by John H. Cochrane

Discussion

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What the Paper’s About

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- **Answer: No.**
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- Does the Taylor principle uniquely determine equilibrium?
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• Conclusions are bold:
  – cannot rely on monetary policy for determinacy
  – fiscal policy is the only *economic* model that uniquely determines the price level
Estimation & Identification in a Fisherian Model

\[
\begin{align*}
  i_t &= r + E_t \pi_{t+1} \\
  i_t &= r + \phi \pi_t + x_t
\end{align*}
\]\
\[
E_t \pi_{t+1} = \phi \pi_t + x_t
\]

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

\[\phi > 1 : \text{unique bounded solution is}\]

\[\pi_t = \rho \pi_{t-1} - \frac{1}{\phi - \rho} \varepsilon_t\]

- OLS of \(i_t\) against \(\pi_t\) yields \(i_t = \rho \pi_t\) with \(R^2 = 1.0\)
- IV of no help
- Is this about identification or estimation?
Estimation & Identification in a Fisherian Model

• A problem of simultaneous equations bias?
  – it is
  – but there’s more: \( \pi \) dynamics pin down \( \rho \), but then need to use \( Var(\pi_t) \) to estimate both \( \phi \) and \( \sigma^2 \)
  – there is clearly an identification problem
  – there is a contour along which \((\phi, \sigma^2)\) pairs yield identical likelihood values
Likelihood Contour at Maximum

\[ L = \left( \frac{1}{\phi - \rho} \right)^2 \sigma^2 \]
Importance of a Single AR(1) Shock

- Due to Todd Walker
- Generalize: seek a solution $\pi_t = b(L)\varepsilon_t$ with $x_t = a(L)\varepsilon_t$
- Apply the famous Hansen-Sargent formula:
  \[ b(L)\varepsilon_t = \left[ \frac{La(L) - \phi^{-1}a(\phi^{-1})}{1 - \phi L} \right] \varepsilon_t \]
  - now we have the eqm $\pi$ representation: $\phi$ reappears
  \[ \pi_t = \phi\pi_{t-1} + x_{t-1} - \phi^{-1}a(\phi^{-1})\varepsilon_t \]
  - if $x_t$ is AR(1), this collapses to
  \[ \pi_t = \rho \pi_{t-1} - \frac{1}{\phi - \rho} \varepsilon_t \]
  - if $x_t$ anything except AR(1), potentially can estimate $\phi$
JHC claims the problem persists in NK model

Maybe, but it depends on relative variances of the shocks and other parameter estimates

Shocks orthogonal to MP move $\pi_t$ and $i_t$ in the proportion $\phi$

- simultaneous equations estimators can estimate $\phi$

There might be problems estimating other parameters

- but that’s not really JHC’s original point

Is this a critical review of Taylor rules, new Keynesian models, rational expectations, or OLS?

Who is the naked emperor?
Determinacy of Equilibrium

- There are many solutions to $E_t \pi_{t+1} = \phi \pi_t + x_t$, $\phi > 1$
- All except the unique bounded one imply explosive inflation
- JHC: “nothing in economics rules out explosive nominal paths”
  - this point reminiscent of Obstfeld-Rogoff
  - money needs to be “backed” by promise to exchange it for real commodity
Determinacy of Equilibrium

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  - money needs to be “backed” by promise to exchange it for real commodity
- JHC: “the ‘non-Ricardian’ [fiscal theory] fiscal regime is the only economic model that can do so”
  - this point reminiscent of Sims
  - whether exploding $\pi$ is an eqm depends on trans. tech.
  - if non-monetary eqm exists, need right kind of FP to get determinacy
Playing by Cochrane’s Rules

• JHC’s “rules of the game”: take seriously the possibility of equilibria with $\pi \to \infty$ but posit that policy always obeys

$$i_t = \phi(\pi_t/\pi^*_t), \text{ with } \phi_\pi > 1 \quad \text{(TR)}$$

• What’s wrong with these rules of the game?
• JHC’s “rules of the game”: take seriously the possibility of equilibria with $\pi \rightarrow \infty$ but posit that policy always obeys

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(TR)

• What’s wrong with these rules of the game?
  – even though following TR has produced explosive inflation, people expect the CB to continue to follow it
  – JHC applies this logic to argue that if CB followed this policy, we likely would observe hyperinflation
  – we don’t observe hyperinflation, so TR must not be determining the eqm

• Any arguments for bounded equilibria that require amending or suspending TR in extreme circumstances violate the “rules”
What is the Taylor Rule?

• A magical transformation from empirical TR to theoretical TR
  – empirical: reduced-form relationship among endogenous variables over a short sample
  – theoretical: loftier status as a complete specification of how policy behaves in all states of the world

• No one who has estimated TR claims this status for them
  – at best, TR an approximate description of policy in “normal times”

• Determinacy arguments are not about “normal times”

• To study non-normal times, need to change rules of the game
• **New rule:** if I have to take explosive equilibria seriously, I get to specify policy seriously
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  – once $i \approx 0$, abandon “traditional” means to stimulate AD
  – he listed several non-traditional actions
  – few of these can be studied in frictionless, cashless models
Changing the Rules

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• The Federal Reserve Act
  – “price stability”: see Bernanke’s speech
  – “financial stability”: witness 9/11, financial crises
  – in non-normal times, Fed abandons its usual rule
The Economics of Price Level Determination

- There is plenty of *economics* around to uniquely determine equilibrium
- This economics just isn’t represented by a time-invariant Taylor rule with time-invariant passive FP
- Maybe the economics that determines equilibrium is not in most of our models
- Ultimately, though, whether an equilibrium is determinate is...
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  – a *known unknown* that is...
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  - a *known unknown* that is...
  - *unknowable*
What About Fiscal Policy?

- I am a card-carrying fiscal theorist
- I believe fiscal policy does all kinds of things not captured by our models
- Determining the price level might be one of them
- If this is so, it’s more fortuitous than logically preordained
- If you think there are identification problems with MP...
  - just wait until we think about FP
- Opening a whole new kettle of worms
Identifying Fiscal Policy

• Problems to confront in solving this identification

1. **Not even a vague mandate guiding fiscal decisions**

2. **Hard to separate tax rule from “debt-valuation equation”**

3. Multiple decision-making (elected) entities

4. Tremendous detail in tax code and in spending types

5. Potentially important low-frequency phenomena

6. **How to nail down when “news” about fiscal decisions arrives**

7. Complex interactions between monetary & fiscal policies

• Makes identifying MP look like child’s play
A Puzzling Statement

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• Not obvious how to do this with time-invariant policy rules

• Typical fiscal theory eqm
  – net-of-interest surplus exogenous, MP passive ($|\phi| < 1$)
  – MP contraction: $i_t \uparrow$ via open-market sale, $B_t \uparrow, M_t \downarrow$
  – expansion in nominal debt $\Rightarrow P_t \uparrow$, real rate $\downarrow$, $y_t \uparrow$
  – both price and output “puzzles”
  – eqm dynamics completely different
Maybe We Can Change the Rules

- Suppose MP always obeys the Taylor principle
- Tax policy is usually passive \((B_t/P_t \uparrow \implies T_{t+j} \uparrow)\)
- But an explosive inflation path
  - triggers switch in FP to exogenous taxes
  - as \(B/P \downarrow\) with fixed future \(T\), demand falls
  - can this eliminate explosive inflation paths?
- Not sure if this hangs together
- Eqm will always be the NK policy mix
I Agree with Cochrane

- If this is what’s going on, “let that be modeled”