Monetary Economics

Rules and Discretion

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Outline

Rules and Discretion

- Long-standing arguments about rules versus discretion
  - Henry Simons, Milton Friedman
  - James Tobin, Robert Solow and Paul Samuelson
- Standard arguments
  - Is a fiat money best, or even very good?
  - How much is known about the effects of monetary policy?
    - ★ When can "doing something" based on good intentions be worse than "doing nothing"?
  - Argument against rules: Rules can only restrict the monetary authority's action compared to discretion and those restrictions only mean that a beneficent, prudent monetary authority is prevented from doing good things

Monetary Policy and Equilibria

- Up until the 1970s, analyses of changes in monetary policy were analyses of interventions
- Interventions: Changes in government policy compared to what agents expected before the change
- The interventions were not expected and the parameters of the model – typically a Keynesian econometric model – were assumed to be constant
- Fiscal policy too, but that is not the topic here

Monetary Policy and Rational Expectations

- Introduction of Rational Expectations changed all that
- Government anticipates what households do
- Households anticipate what government does
- Result is an equilibrium
- The equilibrium can depend on the set of actions available to the government

Time Inconsistency

- If the government has the capability of taking some actions that are beneficial short term and harmful long term, people can be worse off
- Example: Capital expropriation
- Two-period world
- Foreign private agent
  - Invests in capital in first period in foreign country, Xstan
  - Employs people and receives income in first period
  - Receives residual value of capital in second period
- Government seeks to benefit residents of Xstan
  - In first period, it allows the foreigners to invest and has an incentive to not expropriate
  - In the second period after the investment is made, the government has an incentive to expropriate the capital and give it to residents of Xstan
  - If the second period is the end of the world, the government will expropriate and give the value of the capital to residents

Time Inconsistency and Equilibrium

- What is an equilibrium with perfect foresight?
  - If the foreigner expects expropriation, then he will not invest in the country
    - ★ This depends on value of income in first period and residual value of capital but suppose they are consistent with no investment
  - The equilibrium investment is zero
  - Residents of Xstan are worse off than if investment occurred and foreigner received residual value
- Trying to make the residents of Xstan better off by expropriating foreigners actually has made the residents worse off in equilibrium

Time Inconsistency and Equilibrium

- The government's attempt to make the residents of Xstan better off actually has made them worse off in equilibrium
- Solution to dilemma
  - Impose an enforced binding rule that the government will not expropriate
  - Then investment will occur
  - Residents of Xstan better off than with no investment
  - Residents of Xstan worse off than with investment and expropriation, but that is not an equilibrium and will not happen
- Conclusion: A rule binding the policymaker can make everyone better off

Time Inconsistency and Equilibrium with Repetition

- Not all of story
- Suppose there are an infinite number of time periods and many private agents
- It can be an equilibrium that the government has a reputation for not expropriating and it does not expropriate
- This reputation can be supported by the punishment the government and people of Xstan will get if the government expropriates
  - For example, no one will invest in Xstan ever again
  - Or no one will invest in Xstan for long enough that the government and people of Xstan are worse off with expropriation than if they just continued the equilibrium with investment
  - Not investing after expropriation is an example of a "trigger strategy"

Outline

- Describe economy
- Describe monetary authority's goal
- Show equilibrium with given expectations
- Show equilibrium with rational expectations
- Distinguish discretion and a rule

Phillips' Curve

- A simple Phillips curve for output

$$y = y_n + \alpha\left(\pi - \pi^e\right) + \varepsilon$$

  - where y is output
  - y_n is the "natural" level of output
  - π is the actual inflation rate in the period
  - π^e is the anticipated inflation rate in the period
  - ε is a zero-mean error term (innovation) which is serially uncorrelated
  - $\alpha > 0$ and indicates the effect of unexpected inflation on output
- Simplified Phillips curve
  - Does not include other factors, most obviously lagged output reflecting serial correlation of deviations from the natural level of output
  - Does not include any exogenous variables

Monetary Authority

- Monetary authority concerned about output and inflation

$$U = \lambda (y - y_n) - \frac{1}{2}\pi^2$$

- Maximize U
  - Prefer higher output, all else the same, $\lambda > 0$
    - ★ For unemployment, this would be lower unemployment
  - Prefer zero inflation and equally weight higher and lower inflation
    - ★ Could have $-\frac{1}{2}(\pi - \pi^*)^2$ for an inflation rate different than zero

