Discussion of Sophisticated Monetary Policies
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What is the paper about?

Adapting formal framework from Implementation literature to macro model set-up. Notation allows to productively analyze on and off equilibrium path and policies.

Specifically design policies on and off equilibrium path to implement particular outcome: sophisticated policies.

Distinguish between implementation via non-existence vs implementation designing incentives to deviate from average action.

(Formally) Introducing sufficient conditions for implementability: controllability of best response. Sufficient to implement using a regime switch.

Apply to implementation of interest rate rules. Comparisons with monetary supply rules.
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Outline

- Clear, explicit theoretical framework.
- Two completely worked out monetary models, with negative results about desirability of using simple (restricted) interest rate rules to attain uniqueness.
- My discussion: simplify set-up: one period, no uncertainty, general problem.
- Better illustrate some theoretical points.
- Suggest modification for clarity: more specific definitions.
- Substantive message of first model is very simple. Simple static deterministic set-up is rich enough to illustrate it.
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▶ **We agree with those who argue that this approach trivializes the implementation problem.**

▶ **Our approach, in contrast, insists that policies be specified so that a competitive equilibrium can exist following a deviation.**

▶ **Best responses be controllable, in the sense that policies can be found which ensures that, following any deviation, the best response of any individual private agent is different from the average choice of the private agents.**
One Period Problem

▶ \( x(i) \) individual action,
\( x \) average action,
\( y \) economy wide market variable,
\( \delta \) government policy outcome.

▶ Order of moves:
- private agents choose simultaneously \( x(i) \),
- government chooses \( \delta \),
- market determines \( y \) as: \( 0 = E(x, y, \delta) \)

▶ Constraint 0 = \( E(x, y, \delta) \) represents:
- market clearing,
- resource constraints,
- government budget constraint.

▶ Objective function:
\( U(x(i), x, y, \delta) \)
- determines prices, taxes, position of demand curve, etc.
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- CEO $a = (x, y, \delta)$ satisfy two conditions:
  - $x = B(a)$, $x$ is best response
  - $0 = E(a)$, $a$ satisfy Mkt. Eqm. constraint.
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- Multiple Eqm. for policy outcome \( \delta \):
  - \( a = (x, y, \delta) \) is CEO,
  - \( a' = (x', y', \delta) \) is CEO.
One Period Problem

Market Equilibrium Constraint $E$

If we can define function $y = e(x, \delta)$ so that:

- for all $x, \delta$: $0 = E(x, e(x, \delta), \delta)$

Market Eqm. constraint never bind.

In this case we can define an indirect utility function $u(x(i), x, \delta)$ - notice $y$ is not an argument.

Let $u(x(i), x, \delta) \equiv U(x(i), x, e(x, \delta), \delta)$

Define best response $x = b(x, \delta)$:

- solution to: $0 = u_1(b(x, \delta), x, \delta)$.

Competitive Eqm. Outcome (CEO): fixed point of best response $x = b(x, \delta)$.

Advantage: simplicity.

Disadvantage: does not cover case gov. purchases positive, taxes zero. Which gov. policies are restricted is encoded in the definition of $u$.
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- $\{x, \sigma_g\}$ is a Sophisticated Equilibrium if $a = (x, y, \delta)$ is an CEO:

  \[
  \begin{align*}
  x &= B(x, y, \delta) \text{ best response} \\
  0 &= E(x, y, \delta) \text{ mkt. eqm. constraint} \\
  \delta &= \sigma_g(x) \text{ sophisticated policy.}
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- Consider a CEO $a^*$. We can now talk about in and out of equilibrium policy actions implementing it.
Unique Implementation of CEO $a^*$:

A policy is not equilibrium if $x'$ is a solution then $x'$ is a solution, and $y'$ is a solution, then $y'$ is a solution.

For all $x'$ such that $x'$ is not a solution, and $y'$ is not a solution, then $y'$ is not a solution.

Non-Trivial Implementation: Restrict sophisticated policies $\sigma_g$:

For all $x$, there is a $y$ such that:

$0 = E(x, y, \sigma_g(x))$
Unique Implementation of CEO $a^\ast$  ($x^\ast = B(a^\ast), 0 = E(a^\ast)$) for all $(x', y')$ such that

$$x' \neq x \text{ and that } 0 = E(x', y', \sigma_g(x'))$$

it is not optimal for the private sector to choose $x'$:

$$x' \neq B(x', y', \sigma_e(x')).$$
Unique Implementation of CEO $a^*$ ($x^* = B(a^*), 0 = E(a^*)$) for all $(x', y')$ such that

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Trivial Implementation of CEO $a^*$:
Find policy $s(x)$ for which there is no equilibrium: for all $x$

$$0 \neq E(x, y, s(x)) \text{ for all } y$$
Unique Implementation of CEO $a^*$: $(x^* = B(a^*), 0 = E(a^*))$

