}}{P_2} \right)^{-\theta-1},$$

- Optimal choice: set $p_{ij2} = P_3$!

Determination of cost threshold

- Profits of uninformed producers (same as informed producers in the informed equilibrium):

$$u'^{-1} \left(\frac{\theta}{\theta - 1} \right) \frac{1}{\theta - 1}$$

- Profits of single informed producer in utility terms:

$$(u')^{-1} \left(\frac{\theta}{\theta - 1} \right) \frac{1}{\theta - 1} [E_2 P_3^{-1}]^{-\theta} E_2 P_3^{-\theta}$$

- Red term > 1 (Jensen's inequality again)
- Cost threshold dictated by uncertainty
- Particularly sensitive to **left-tail** risk
- Best-case scenario: P_3 really low, informed sets low P_2 , sells a ton of goods with a good markup

Tail asymmetry in our application

- Downside risk limited, when fiscal resources are plentiful we are in the M regime (with high probability)
- Risk tilted to the upside
- \implies Likely that cost threshold for optimally acquiring information **lower** when others do
- Strategic complementarity
- Region of multiple equilibria

Summing up: As uncertainty about regime increases...

- First, equilibrium with no info acquisition, little response to fiscal news
- Then, multiple-equilibrium regime, at some point jump to info acquisition, response jumps up
- Finally, only informed equilibrium survives (jump must occur at that point)

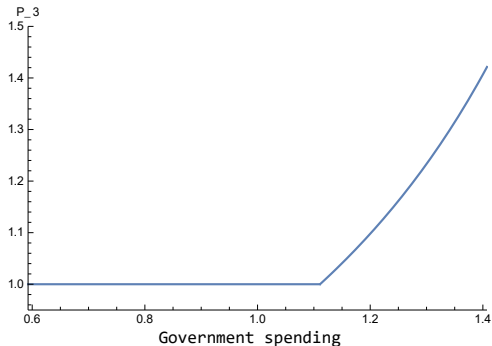
Period 1

- Equilibrium exists (unique conditional on period 2 eq'm selection)
- Get baseline price level P_1 (only depends on prior)
- \implies Everything we said about P_2 is true of inflation between periods 1 and 2

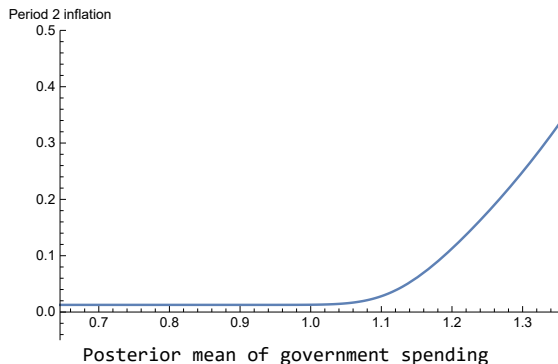
Numerical Example

- Normal shocks to G_3
- Normal signal
- Maximum tax rate \bar{T} : when insufficient, regime F is triggered

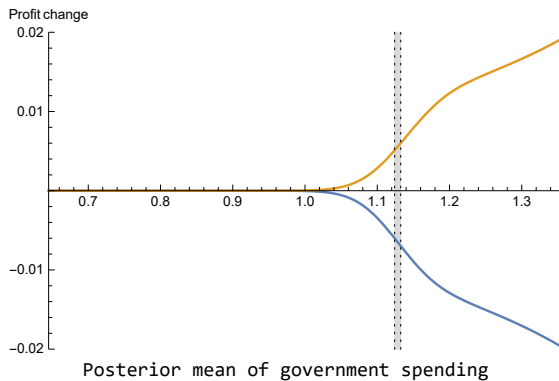
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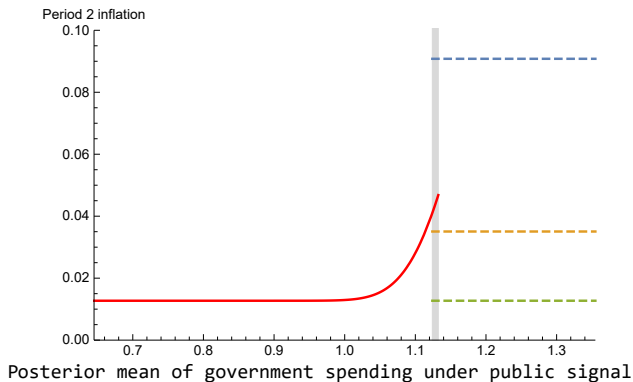
Inflation in the Uninformed equilibrium ($K = \infty$)



Costs and Benefits of acquiring information



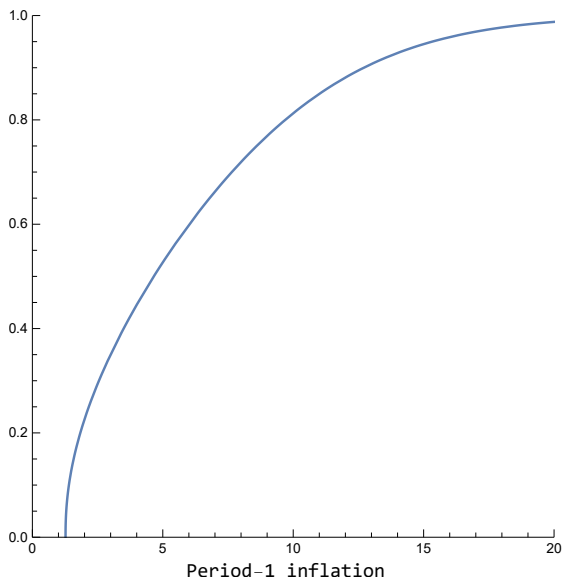
Period 2 inflation as a function of signal under endogenous information



Extensions

- Information choice a one-time decision
- Could think of dynamic environments: once π is high, constant tracking of news about G_3
- Complementarities in info production (newspapers talk more about fiscal news)
- Debt might be more liquid for low $\pi \implies$ liquidity role less sensitive to final payoff

4-Period Extension



Conclusion

- Developed model where not much happens to inflation in response to fiscal news over some range...

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Conclusion

- Developed model where not much happens to inflation in response to fiscal news over some range...
- ... but reaction becomes stronger as a “fiscal limit” is attained...
- ... can observe sudden jumps with endogenous information acquisition...
- ... dangerous to take for granted that inflation will not move because it did not in the past!

Thank you!