Coordination of Expectations and the Informational Role of Policy

Yang K. Lu  
Ernesto Pasten

Boston University  
Toulouse School of Economics

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Motivation

- Economic fluctuations are large relative to fundamental shocks
  - Hamilton (1989): Two regimes represent well the cycles;

- An appealing explanation: Multiple Equilibria
  - Strategic complementarity (Cooper & John 1988)
  - Equilibrium selection by imperfect information (Morris & Shin 1998)
  - Can a government without a "crystal ball" do something? YES! Policy affects what information is conveyed by public events.
What we do

- We study optimal taxation in an economy *a la* Chamley (1999):
  - Production externality, heterogeneity in costs and persistent shocks on fundamentals;
  - Two regimes: rational "optimism" (boom) and "pessimism" (recession);
  - Transitions: accumulation of shocks occasionally fully reveals fundamentals and triggers expectation switches.

- Informational role of policy: improve coordination.

- How? controlling the size of shocks needed to trigger transitions.

- And extracting information every period.
Key results

- Policy should exploit its dynamic effects:
  control transition & extract information

- Optimal taxation?
  - At the onset of "regimes", static optimal tax rate;
  - To extend booms, gradual and permanent tax cuts;
  - To break recessions, deep but transitory tax cuts;

- Pure policy experimentation is suboptimal:
  transitions are endogenous!
The Economy - Setup

- Agents live for one period, but observe history of aggregate activities $A$ and taxes $\tau$.
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- Each agent owns one indivisible unit of labor

$$U(a, A, c_i, \tau) = \begin{cases} 
(1 - \tau) m(A) - c_i + \phi(g) & \text{if } a = 1 \\
\phi(g) & \text{if } a = 0
\end{cases}$$

Productivity depends on others' actions, $A$ – mass of participation

$$m(A) = \varepsilon + (1 - \varsigma) \varepsilon A$$

Heterogeneous participation cost $c_i H(j \theta)$, $\theta \in [0, 1]$

Signiﬁcant mass of agents with cost $2[\theta, \theta + \sigma]$ – “Cluster”

Key fundamental: $\theta \in [0, 1]$, moving one “step” a time

Public goods: $\phi(g)$ with $g = \tau m(A)$

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- Public goods: $\phi(g)$ with $g = \tau m(A)$
Equilibria with observable fundamental

- Equilibrium cutoff strategy $c^*$ conditional on $\theta$

$$(1 - \tau) m [H(c^* | \theta)] = c^*$$

Distribution of Production Cost $C_i$
Equilibria with observable fundamental

- Equilibrium cutoff strategy $c^*$ conditional on $\theta$

\[(1 - \tau) m[H(c^* | \theta)] = c^*\]
Equilibria with observable fundamental

- Equilibrium cutoff strategy \( c^* \) conditional on \( \theta \)

\[
(1 - \tau) m [H (c^* \mid \theta)] = c^*
\]
Unique dynamics with unobservable fundamental

- Equilibrium cutoff strategy is now conditional on the observable $A$

If $c_t^* = c_L^*$ \quad $\theta_t > c_L^*$ \quad Cluster does not participate \quad $A_t$ constant

$\theta_t < c_L^*$ \quad Part of cluster participates \quad $A_t$ jump up

- Low regime: $\theta_t < c_L^*$ reveals its position by unexpected high $A$
  Transition to the high regime: $c_{t+1}^* = c_H^*$

If $c_t^* = c_H^*$ \quad $\theta_t < c_H^* - \sigma$ \quad Cluster participates \quad $A_t$ constant

$\theta_t > c_H^* - \sigma$ \quad Part of cluster quits \quad $A_t$ jump down

- High regime: $\theta_t > c_H^* - \sigma$ reveals its position by unexpected low $A$
  Transition to the low regime: $c_{t+1}^* = c_L^*$
The tax effect
Unique dynamics with uncertainty

- Tax changes transition triggers $c_L^*(\tau)$, $c_H^*(\tau)$ through payoff
Government

