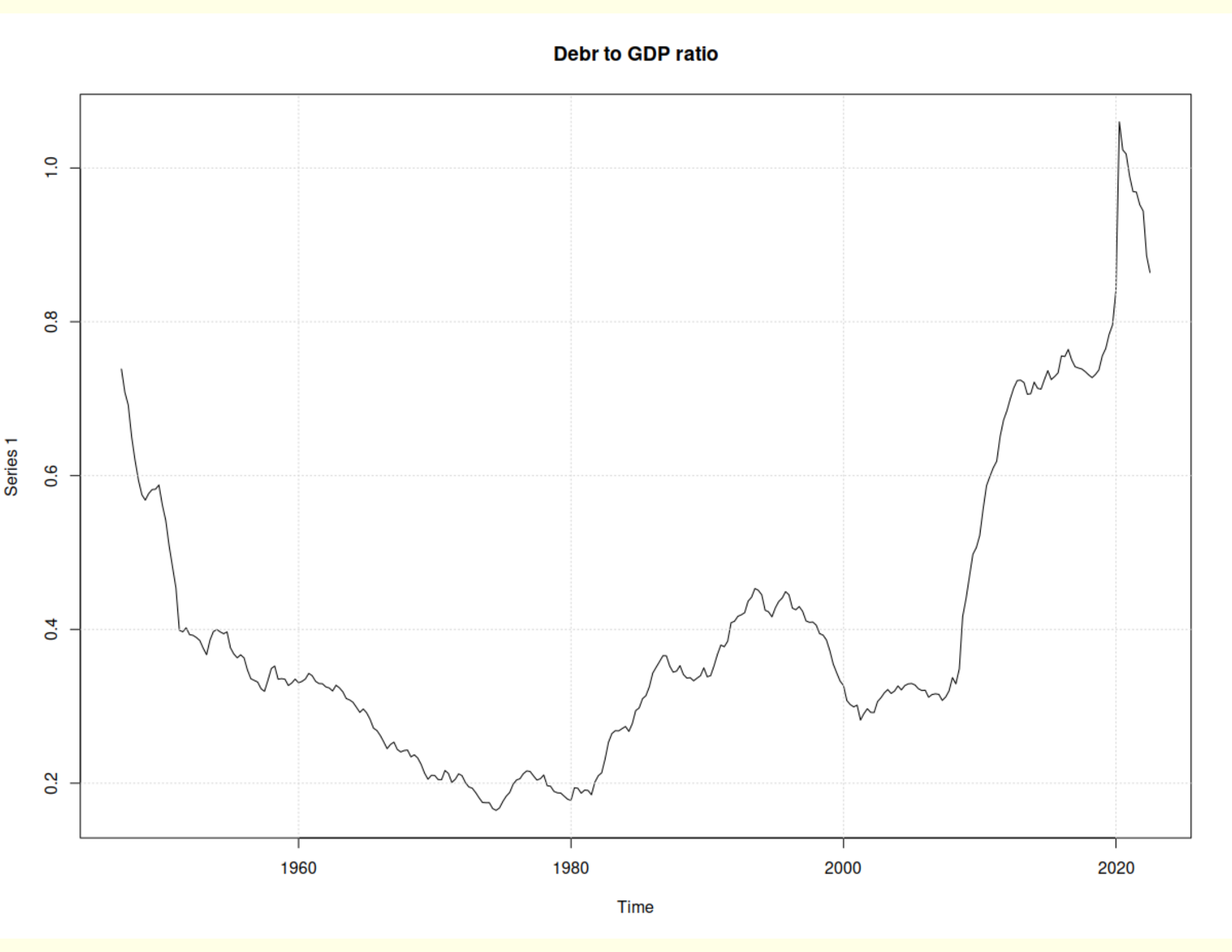
Origins of US Inflation Since 1950: Empirical Food for Thought