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- All sophisticated policies are non-trivial.
- Can eliminate $y$ from problem, use $u, b$ (easier).
- Makes less transparent the reason why an equilibrium does not exist.
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If there is a function $y = e(\cdot)$ such that $0 = E(x, e(x, \delta), \delta)$:
- All sophisticated policies are non-trivial.
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- Makes less transparent the reason why an equilibrium does not exist.
A *Controllable best response* allows to uniquely implement a Comp. Eqm. Outcome \( a^* \ (x^* = B(a^*), 0 = E(a^*) \) using a *regime switch*.
A controllable best response allows to uniquely implement a Comp. Eqm. Outcome $a^* (x^* = B(a^*), 0 = E(a^*))$ using a regime switch.

- Find a policy $\tilde{\delta}$ and associated unique CEO $\tilde{a} = (\tilde{x}, \tilde{y}, \tilde{\delta})$ and policy $\bar{\delta}$:
  
  $\tilde{x} = B(\tilde{a}), \quad 0 = E(\tilde{a})$
  
  $x' \neq B(x', y', \bar{\delta})$, for all $x' \neq \tilde{x}$ and $y' : 0 = E(x', y', \bar{\delta})$
  
  $\tilde{x} \neq B(\tilde{x}, \tilde{y}, \bar{\delta})$ and $0 = E(\tilde{x}, \tilde{y}, \bar{\delta})$. 

In general can choose $\bar{\delta} = \delta^*$. 

The following sophisticated government policy uniquely implements $a^* \sigma_g(x^*) = \delta^*$, otherwise switch regime $\sigma_g(x') = \tilde{\delta}$ for all $x' \neq \tilde{x}$, and $x' \neq x^*$, $\sigma_g(\tilde{x}) = \bar{\delta}$.

Notice that for this sophisticated policy $\sigma_g$ to be non-trivial we require that for all $x' \neq x^*$ there is a $y'$ such that $0 = E(x', y', \tilde{\delta})$. 

A **Controllable best response** allows to uniquely implement a Comp. Eqm. Outcome $a^* (x^* = B(a^*), 0 = E(a^*))$ using a **regime switch**.

- **Find a policy** $\tilde{\delta}$ and associated **unique CEO** $\tilde{a} = (\tilde{x}, \tilde{y}, \tilde{\delta})$ and policy $\bar{\delta}$:

  \[ \tilde{x} = B(\tilde{a}), \quad 0 = E(\tilde{a}) \]
  \[ x' \neq B(x', y', \tilde{\delta}), \quad \text{for all} \quad x' \neq \tilde{x} \quad \text{and} \quad y' : \quad 0 = E(x', y', \tilde{\delta}) \]
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- Notice that for this sophisticated policy $\sigma_g$ to be non trivial we require that for all $x' \neq x^*$ there is a $y'$ such that
  
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In words

Using a controllable best response if private agents deviate from \( x^* \) they are faced with a switch to gov. policy outcome \( \tilde{\delta} \).

The new policy \( \tilde{\delta} \) was chosen so that it has a unique equilibrium associated with it.

This is the sense in which uniqueness somewhere leads to uniqueness everywhere.

Notice that implementation in the paper is a bit different: the regime to which the sophisticated policy switches depends on the private agent deviations (there is no unique regime to revert to \( \tilde{\delta} \)).
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Essence of the result of first model can be seen in simpler example.
Interest Rate Rules vs Monetary Supply Rules

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- Consider model:
  - constant output,
  - constant real rate,
  - flexible prices,
  - perfect competition,
  - constant velocity.

- Equilibrium in simple model is completely static:
  - unique interest rate if path of money supply is given.
  - price level indeterminate if nominal interest rate is given.

- Sophisticated policy can uniquely implement equilibrium with interest rate rule:
  - use uniqueness of price path with money supply rule ($\delta$).
  - after deviation of prescribed price level, revert to printing money at a rate consistent with other inflation/price path.

- Authors use more complicated model because it is (more similar to) the one used more frequently in the literature.
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Conclusions

Somewhat **Negative** result about interest rate rules.

The result about interest rates is negative in the sense that they are not used to implement the unique equilibrium. Instead, money supply rules are used upon a deviation. This brings the obvious point, why not use money supply rules directly?

Conclusion: Central Banks do use interest rates as instrument. But, according to the two models in this paper, it is not clear that theoretically the reason is due to out of equilibrium concerns.

(Two) 'big picture' comment(s).

Positive Analysis: what are reasonable ways to model the off-equilibrium conjectures? Are extrapolations from behavior in Eq. path reasonable? (Taylor rules)

Normative Analysis: How should government announce and conduct policy to influence these conjectures?
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