- Timing: taxes announced; agents’ action; taxes levied; $A_t$ observed
- "Benevolent" government cares the aggregate welfare

$$
\max_{\{\tau_t\}_{t=0}^{\infty}} E_0 \left\{ \sum_{t=0}^{\infty} \gamma^t \left[ \int_0^1 U(a, A_t, c, \tau_t) dH(c | \theta) \right] \right\}
$$

- The government only observes public information.
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- Bellman equations conditional on current regime:

$$H(\mu_t) = \max_{\tau_t \in [0,1]} Z(c_H^*, \tau_t) + \gamma \left( 1 - \pi_t^H \right) H(\mu_{t+1}) + \gamma \pi_t^H L(\mu_1)$$

$$L(\mu_t) = \max_{\tau_t \in [0,1]} Z(c_L^*, \tau_t) + \gamma \left( 1 - \pi_t^L \right) L(\mu_{t+1}) + \gamma \pi_t^L H(\mu_1)$$
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- State variable $\mu_t$: belief of $\theta_t$ where $\mu_{it} = \Pr[\theta_t = w_i]$
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- State variable $\mu_t$: belief of $\theta_t$ where $\mu_{it} = \Pr[\theta_t = w_i]$
- Transition prob: $\pi_H^t = \Pr(\theta_t > c_H^* - \sigma); \pi_L^t = \Pr(\theta_t < c_L^*)$
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- **Bellman equations conditional on current regime**:

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  H(\mu_t) = \max_{\tau_t \in [0,1]} Z(c^*_H, \tau_t) + \gamma \left( 1 - \pi^H_t \right) H(\mu_{t+1}) + \gamma \pi^H_t L(\mu_1)
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- **State variable** $\mu_t$: belief of $\theta_t$ where $\mu_{it} = \Pr[\theta_t = w_i]$.

- **Transition prob**: $\pi^H_t = \Pr(\theta_t > c^*_H - \sigma)$; $\pi^L_t = \Pr(\theta_t < c^*_L)$

- **Bayesian updating** $\mu_t$: $\theta_t \in [c^*_L, c^*_H - \sigma]$ if no transition
Trade-offs

- Concave momentary welfare $Z(c^*_S, \tau_t)$
  - Current welfare losses if tax deviates from static optimal level

- Dynamic gain of extending high regimes and shortening low regimes:
  - Tax cuts reduce transition prob in high regimes;
  - Raise transition prob in low regimes.

- Bayesian learning from occurrence of transitions
  - Under tax cuts, if a low regime persists or a high regime ends, fundamentals are learnt to be particularly bad.

Trade-off: current welfare v.s. future chance of being in a high regime taking into account the learning effect.

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Optimal policy - Properties

- Static optimal tax rates right after transitions.
  - revealing extreme $\theta$ value implies no transition prob for $\forall \tau \in [0, 1]$

- In a high regime, small tax cuts set transition prob to zero.
  - Bayesian learning from no transition implies
    \[
    \theta + \sigma < c_H^*(\tau) < c_H^*(\tau - \varepsilon)
    \]

- In a low regime, deep tax cuts increase transition prob but only last for one period if no transition to a high regime.
  - tax cuts are less effective in raising trigger value $c_L^*(\tau)$
  - extremely bad information of $\theta$ is revealed if no transition
Gradual tax cuts to extend optimism; violent tax cuts to break pessimism.
Optimal policy - Accumulated transition probability

- The government has partial, yet relevant control on dynamics.
Optimal policy - Welfare

- The active plan generates significant (ex-ante) welfare improvement over static optimal flat rates
Conclusions

- Large fluctuations without large shocks may be the result of strategic complementarity, heterogeneity and imperfect observation of fundamentals.

- A government – without information superiority – may still improve coordination through the effect of taxes on the amount of information conveyed by past events.

- The key: the triggers for large revisions in expectations.

- Asymmetric policies in business cycles:
  tax cuts should be gradual and permanent in booms
  but violent and transitory in recessions.

- The "informational role of policy" has many other applications:
  technology adoption; speculative attack