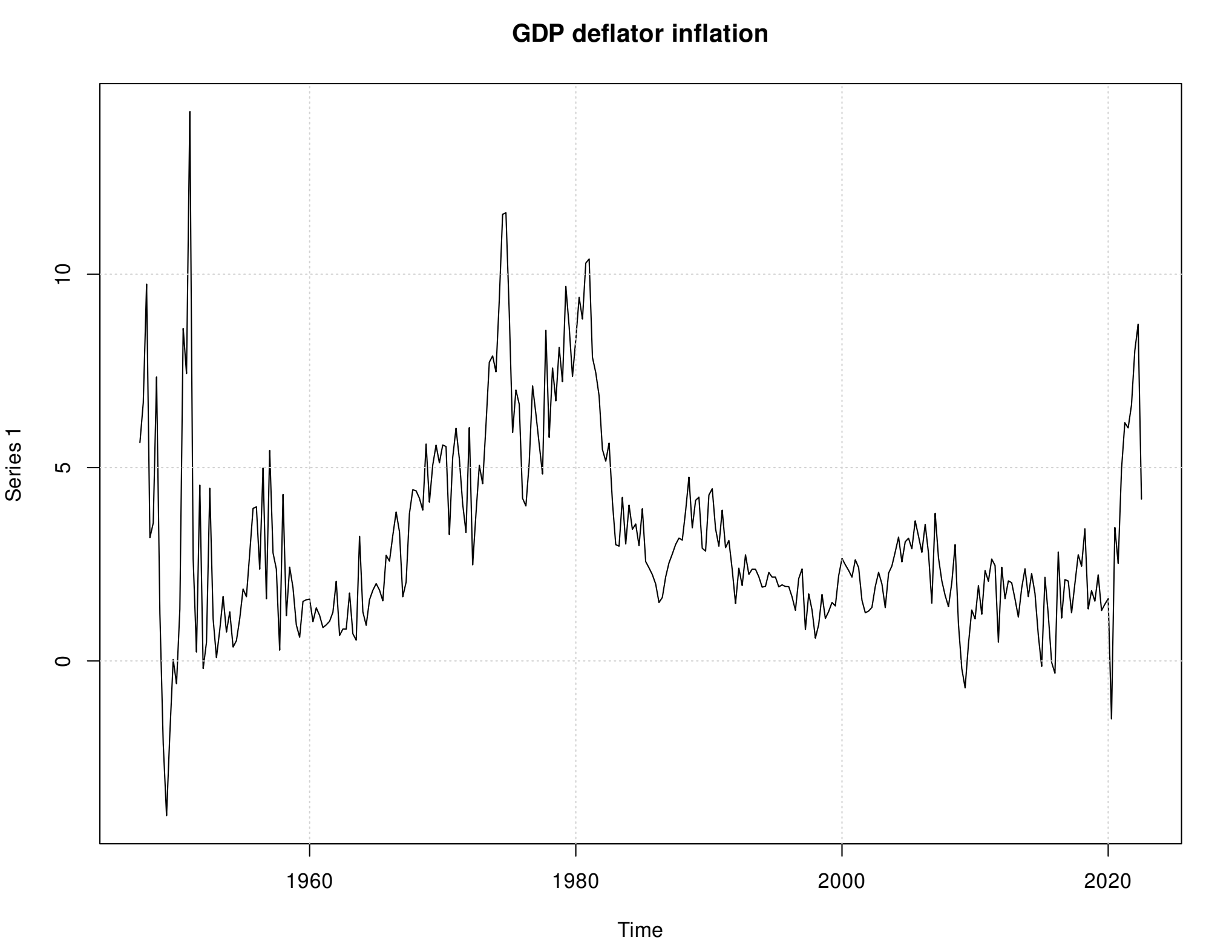
Chris Sims

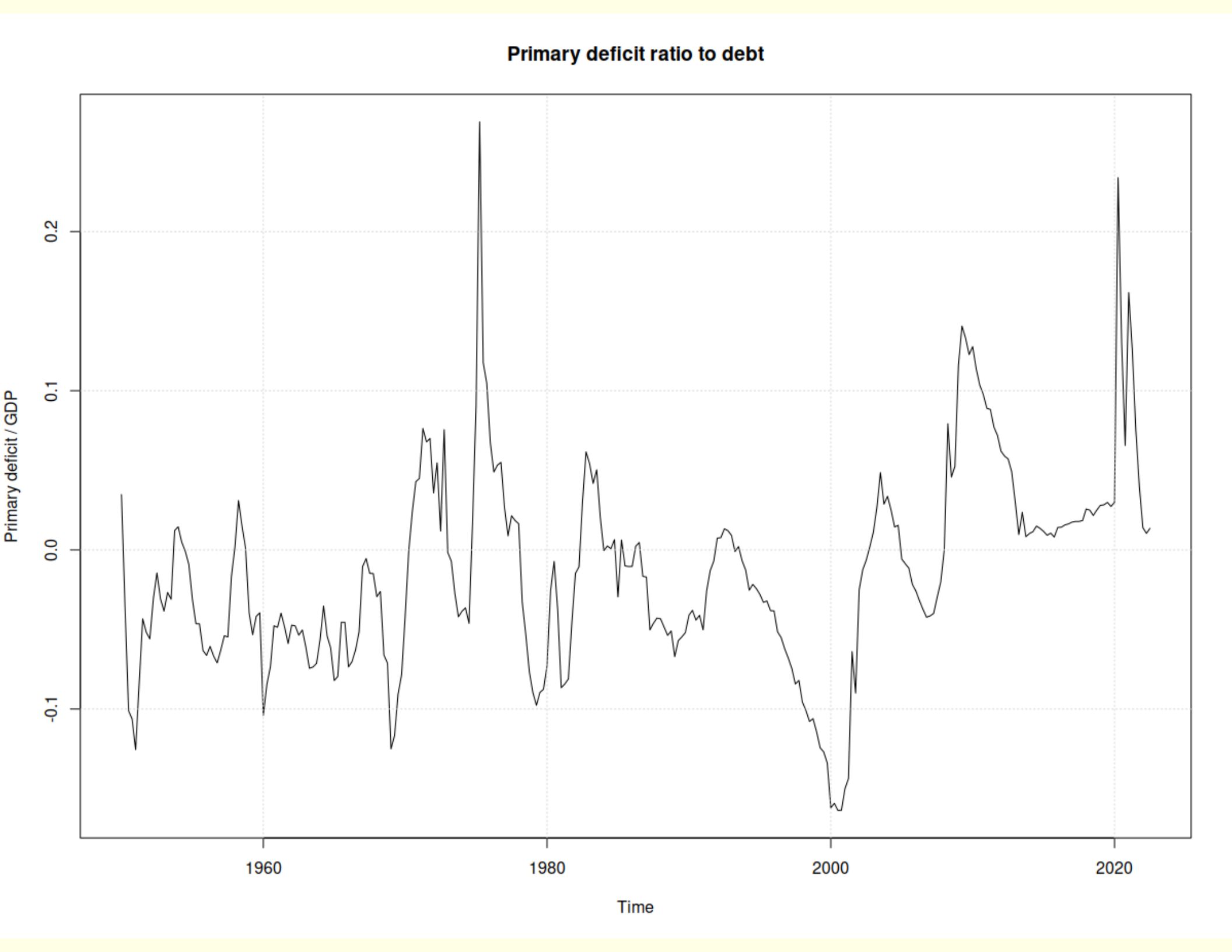
February 7, 2023

Motivation

- US levels of federal debt relative to GDP are currently at levels not seen since the end of World War II.
- The US federal primary deficit to debt ratio has recently been at levels not seen since the mid-1970's.
- US inflation has recently been at levels not seen since the mid 1970's and the 1950's.


