A Discussion of Roger Farmer's **Global Sunspots and Asset Prices in a Monetary Economy**

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Main questions

- How (Do sunspots matter?)
- Can (sunspots matter) enough?

The **How** question

Main mechanism is good old **real indeterminacy** of equilibrium

How - Historical detour

Once upon a time, D. Cass, J. Geanakoplos and A. Mas Colell, M. Magill and M. Quinzii, ... constructed economies where:

- Financial assets were nominal: $n^j = \begin{pmatrix} n_1^j \\ \vdots \\ n_S^j \end{pmatrix}$ - $S = \{1, \ldots, S\}$ is the state space, $J = \{1, \ldots, J\}$ are the assets traded;
- Markets were incomplete, $J < S$.

How - Historical detour

In these economies:

- the relevant asset span is the real asset span $< \left[r^j\right]_{j\in J} >$, where

$$r^j = \begin{pmatrix} \frac{n_1^j}{p_1} \\ \vdots \\ \frac{n_S^j}{p_S} \end{pmatrix}$$

- Given $\left[n^j\right]_{j\in J}$ the real asset span is parametrized by $(p_2, \ldots, p_S)$.

$\Longrightarrow$ real indeterminacy arises: that is, an $S-1$-dimensional manifold of equilibria parametrized by state-dependent inflation rates.

How - This paper

- OLG perpetual youth model with (two types - not necessary for the HOW question?) complete markets
- Main friction: bond is nominal asset
- Equilibrium conveniently reduced to

$$\begin{bmatrix} m(t+1) \\ b(t+1) \end{bmatrix} = \begin{bmatrix} F(m(t), b(t)) \\ G(m(t), b(t)) \end{bmatrix}$$

where $m(t)$ is the marginal rate of substitution at t.

How - This paper

- OLG implies solution is not a function of total wealth (value of tree + value of gov't bonds) $W = p_k(1-\tau) + b$; this is because the consumption decisions of agents born at t only depends on $p_k(t)$, as they hold no gov't bonds;
- Initial conditions + transversality condition (that is, the restriction that exogenous initial condition, $p_k(0)$ and $b(0)$ induce the stochastic discount factor $m(0)$ and $b(0)$ to be on the stable maniforl) do not determine both $p_k(0)$ and $b(0)$ distinctly (and - as noted - the sum is not enough to determine the solution)

$\Longrightarrow$ real indeterminacy arises: that is, a 1-dimensional manifold of equilibria parametrized by inflation rate at $t = 0$: $p(1)/p(0)$.

How - From real indeterminacy to sunspots

Let (S, μ, Σ) be a probability space and m an i.i.d. (over time) random variable in the space.

Then (S, μ, Σ) is the sunspot space.

How - Taking stock

- Sunspots do not really act on (force) m - which is not an exogenous parameter of the model - they act on (force) p, which instead is indeed exogenous and parametrized the real indeterminacy in the model.
- Prices p are in principal observable.

This is good!!

The **Can** question

- The calibration in the paper - taken literally (which I have to) - provides an affirmative answer to the Can question.
- But only with no discipline on the forcing variable p - no link to inflation in the calibration.

Conclusion: What is the real interesting question

- Why should we care whether sunspots CAN matter enough? [historical/inside reasons?]
- Why not instead go back to asking whether they DO matter (caveat for the reader: Cass and Shell posed their question as a DO question but they are theorists, they really answered the "Can sunspot matter?" question)
- Why not even ask HOW MUCH (do sunspots matter?), relatively to the many other asset pricing factors factors people have identified.

Conclusion: Very interesting paper

- If I am right that

  HOW MUCH (do sunspots matter?)

  is the most interesting question in this day and age;
- then this paper, linking sunspots to an observable variable (e.g., inflation) is a clear important step ahead in the right direction.