Monetary Authority's Optimal Inflation Rate Given Expectations

- Suppose that monetary authority maximizes given expectations and picks the inflation rate
- Then

$$U = \lambda \left(y_n + \alpha \left(\pi - \pi^e \right) + \varepsilon - y_n \right) - \frac{1}{2} \pi^2$$

- Suppose the monetary authority does not know value of ε when it picks the optimal inflation rate
- Maximize the expected value of utility

$$\mathrm{E}\, U = \mathrm{E}\, \lambda \left(\alpha \left(\pi - \pi^e \right) + \varepsilon \right) - \mathrm{E}\, \frac{1}{2} \pi^2$$

Monetary Authority's Optimal Inflation Rate Given Expectations

- Maximize the expected value of utility

$$\mathrm{E}\, U = \mathrm{E}\, \lambda \left(\alpha \left(\pi - \pi^e \right) + \varepsilon \right) - \mathrm{E}\, \frac{1}{2} \pi^2$$

- First part is linear and λ, y_n, α and π^e are known, $\mathrm{E}\, \varepsilon = 0$ and π is chosen by the monetary authority, so

$$\mathrm{E}\, \lambda \left(\alpha \left(\pi - \pi^e \right) + \varepsilon \right) = \lambda \alpha \left(\pi - \pi^e \right)$$

- Also, because π is chosen by the monetary authority,

$$\mathrm{E}\, \frac{1}{2} \pi^2 = \frac{1}{2} \pi^2$$

Monetary Authority's Optimal Inflation Rate Given Expectations

- Maximize the expected value of utility

$$\mathrm{E}\, U = \lambda\alpha\left(\pi - \pi^{e}\right) - \frac{1}{2}\pi^{2}$$

- Maximization implies

$$\frac{\partial \mathrm{E}\, U}{\partial \pi} = \lambda\alpha - \pi = 0$$

$$\pi = \lambda\alpha$$

- Equilibrium inflation and output are

$$\pi = \lambda\alpha > 0$$

$$y = y_n + \alpha\left(\lambda\alpha - \pi^{e}\right) + \varepsilon$$

Economy and Monetary Authority with Given Anticipated Inflation at Preferred Rate

- Suppose that $\pi^e = \pi^* = 0$. Then

$$\begin{aligned} \pi &= \lambda\alpha > 0 \\ y &= y_n + \alpha(\lambda\alpha) + \varepsilon \end{aligned}$$

- This implies

$$\mathrm{E}\, y = y_n + \alpha^2\lambda > y_n$$

- If people anticipate the preferred inflation rate of zero, it is optimal to have positive inflation to increase expected output above the natural rate

Anticipated Inflation Rate at Rate Set by Monetary Authority

- If people's anticipated inflation rate equals the inflation rate $\pi^e = \lambda\alpha$, then output is

$$\begin{aligned} y =& y_n + \alpha\left(\pi - \pi^e\right) + \varepsilon \\ =& y_n + \alpha\left(\lambda\alpha - \lambda\alpha\right) + \varepsilon \\ =& y_n + \varepsilon \end{aligned}$$

Rational Expectations

- Suppose private agents have rational expectations so

$$\pi^e = \mathsf{E}\left[\pi | I_p\right]$$

  - where I_p is information known to the public
- Suppose private agents know that the monetary authority's optimal choice of the inflation rate is

$$\pi = \lambda\alpha$$

- Then

$$\pi^e = \mathsf{E}\,\pi = \lambda\alpha$$

- and

$$\begin{aligned} \pi &= \lambda\alpha \\ y &= y_n + \varepsilon \end{aligned}$$

- It would be sufficient that people observed inflation of $\lambda\alpha$ long enough. They need not know all the details about the central bank.