Debr to GDP ratio
Series 1
1.0
0.8
0.6
0.4
0.2
1960
1980
2000
2020
Time


GDP deflator inflation
Series 1
0
5
10
1960
1980
2000
2020
Time


Primary deficit ratio to debt
Primary deficit / GDP
0.2
0.1
0.0
-0.1
1960
1980
2000
2020
Time

Has old data become less userul?

- One reaction to this situation might be, "Everything seems to have changed since 2019; older data has become irrelevant".
- This paper's approach: Big surprises in the macro data have occurred before; let's see if by using *more* past data we can learn from them.

Fiscal variables and inflation

- Fiscal variables — the ratio of debt to GDP and to the primary surplus for example — have changed rapidly in recent years.
- We have theoretical models that suggest these changes could be related to inflation.
- This paper looks for evidence in the data that the mechanisms in FTPL theory could be at work.

Comparison to previous semi-structural modeling of fiscal policy

- Much of the previous work has looked for a one-dimensional fiscal effect. We see attempts to estimate a time series of "fiscal shocks", or attempts to estimate a "multiplier".

- Keynesian theory, with its simpler forms suggesting that both monetary and fiscal policy operate through "aggregate demand", may partly explain this.

- Also, the relative success of monetary policy VAR's, where treating monetary policy as one-dimensional (tight or loose) is plausible, may have suggesting doing something similar for fiscal policy.

- But FTPL makes clear that fiscal policy actions, changing taxes or spending, have effects that differ drastically according to what changes in expectations of future fiscal policy accompany them.

- Futhermore, the "GFC" reminded us that sudden increases in the demand for government paper can occur and are likely to be partially accommodated by policy.

The current project

- Estimate a structural VAR, "identified" through time variation in the mutually orthogonal structural shocks, using four fiscal variables, a monetary policy instrument, a measure of financial stress, GDP, and the price level.

- Identification is in quotes here, because the statistical modeling does not deliver directly interpretable shocks or equations.

- Instead it delivers unnamed mutually orthogonal shocks that explain the data. The impulse responses of the variables to the estimated shocks may let us interpret them, as in the "sign restriction" approach to identifying monetary policy VAR's.

The time-varying variance assumption

- Variances of changes in these variables are very different in different periods, so recognizing time variation in variances is necessary for valid inference.

- Assuming these changes are generated by changes in the relative size of a finite dimensional vector of orthogonal shocks amounts to assuming a factor structure on the covariance matrix of variable innovations, a reasonable way to control dimensionality.

- This assumption can under some assumptions lead to interpretable policy effects (i.e., identification). We will see if this is possibly true in these data.

Model structure

$$A(L)y_t = c + \varepsilon_t$$

$$\varepsilon_{it} \sim N(0, \sigma_{it}^2)$$

$$\varepsilon_{is} \perp \varepsilon_{jt} \text{ unless } i = j, s = t$$

structural irf's: $y_t = A(1)^{-1}c + A^{-1}(L)\varepsilon_t$

Variables, regime dates

PDbyD:	Primary deficit ratio to debt
NonIntExpbyD:	Non-interest expenditures ratio to debt
IntExpbyD:	Interest expense ratio to debt
Debt:	Log of dollar value of marketable debt (including Fed holdings)
rgdp:	Log of real GDP
pgdp:	Log of GDP deflator
Rdisc:	Federal Reserve discount rate
BAsprd:	Baa to Aaa bond rate spread

Ends of variance regimes:

