Reputation and the Credibility of Inflation Plans

Rumen Kostadinov
McMaster

Francisco Roldán
IMF

Expectativas, Inflación y Crisis: celebrando los 75 años de Daniel Heymann
Universidad de Buenos Aires, Diciembre 2024

The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

What is credibility?

- Macro models: expectations of future policy determine current outcomes
- Policy typically set assuming **commitment** or **discretion**

- Governments actively attempt to influence beliefs about future policy
  - Forward guidance, inflation targets, fiscal rules...

- This paper   Rational-expectations theory of the credibility of announcements
  ... borrowing insights from game-theory literature on reputation
- Application in a (modernized) Barro-Gordon setup

What is credibility?

- Macro models: expectations of future policy determine current outcomes
- Policy typically set assuming **commitment** or **discretion**

- Governments actively attempt to influence beliefs about future policy
  - Forward guidance, inflation targets, fiscal rules...

- **This paper** Rational-expectations theory of the credibility of announcements

  ... borrowing insights from game-theory literature on reputation
- Application in a (modernized) Barro-Gordon setup

Our approach

- Reputation is other agents' belief about my commitments

  … conceptualize commitment with private-information behavioral types

- Discipline (rational expectations)

  … can only have reputation for possible things

  … reputation changes through Bayes' rule after actions and announcements

- Setup
  - Initial announcement of inflation targets

    … collapses the set of reputations
  - Continuation equilibrium *given a plan*

    … Crucial assumption: government action observed imperfectly

    … Dynamics of reputation

Our approach

- Reputation is other agents' belief about my commitments

  … conceptualize commitment with private-information behavioral types

- Discipline (rational expectations)

  … can only have reputation for possible things

  … reputation changes through Bayes' rule after actions and announcements

- Setup
  - Initial announcement of inflation targets

    … collapses the set of reputations
  - Continuation equilibrium *given a plan*

    … Crucial assumption: government action observed imperfectly

    … Dynamics of reputation

Our approach

- Reputation is other agents' belief about my commitments

  … conceptualize commitment with private-information behavioral types

- Discipline (rational expectations)

  … can only have reputation for possible things

  … reputation changes through Bayes' rule after actions and announcements

- Setup
  - Initial announcement of inflation targets

    … collapses the set of reputations
  - Continuation equilibrium *given a plan*

    … Crucial assumption: government action observed imperfectly

    … Dynamics of reputation

Main results

1. Compare continuation equilibria of different plans
   - … Larger deviations are **easier** to detect
   - … ‘More time-inconsistent’ plans have a more negative average drift of reputation
   - … Tradeoff between credibility and promised outcomes
2. Main result choose a back-loaded plan with gradual disinflation
   - … Gradualism helps incentives and slows down reputation losses
   - … despite no inertia or other *real* reasons for gradualism
3. Take the limit as *initial reputation* vanishes to zero
   - … Gradualism result is preserved

Literature

- **Sustainable plans** – anything goes
  from Kydland and Prescott (1977), Chari and Kehoe (1990), Abreu, Pearce, and Stacchetti (1990), Phelan and Stacchetti (2001)

- **Reputation without noise** – zero inflation at onset
  Milgrom and Roberts (1982), Kreps and Wilson (1982), Barro (1986), Backus and Driffill (1985), Barro and Gordon (1986), Sleet and Yeltekin (2007)

  Dovis and Kirpalani (2019) – constant but more than zero

- **Reputation with noise**
  Commitment: Lu (2013), Lu, King, and Pastén (2008, 2016)
  Static plans: Faingold and Sannikov (2011)

- **Preference uncertainty with noise** – announcements irrelevant
  Cukierman and Meltzer (1986), Faust and Svensson (2001), Phelan (2006), Amador and Phelan (2024), etc

Roadmap

- Model
- Continuation equilibria
- Plans
- Concluding remarks

Model

Framework

- A government dislikes inflation and output away from a target $y^\star > 0$

$$L_t = \mathbb{E}_t\left[\sum_{s=0}^{\infty} \beta^s \left((y^\star - y_{t+s})^2 + \gamma\pi_{t+s}^2\right)\right]$$

- A Phillips curve relates output to current and expected future inflation

$$\pi_t = \kappa y_t + \beta\mathbb{E}_t\left[\pi_{t+1}\right]$$

- The government controls inflation only imperfectly (through g_t)

$$\pi_t = g_t + \epsilon_t$$

with $\epsilon_t \overset{iid}{\sim} F_\epsilon$

Reputation

- The government can be rational or one of many *behavioral* types
  - Behavioral types $c \in \mathcal{C}$
  - Type c is committed to an inflation plan $\{a_t\}_{t=0}^{\infty}$
  - For simplicity let all plans have $a_{t+1} = \phi_c(a_t)$ [Finding the state is an art]
- Behavioral types have (total) probability z (initial reputation)
  - Conditional on behavioral, probability ν over $\mathcal{C}$
- Private sector knows z and ν
  - Does *inference* over the government's type
  - Uses announcements and inflation observations

Reputation

- The government can be rational or one of many *behavioral* types
    - Behavioral types $c \in \mathcal{C}$
    - Type c is committed to an inflation plan $\{a_t\}_{t=0}^{\infty}$
    - For simplicity let all plans have $a_{t+1} = \phi_c(a_t)$ [Finding the state is an art]
- Behavioral types have (total) probability z (initial reputation)
    - Conditional on behavioral, probability ν over $\mathcal{C}$
- Private sector knows z and ν
    - Does *inference* over the government's type
    - Uses announcements and inflation observations

Behavioral types

- What is the set $\mathcal{C}$?