An Alternative Equilibrium

- Suppose the central bank were required to set $\pi = 0$ and had no discretion to do otherwise
- With rational expectations by private agents about the monetary authority's setting of the inflation rate, then $\mathrm{E}\,\pi = 0$ and

$$\begin{aligned} \pi &= 0 \\ y &= y_n + \varepsilon \end{aligned}$$

Contrasting Equilibria

- Monetary authority attempts to maximize the expected utility function

$$\mathrm{E}\, U = \lambda\alpha\left(\pi - \pi^{e}\right) - \frac{1}{2}\pi^{2}$$

  - and the equilibrium is

$$\begin{aligned} \pi &= \lambda\alpha \\ y &= y_n + \varepsilon \\ \mathrm{E}\, U &= -\frac{1}{2}\left(\lambda\alpha\right)^{2} < 0 \end{aligned}$$

- The monetary authority is required to set

$$\pi = 0$$

  - and the equilibrium is

$$\begin{aligned} \pi &= 0 \\ y &= y_n + \varepsilon \\ \mathrm{E}\, U &= 0 \end{aligned}$$

Rules and Discretion

- The equilibrium with the monetary authority attempting to maximize expected utility can be characterized as an equilibrium with "discretion"
  - "Equilibrium" with $\pi^e = 0$ and $\pi = \lambda\alpha$ can be called "time inconsistent"
  - This is not an equilibrium with rational expectations
  - I do not use this terminology
  - Can say that the solution with discretion and $\pi = 0$ is "time inconsistent"
  - It is not an equilibrium with rational expectations; it will not happen
- The preferred equilibrium is
  - The equilibrium with the monetary authority required to set inflation to zero can be characterized as an equilibrium with a "rule"

Rules and Discretion

- Many people find this counter-intuitive

  The monetary authority has discretion to make things better and, because it tries to make things better, it makes things worse

- Actually, similar to the capital expropriation example
  - Foreign investors are concerned about expropriation to benefit residents of the country
  - If the government can commit to not expropriate, investment will occur and people will be better off than with no investment
  - If the government cannot commit and it has an incentive to expropriate, the equilibrium is no investment and no expropriation
  - Only with a surprise expropriation can the government get the investment and the expropriation
  - But the expropriation is not a surprise if the investors know the government's incentives or have seen it done before
  - Expropriation is predictable and therefore not a surprise
  - Hence expropriation does not occur in a rational-expectations equilibrium

Rules and Discretion

- Similarly, surprise inflation raises output and this increases expected utility

  The monetary authority has discretion to make things better and, because it tries to make things worse

- Households are concerned about inflation
- If the government can commit to zero inflation, inflation will be zero and the central bank and presumably households will be better off with output at the natural level
- If the government cannot commit and it has an incentive to inflate, the equilibrium is output equal to the natural level and positive inflation
- Only with a surprise inflation can the government get the output increase
- But the inflation is not a surprise if the investors have rational expectations
- Inflation is predictable and therefore not a surprise
- Hence output above the natural level does not occur in a rational-expectations equilibrium
- Inflation higher than the preferred rate of zero does occur

Reputation

- This is an example of a one-shot game
  - The events happen one period and there is no connection to any other period
- Suppose that the single-period is infinitely repeated and there is a connection across periods
  - Then many other things can happen
  - Folk theorem: a cooperative equilibrium, and maybe an infinite number of alternative equilibria, can be supported
  - In this case, there can be an equilibrium in which a central bank with discretion sets the inflation rate to zero and everyone expects that it will do so
  - Can be supported by an expectation, for example, by both the monetary authority and private agents that the expected inflation rate will be $\lambda\alpha$ for some period after a deviation of the inflation rate from zero
- Can say that the monetary authority has a "reputation" for generating zero inflation which is positive marginal-value to the monetary authority compared to the alternative of the discretionary equilibrium

Repeated Game

- Suppose the monetary authority's objective function is

$$\sum_{i=0}^{\infty} \beta^i \, \mathrm{E}_t \, U_{t+i}$$

  - where $\mathrm{E}_t \, U_{t+i}$ is the expected value of utility conditional on information available at period t
- With the expectations of $\mathrm{E}\,\pi = 0$ or $\mathrm{E}\,\pi = \lambda\alpha$, this intertemporal maximization would not affect the result above
- If expectations are formed differently though, the equilibrium could be different

Repeated Game with Trigger Strategy

- The monetary authority's objective function is

$$\sum_{i=0}^{\infty} \beta^i \, \mathrm{E}_t \, U_{t+i}$$

- Suppose that expectations are

$$\pi^e_{t+i+1} = \bar{\pi}$$

if

$$\pi_{t+i} = \bar{\pi}$$

else

$$\pi^e_{t+i+1} = \lambda\alpha$$

  - If the monetary authority generates inflation greater than π^e_{t+i}, then the public expects higher inflation in the future for one period
  - This is a simple example of a trigger strategy
    - ★ Pull the trigger on punishment