1959:4, 1969:4, 1979:3, 1983:4, 1989:4, 1999:4, 2008:3, 2019:4, 2022:3

Important details we skip over

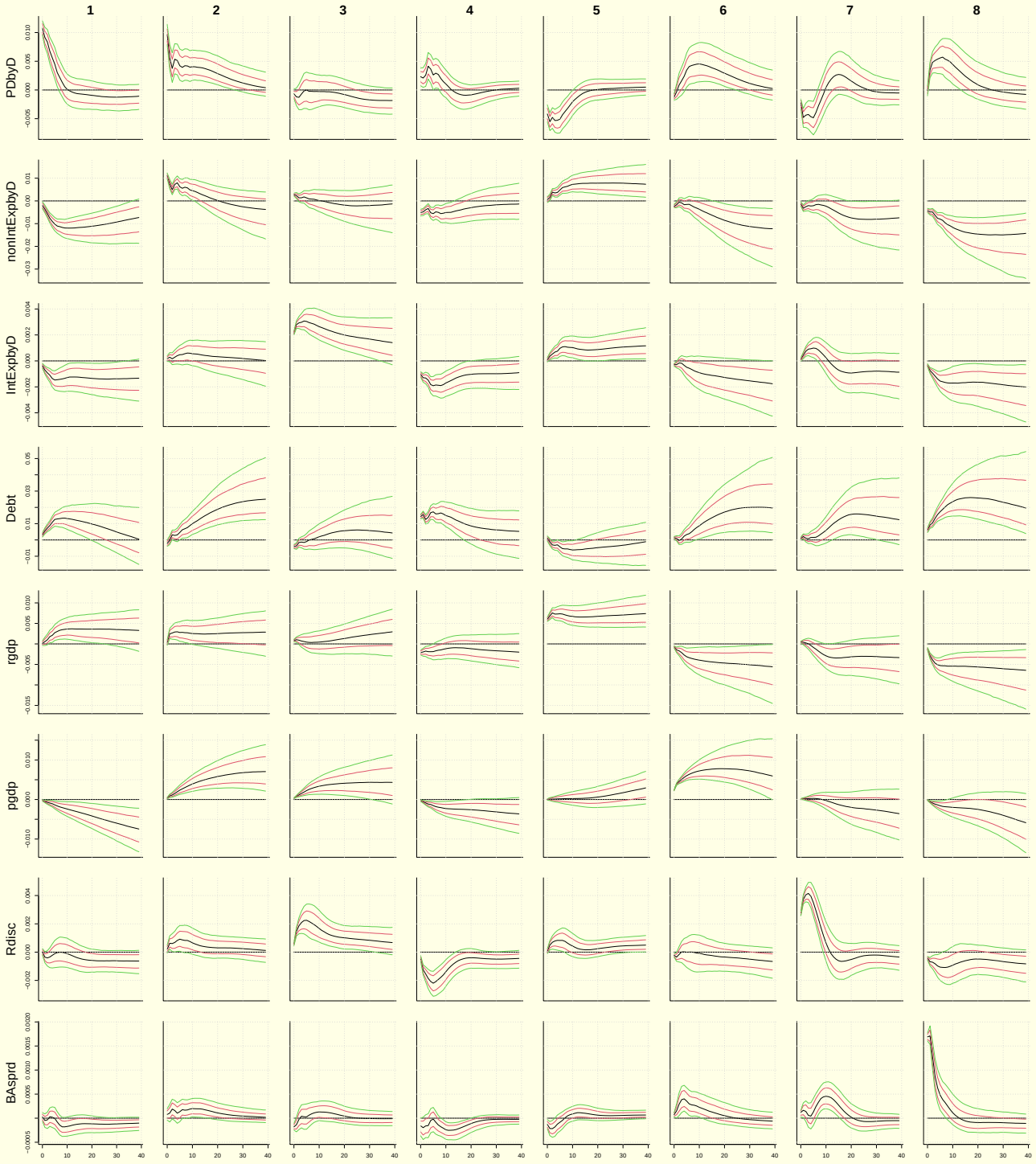
- Estimation is Bayesian, with inference based on the shape of the likelihood and a prior.

- Part of the prior is Minnesota-style, conjugate, based on dummy observations. That on A_0 is normal and independent across coefficients. That on the relative sizes of structural variances is log-normal, normalized to have geometric mean 1 across regimes.

Results

The next slide shows an 8 by 8 array of impulse responses, with 68% and 90% error bands, with one plot for the effect of each of the 8 shocks to each of the 8 variables. we will refer to it in discussing these results.

