FTPL: Basics

Empirical model 0000

Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Quantifying Fiscal Policy's Contribution to Inflation Incomplete and very preliminary!

Nathan S. Balke¹ Carlos Zarazaga¹

¹Southern Methodist University

Southern Economic Association Meetings, November 20, 2023

FTPL: Basics

Empirical model

Results

Research question

What has been the fiscal contribution to inflation in the U.S.?



FTPL: Basics

Empirical model

Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Our approach

- Estimate simple New Keynesian macro model (based on Smets and Wouters (2007))
- Introduce a fiscal block into model
 - Govt budget equation
 - real market value of government debt = PV of current and future primary surpluses
 - long-term debt
 - Active fiscal policy
 - Allow two types of deficit shocks:
 - Ricardian deficit shocks (fully repaid at constant discount rates)
 - Non-Ricardian deficit shocks (not fully repaid)
- Examine quantitatively the contribution of these shocks (and others) to inflation

FTPL: Basics

Empirical model

Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Preview of results

Preliminary results (benchmark model):

- Non-Ricardian deficit shocks look like "aggregate demand" shocks
- Non-Ricardian deficit shocks are an important contributor to inflation variability
- Roughly 25-33% of the surprise inflation in 2021-22 is attributed to non-Ricardian fiscal shocks
- Important inflationary fiscal shocks in early 1970s and disinflationary fiscal shocks in early 1980s and 1995

FTPL: Basics

Empirical model 0000 Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Related literature

- Huge FTPL literature
- Leeper (1991) Active vs passive fiscal and monetary policy
- Borrow a lot from Cochrane (2022 a,b) and Cochrane (2023)
- Lots of recent papers looking at sources of post-pandemic inflation
- Our distinction between Ricardian and non-Ricardian deficit shocks similar in flavor to funded and unfunded shocks of Bianchi et al (2023)

FTPL: Basics

Empirical model

Surpluses, Debt, and Inflation



🛯 ୬ବ୍ଚ

FTPL: Basics

Empirical model

Results

▲□▶▲□▶▲≡▶▲≡▶ ≡ めぬぐ

Surpluses, Debt, and Inflation

- corr(π ,debt-to-GDP) = .65
- corr(π ,primary surplus) = -.21

FTPL: Basics •00000000 Empirical model 0000 Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Government budget flow equation

$$R_t^V V_{t-1} = P_t S_t + V_t$$

- R_t^V gross nominal return on debt
- V_t nominal market value of debt
- S_t real primary surplus
- *P_t* aggregate price level

FTPL: Basics

Empirical model 0000

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Government budget flow equation rewritten

$$\left(\frac{V_{t-1}}{P_{t-1}Y_{t-1}}\right)\frac{R_t^V}{\Pi_t G_t} = \frac{S_t}{Y_t} + \frac{V_t}{P_t Y_t}$$

- Π_t gross inflation rate
- *G_t* gross output growth rate
- $\frac{V_t}{P_t Y_t}$ debt to GDP ratio

FTPL: Basics

Empirical model 0000 Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Government budget: present value of surpluses

Substituting recursively forward and taking expectations:

$$\frac{V_{t-1}}{P_{t-1}Y_{t-1}}\frac{R_t^V}{\Pi_t G_t} = \frac{S_t}{Y_t} + \sum_{i=1}^{\infty} \mathbb{E}_t \left(\prod_{j=1}^i (R_{t+j}^V)^{-1} \Pi_{t+j} G_{t+j}\right) \frac{S_{t+i}}{Y_{t+i}}$$

FTPL: Basics

Empirical model

▲□▶ ▲□▶ ▲ 三▶ ▲ 三▶ 三三 - のへぐ

Present value of surpluses

$$\frac{V_{t-1}}{P_{t-1}Y_{t-1}}\frac{R_t^V}{\Pi_t G_t} = PV(S_{t+i-1}, RV_{t+i}, \Pi_{t+i}, G_{t+i})$$

FTPL: Basics

Empirical model 0000

Ricardian vs Non-Ricardian deficit shocks

- Ricardian deficit shock
 - $\Delta PV(S_{t+i-1}, RV_{t+i}, \Pi_{t+i}, G_{t+i}) = 0$
 - No effect on $\frac{R_t^V}{\prod_t G_t}$
 - Deficit shock and value of debt move one-for-one
- Non-Ricardian deficit shock
 - $\Delta PV(S_{t+i-1}, RV_{t+i}, \Pi_{t+i}, G_{t+i}) \neq 0$
 - Effect on $\frac{R_t^V}{\prod_t G_t}$
 - Deficit shock and value of debt don't move one-for-one