  $\cdots$ and associated possible ϕ_c functions

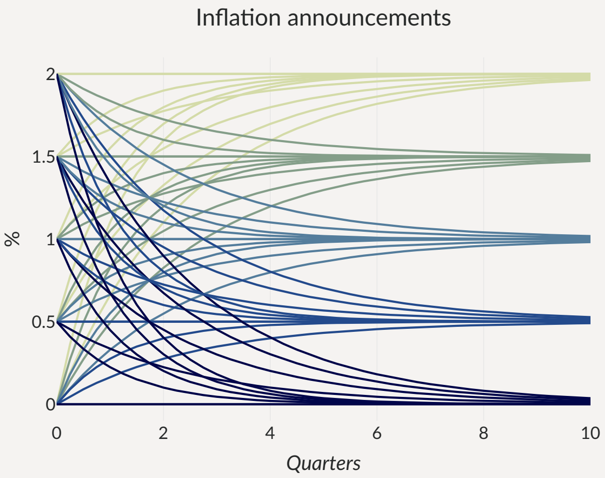
- Consider $\{a_t\}_t$ paths characterized by
  - Starting point a_0
  - Decay rate ω
  - Asymptote χ

$$a_t = \chi + (a_0 - \chi)e^{-\omega t}$$
$$\phi(a) = \chi + e^{-\omega}(a - \chi)$$

Behavioral types

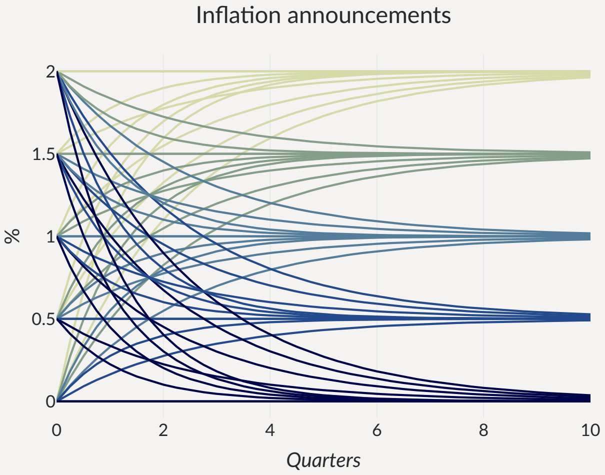
- What is the set $\mathcal{C}$?
  - $\cdots$ and associated possible ϕ_c functions
- Consider $\{a_t\}_t$ paths characterized by
  - Starting point a_0
  - Decay rate ω
  - Asymptote χ

$$a_t = \chi + (a_0 - \chi)e^{-\omega t}$$
$$\phi(a) = \chi + e^{-\omega}(a - \chi)$$



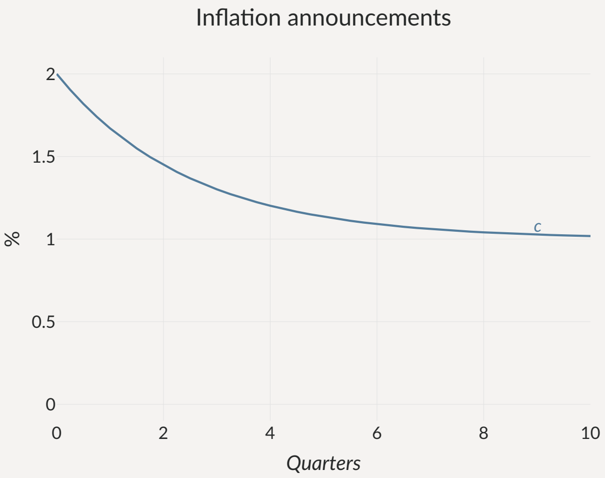
Gameplay

- At $t = 0$, inflation targets are announced
  - Type $c \in \mathcal{C}$ says c
  - Rational type strategizes announces r possibly $\in \mathcal{C}$
- At time $t \geq 0$, the government sets inflation
  - Behavioral type $c \in \mathcal{C}$ implements $g_t = a_t^c$
  - Rational type acts strategically chooses $g_t \lesseqgtr a_t^c$