IRF's for 1950:I to 2022:III data



There are several sources of inflation

Looking across the pgdp row of the plots it's clear that inflation arises from several of the shocks, with the 6th, 2nd and 3rd particularly important — but all except the 5th economically significant and at least marginally statistically significant.

Is one of these shocks a monetary policy shock?

- One of the shocks, number 7, looks like a monetary policy shock: It is the largest component of variation in the discount rate, it lowers GDP growth with a delay, and it lowers inflation, with even more of a delay.

- Note, though, that it is accompanied by an increased primary surplus (or decreased primary deficit). FTPL emphasizes that monetary policy that raises interest rates dampens demand only if it is accompanied by current or future contraction in the primary deficit — which seems to be happening in response to this shock.

- This monetary policy shock accounts for only a small portion of variation in the price level, or even in GDP, and there are some other shocks that account for a substantial fraction of variation in `Rdisc`.

- One of these other shocks, number 3, might be interpreted as a "monetary contraction without fiscal support" shock: it raises interest rates and interest expense, but with no accompanying change in the primary deficit — and, as FTPL predicts, inflationary, not deflationary, effects.

Are there "fiscal shocks" producing inflation?

- The single biggest source of inflation variation is shock 6. Remember that the `line` shows responses of the price *level*. The slopes of these responses are the responses of inflation, and for the first two years or so, the shock 6 inflation responses are much bigger than those of any other shock.

- This inflation surge is not accompanied by an increase in real GDP — in fact real GDP declines in the wake of this shock, so the Phillips curve mechanism is not at work.

- It does, though, show a relatively large, sustained positive response of future (not current) primary deficits.

- The shock could be interpreted as showing a loss of confidence in future fiscal backing for debt translating directlly into current inflation.

A fiscal shock with Phillips curve?

- Shock 2 also pairs a sustained positive primary deficit with increased inflation.

- Unlike shock 6, where the primary deficits come from reduced revenue, this one has almost no change in revenue, but an increase in expenditure and in GDP

A financial shock

- Shock 8 briefly and sharply increases the risk spread, depresses output and prices, and is accompanied by a positive and sustained primary deficit.

- This is interpretable as showing fiscal accomodation to the increased demand for liquid assets accompanying the financial disturbance.

- Note that there is no one-dimensional link from primary deficits to inflation. Some shocks move them both in the same direction, but others, like the financial shock, move them in opposite directions.

Forecasts, as of 2022:3

Annual rates of change over the next two years, with shock variances at geometric mean

	PDbyD	nonIntExpbyD	IntExpbyD	Debt
q10	-0.0479	-0.0810	-0.0250	-0.0422
median	0.0076	-0.0138	-0.0023	0.0821
q90	0.0650	0.0487	0.0199	0.2173

	rgdp	pgdp	Rdisc	BAsprd
q10	-0.0377	0.0077	-0.0160	-0.0120
median	0.0093	0.0285	0.0003	0.0004
q90	0.0520	0.0502	0.0175	0.0132

These show tremendous uncertainty, though nothing very drastic in the median forecast.

More interesting stuff we don't have time for

- Which shocks have relatively high or low variances in which periods?
- Which shocks have large positive or negative values in which periods?
- Which *weighted* shocks are large when? (These observations have the strongest effects on the estimates.)
- What happens if we omit the pandemic period? (Estimates hardly change.)
- What happens if we throw out pre-1970 data? (Haven't done this with exactly this specification.)

- Test for stability of $A(L)$: Compare integrated posterior for this, with integrated posterior from two separate fits to sample split around 1985. (Haven't done this.)

Conclusion

- These results suggest a potential improvement for policy models if they incorporate a richer array of fiscal variables and take account of wealth effects.

- It's not so clear yet that the extension of the data back to 1950 has had a major payoff.

- The software I used for this is an R package in a private git respository. If you're interested, I could send you a clone. Or if there is a lot of interest I cpuld put it on GitHub.