FTPL: Basics

Empirical model 0000 Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Active vs passive fiscal policy

- Active fiscal policy
 - $PV(S_{t+i-1}, RV_{t+i}, \Pi_{t+i}, G_{t+i}) \Longrightarrow \frac{R_t^V}{\Pi_t G_t}$
- Passive fiscal policy
 - $\frac{R_t^V}{\prod_t G_t} \Longrightarrow PV(S_{t+i-1}, RV_{t+i}, \prod_{t+i}, G_{t+i})$

FTPL: Basics

Empirical model 0000 Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Log linearized version (Cochrane)

• flow constraint

$$r_t^{\nu} - \pi_t - g_t = s_t + \rho v_t - v_{t-1}$$

•
$$v_t = log(V_t/(P_tY_t))$$

• $\rho = V/(PS + V)$ in ss (= .9999 in empirical analysis)

•
$$r_t^v = log(R_t^v)$$

• st taken as residual in log linearized flow equation

FTPL: Basics

Empirical model 0000 Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Log linearized version (Cochrane)

flow constraint

$$\begin{aligned} r_{t}^{v} - \pi_{t} - g_{t} &= \mathbb{E}_{t-1} \left(r_{t}^{v} - \pi_{t} - g_{t} \right) \\ &+ \Delta \mathbb{E}_{t} \left[\sum_{i=0}^{\infty} \rho^{i} s_{t+i} - \sum_{i=1}^{\infty} \rho^{i} \left(r_{t+i}^{v} - \pi_{t+i} - g_{t+1} \right) \right] \end{aligned}$$

- "surprises" in PV of surpluses matter.
- expectations of real return on debt relative to growth rate of GDP matter
- Cochrane, Leeper, and others: "Fiscal policy determines surprise inflation, monetary policy determines expected inflation"

FTPL: Basics

Empirical model

Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

stance of fiscal policy

• Define stance of fiscal policy

fiscal stance =
$$-(r_t^v - \pi_t - g_t) = -(s_t + \rho v_t - v_{t-1})$$

- fiscal stance $> 0 \implies$ expansionary fiscal stance \implies inflationary pressure
- need additional information to determine how r_t^v , π_t , and g_t individually respond.

FTPL: Basics

Empirical model •000 Results

New Keynesian macro block

Off-the-shelf New Keynesian model (Smets and Wouters, 2007)

- Many of standard frictions: wage and price stickiness, habit in consumption, policy inertia, investment adjustment costs
- seven observables: GDP, consumption, investment, and real wage growth, hours, short-term interest rate, and inflation
- seven structural shocks: TFP, risk premium, exogenous expenditures, investment technology, price markup, wage markup, and monetary policy,

FTPL: Basics

Empirical model

Results

Macro block

Where we differ:

- Add two observables: log debt-to-GDP and primary surplus
 - data on market value of debt from Hall and Sargent (2021)
 - back out s_t , $s_t = v_{t-1} + r_t^v \pi_t g_t \rho v_t$
- GDP minus federal government expenditures is "output" variable
- Annual data (priors adjusted slightly)
- Sample period: 1959-2022
- Shock processes are AR(1)
- Allow for passive monetary policy $(\gamma_{\pi} < 1)$

- TPL: Basics

Empirical model

Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ □ のQで

Add: Long-term govt debt (draws on Cochrane)

• Long term govt debt (geometric maturity structure)

- $r_t^{v} = \omega q_t q_{t-1}$, $\frac{1}{1-\omega}$ is duration of gov't debt
- $\mathbb{E}_t r_{t+1}^v = r_t$, expectations theory

•
$$r_t^{\nu} = r_{t-1} - \Delta \mathbb{E}_t \sum_{i=0}^{\infty} \omega^i r_{t+i}$$

TPL: Basics

Empirical model

Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ □ のQで

Add: Active fiscal policy (draws on Cochrane)

- Fiscal Block (Active fiscal policy)
 - Govt flow equation: $r_t^v \pi_t g_t = s_t + \rho v_t v_{t-1}$
 - Fiscal policy rule:
 - $s_t = s_t^r + s_t^n$
 - Non-Ricardian: $s_t^n = \theta_n(L)\epsilon_t^n$
 - Ricardian: $s_t^r = \alpha_v v_{t-1}^r + \theta_\pi^r \pi_t + \theta_y^r y_t + \theta_r(L) \epsilon_t^r$
 - Repaid debt: $v_t^r = \rho \mathbb{E}_t v_{t+1}^r + \mathbb{E}_t s_{t+1}^r$