Repeated Game with Trigger Strategy

- With these expectations, there is a link between periods
- There is a gain from higher inflation in period $t + i$
- There is a loss because people will expect higher inflation next period
- Monetary authority weighs off the benefit and the cost
- This example is a trigger strategy with punishment for one period
- Can have punishment for any number of periods, including forever
  - Grim strategy

Gain and Loss

- Without loss of generality we can evaluate this for period t and $t+1$ (i.e. for $i = 0$ and i could just as well be any other number)
- Assume as above that the inflation goal is zero inflation

Gain from Higher Inflation

- What is the gain from raising inflation from $\bar{\pi}$ to a higher level π^d (inflation deviating from expected)
- Expected utility with actual and expected inflation of $\bar{\pi}$

$$\mathrm{E}\,\bar{U}_t = \lambda\alpha\left(\bar{\pi} - \bar{\pi}\right) - \frac{1}{2}\bar{\pi}^2 = -\frac{1}{2}\bar{\pi}^2$$

- Expected utility with deviation instead to π^d

$$\mathrm{E}\,U_t^d = \lambda\alpha\left(\pi^d - \bar{\pi}\right) - \frac{1}{2}\left(\pi^d\right)^2$$

- Gain in expected utility is

$$\mathrm{E}\,U_t^d - \mathrm{E}\,\bar{U}_t = \lambda\alpha\left[\pi^d - \bar{\pi}\right] - \frac{1}{2}\left[\left(\pi^d\right)^2 - \bar{\pi}^2\right]$$

  - The first part is positive and the second part is negative
- The gain is maximized when

$$\pi^d = \lambda\alpha$$

Loss Next Period from Higher Inflation This Period

- There is a loss in expected utility next period
- Expected utility in $t+1$ if do not deviate in t from $\bar{\pi}$

$$\mathrm{E}\,\bar{U}_{t+1} = \lambda\alpha\left(\bar{\pi} - \bar{\pi}\right) - \frac{1}{2}\bar{\pi}^2 = -\frac{1}{2}\bar{\pi}^2$$

- Expected utility in $t+1$ if expected inflation is $\lambda\alpha$ and the inflation rate in $t+1$ is set at π_1^d

$$\mathrm{E}\,U_{t+1}^d = \lambda\alpha\left(\pi_1^d - \lambda\alpha\right) - \frac{1}{2}\left(\pi_1^d\right)^2$$

  - $\pi = \lambda\alpha$ is the optimal inflation rate for any given expected inflation rate in a single period, so the π which maximizes EU_{t+1}^d is $\pi_1^d = \lambda\alpha$
- Change in expected utility is

$$\mathrm{E}\,U_{t+1}^d - \mathrm{E}\,\bar{U}_{t+1} = \lambda\alpha\left[\pi_1^d - \lambda\alpha\right] - \frac{1}{2}\left[\left(\pi_1^d\right)^2 - \bar{\pi}^2\right]$$

Gain and Loss

- If start from $\bar{\pi}$, the equilibrium gain this period from raising inflation this period is