FTPL: Basics

Empirical model

◆□ > ◆□ > ◆豆 > ◆豆 > ̄豆 = のへで

Estimation

- Bayesian estimation
 - similar priors to those of Smets and Wouters (2007)
 - restrict monetary policy to be passive

FTPL: Basics

Empirical model

Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Impulse response analysis

Non-Ricardian deficit shocks

- output growth and inflation rise
- persistent inflation response
- large decline in return-on-debt
- debt to GDP ratio falls

- TPL: Basics

Empirical model

Results

Response to non-Ricardian deficit shock



▶ ▲ 臣 ▶ ▲ 臣 ▶ ○ 臣 ○ � � �

FTPL: Basics

Empirical model 0000 Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Impulse response analysis

- Wage and price shocks shortlived effect on inflation
- Contractionary monetary shocks have small disinflationary effect

FTPL: Basics

Empirical model 0000 Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Impulse response sensitivity analysis

- inflation response is larger the shorter the maturity structure of debt
- inflation response is more persistent the more monetary policy responds to inflation

- TPL: Basics

Empirical model

Results

Response to non-Ricardian deficit shock



FTPL: Basics

Empirical model

Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Variance decompositions

- One-period-ahead forecast variance decomposition
 - Non-Ricardian deficit shocks important for inflation (\approx 25%), nominal return on debt (\approx 69%)
 - Non-Ricardian deficit shocks only a fraction of surplus variance (1%)
- Unconditional forecast variance decomposition
 - Non-Ricardian deficit shocks contribute 64% of inflation variance
 - Non-Ricardian deficit shocks contribute only 5% of surplus variance

One period forecast error decompositions

- Inflation decomposition
 - surprise inflation in 2021-22 due largely to wage and price markup shocks
 - large inflationary non-Rlcardian deficit shocks in 1971 and 1975
 - sequence of contractionary (disinflationary) non-Ricardian deficit shocks in 1981-82, 1984-86
 - large contractionary non-Ricardian deficit shock in 1995 ("Contract with America" ?) and later in 1997-98
 - wage and price markup shocks matter too

- TPL: Basics

Empirical model 0000 Inflation: One period forecast error decomposition



TPL: Basics

Empirical model

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Inflation decomposition over historical episodes

- 1971-75
- 1981-86
- 1995-99
- 2008-12
- 2020-22

- TPL: Basics

Empirical model 0000

Inflation decomposition 1971-1975



OOOOOOOOOO

Empirical model 0000

Inflation decomposition 1981-1986



OOOOOOOOOO

Empirical model 0000 Results

Inflation decomposition 1995-1999



O000000000

Empirical model 0000 Results

Inflation decomposition 2008-2012



- I PL: Basics

Empirical model 0000

Inflation decomposition 2020-2022





• Feedback of inflation and output to non-Ricardian surpluses

<□ > < 同 > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ > < □ < つ < ○</p>

- 1959-2008 estimation period
- Alternative measure of primary surpluses

- I PL: Basics

Empirical model 0000 Results

Inflation decomposition 2020-2022



FTPL: Basics

Empirical model

Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Passive fiscal policy

- Original Smet and Wouters specification with active monetary/passive fiscal policy
- Inflation driven largely by wage and price markup shocks
- Has implications for non-Ricardian primary surpluses

- I PL: Basics

Empirical model 0000

Inflation decomposition 2020-2022



Empirical model

Results

Passive non-Ricardian surpluses 2020-2022



FTPL: Basics

Empirical model

Results

▲ロ ▶ ▲周 ▶ ▲ 国 ▶ ▲ 国 ▶ ● の Q @

Conclusions

- Estimate New Keynesian model with active fiscal policy
- Fiscal (non-Ricardian) shocks are an important contributor to inflation fluctuations
- Other shocks matter too:
 - Post pandemic wage and price markup shocks arguably more important than fiscal shocks

FTPL: Basics

Empirical model

Results

▲□▶ ▲□▶ ▲□▶ ▲□▶ ▲□ ● ● ●

Extensions

- Non lump sum fiscal policy (break up surpluses into taxes net of transfers and gov't expenditures)
- Monetary policy in active fiscal regime: maybe Taylor rule is not as appropriate (Leeper and Zhou (2013), Leeper, et al (2019))
- non-Ricardian deficit shocks are like a wedge in gov't debt valuation equation
 - Explore link between non-Ricardian deficit shocks in our framework and time varying liquidity premium (or service flow) from gov't debt (Brunnermeier et al (2021))
- Deeper model of non-Ricardian shocks: why, when, how large?
- Incorporating other NK frictions:
 - Zero lower bound
 - Uncertainty
 - .