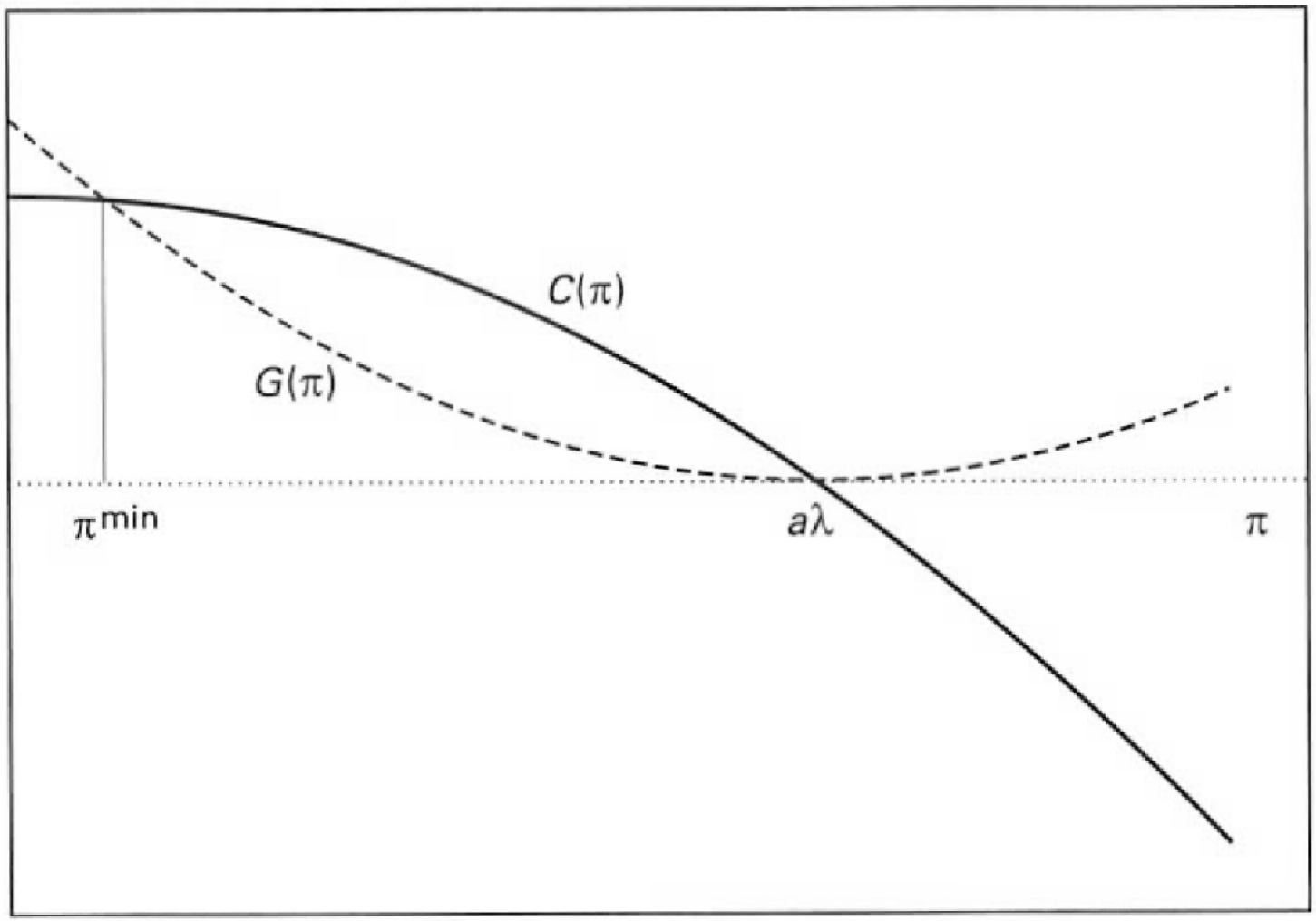
$$\mathrm{E}\, U^d - \mathrm{E}\, \bar{U} = \lambda\alpha \left[\lambda\alpha - \bar{\pi}\right] - \frac{1}{2}\left[(\lambda\alpha)^2 - \bar{\pi}^2\right] = G\left(\bar{\pi}\right)$$

  - Temptation to cheat
- If start from $\bar{\pi}$, the equilibrium present value of the loss in utility next period from raising inflation this period is

$$\mathrm{E}\, U_1^d - \mathrm{E}\, \bar{U}_1 = \frac{1}{2}\beta\left[(\lambda\alpha)^2 - \bar{\pi}^2\right] = C\left(\bar{\pi}\right)$$

  - Enforcement
- What are equilibrium values of $\bar{\pi}$?
- If gain from deviating is less than the cost, no deviation
- If gain from deviating is greater than the cost, always deviate

Gain and Loss Graphically



Central Bank Types

- What if uncertain about central banks' preferences?
- Prefer more or less inflation or relative weight of tradeoff between inflation and output
- Announcements to help private agents distinguish type

Preferences

- Preferences of a central banker may differ from that of the government or society
- A preference for less inflation can reduce the effect of discretion on the inflation rate

Contracts I

- Can interpret the higher inflation with discretion as the result of incorrect incentives
- Rather than rely on reputational equilibria, impose a "rule" on the central bank
- Impose a utility function
- A simple goal would be zero inflation
  - This imposes a goal variable and its value
  - The central bank chooses how to achieve the goal
- Suppose impose that goal
- What happens if inflation is one percent per year? Two percent per year?
- This is an example of a principal-agent problem
  - The principal is the government
  - The agent is the central bank
- Make the central banker's pay contingent on performance

Contracts II

- One possibility: The more inflation deviates from the goal, the less the central banker is paid
- I have not heard of this being done
- Another possibility: Fire the central banker if there is a "large" deviation
- I have not heard of this happening in this context

- In the United States, the Federal Reserve determines the inflation target
  - No real penalty for deviating
  - Not even clear that the Federal Reserve has convinced Congress that two percent inflation is a good target
- Is it a "rule" if the central bank determines it and announces it?
  - No monetary or employment penalty for deviating
- Some governments have the preferences imposed by the government
  - New Zealand is an example
    - ★ Government provides an inflation target to the central bank
    - ★ The central bank must explain deviations
    - ★ Did this have an effect than if there weren't an imposed inflation target?

Contracts III

- Under Humphrey-Hawkins, the Federal Reserve had a similar situation with money growth targets announced
  - ★ The Federal Reserve in its reports would emphasize the measure of money that came closest to the target
  - ★ The Federal Reserve then would explain why the other measures deviated more than the emphasized one

Institutions I

- Institutions can be a way to produce various outcomes
- Central bank independence is one
  - Argument is that independence can reduce the effect of short-run political incentives on the central bank
- Institutions also can include the structure of a system
  - A single central banker
  - A committee decides on monetary policy
  - How are the central banker or central bankers chosen? How often?

How Have Central Banks Done? I

- Is the inflation bias important empirically?
- Have central banks done well? Or at least better than a gold standard?
  - One paper which says "no" is Selgin, Lastrape and White (Journal of Macroeconomics, 2012)

"Time Inconsistency" in Other Contexts I

- "Time consistency" has received a lot of play over the years in monetary economics
- It is important in other contexts as well
- Foreign investment is obvious from the discussion above
- Bailouts
  - "We will not bail out financial institutions in a crisis"
  - In a crisis, policymakers are confronted by possibly large negative effects on the economy if they do not bail out institutions
    - ★ The costs may be perceived as not very probable – although the probability is unknown – but the costs could be very, very large
    - ★ A state of uncertainty, which can make it optimal to avoid the possible very bad outcome
  - Policymakers say they will bail out firms this time but never again
  - The incentive to do it in the next financial crisis is the same as before
  - They will bail out firms
  - Bailouts are the expected results and firms and households adapt to that expectation and the implied relative prices of various activities
  - Bailouts are insurance against bad outcomes and "moral hazard" occurs

"Time Inconsistency" in Other Contexts II

  - V.V. Chari and Patrick J. Kehoe AER 2016, "Bailouts, Time Inconsistency, and Optimal Regulation" is an example of the application to another important area
  - Gerald P. Dwyer, 2019, "Macroprudential Regulation of Banks and Other Financial Institutions" in Handbook of Central Banking also discusses this issue
- Regulation more generally
  - Regulators will impose large costs on regulated firms that deviate from rules
  - In the event, the large costs are not politically sustainable, maybe because of costs imposed on other parties
  - The regulator does not impose the harsh penalty
  - Regulated firms do not expect the harsh penalty
  - Instead regulated firms expect the actual penalty

Summary I

- It used to seem natural to think that a central bank with discretion could achieve anything that a rule could achieve
  - Just use discretion to produce exactly what the rule would indicate
- This argument is incorrect in general if agents' expectations reflect what the central bank actually does given the central bank's incentives
  - As Milton Friedman showed, it also is incorrect if the central bank has an imperfect model of the economy (which everyone surely does)
- In an infinite-horizon equilibrium, it is possible for a central bank with discretion to produce the same outcomes as the rule
- Can interpret the central bank as having a "reputation" for producing low inflation
  - A trigger strategy
  - If the central bank produces higher inflation to increase output one period, it is punished for deviating from the target inflation rate
  - Households expect a higher inflation rate next period or longer
- "Time inconsistency" underlies much discussion of central banks' reputations

Summary II

- Note that the central bank produces good outcomes not because it wants to produce low inflation given its incentives if left alone, but because the central will be punished if it produces high inflation

- "Time inconsistency"is important in other contexts as well