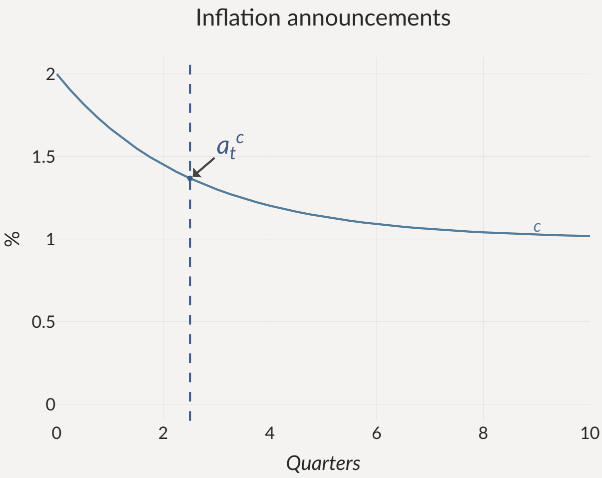
Gameplay

- At $t = 0$, inflation targets are announced
  - Type $c \in \mathcal{C}$ says c
  - Rational type **strategizes** announces r possibly $\in \mathcal{C}$
- At time $t \geq 0$, the government sets inflation
  - Behavioral type $c \in \mathcal{C}$ implements $g_t = a_t^c$
  - Rational type acts strategically chooses $g_t \lesseqgtr a_t^c$



Gameplay

- At $t = 0$, inflation targets are announced
  - Type $c \in \mathcal{C}$ says c
  - Rational type **strategizes** announces r possibly $\in \mathcal{C}$
- At time $t \geq 0$, the government sets inflation
  - Behavioral type $c \in \mathcal{C}$ implements $g_t = a_t^c$
  - Rational type acts **strategically** chooses $g_t \lesseqgtr a_t^c$



Continuation equilibria

Reputation and Outcomes

- Output is determined by **beliefs** $\mathbb{E}_t[\pi_{t+1}]$ and **actual inflation** $\pi_t = g_t + \epsilon_t$

$$\pi_t = \kappa y_t + \beta \mathbb{E}_t[\pi_{t+1}] = \kappa y_t + \beta \mathbb{E}_t\left[\mathbb{1}_c a^c_{t+1} + (1 - \mathbb{1}_c) g^\star_{t+1}\right]$$

- Private sector solves a **signal extraction** problem to update beliefs

$$\mathbb{P}(c \mid \pi_t, \mathcal{F}_{t-1}) = \frac{\mathbb{P}(c \mid \mathcal{F}_{t-1}) \cdot f_\epsilon(\epsilon_t | c)}{\mathbb{P}(c \mid \mathcal{F}_{t-1}) \cdot f_\epsilon(\epsilon_t | c) + (1 - \mathbb{P}(c \mid \mathcal{F}_{t-1})) \cdot f_\epsilon(\epsilon_t | r)}$$

Reputation and Outcomes

- Output is determined by **beliefs** $\mathbb{E}_t\left[\pi_{t+1}\right]$ and **actual inflation** $\pi_t = g_t + \epsilon_t$

$$\pi_t = \kappa y_t + \beta \mathbb{E}_t\left[\pi_{t+1}\right] = \kappa y_t + \beta \mathbb{E}_t\left[\mathbb{1}_c a^c_{t+1} + (1 - \mathbb{1}_c) g^\star_{t+1}\right]$$

- Private sector solves a **signal extraction** problem to update beliefs

$$\mathbb{P}\left(c \mid \pi_t, \mathcal{F}_{t-1}\right) = \frac{\mathbb{P}\left(c \mid \mathcal{F}_{t-1}\right) \cdot f_\epsilon(\epsilon_t | c)}{\mathbb{P}\left(c \mid \mathcal{F}_{t-1}\right) \cdot f_\epsilon(\epsilon_t | c) + \left(1 - \mathbb{P}\left(c \mid \mathcal{F}_{t-1}\right)\right) \cdot f_\epsilon(\epsilon_t | r)}$$

Reputation and Outcomes

- Output is determined by **beliefs** $\mathbb{E}_t\left[\pi_{t+1}\right]$ and **actual inflation** $\pi_t = g_t + \epsilon_t$

$$\pi_t = \kappa y_t + \beta \mathbb{E}_t\left[\pi_{t+1}\right] = \kappa y_t + \beta \mathbb{E}_t\left[\mathbb{1}_c a^c_{t+1} + (1 - \mathbb{1}_c) g^\star_{t+1}\right]$$

- Private sector solves a **signal extraction** problem to update beliefs

$$\mathbb{P}\left(c \mid \pi_t, \mathcal{F}_{t-1}\right) = \frac{\mathbb{P}\left(c \mid \mathcal{F}_{t-1}\right) \cdot f_\epsilon(\epsilon_t | c)}{\mathbb{P}\left(c \mid \mathcal{F}_{t-1}\right) \cdot f_\epsilon(\epsilon_t | c) + \left(1 - \mathbb{P}\left(c \mid \mathcal{F}_{t-1}\right)\right) \cdot f_\epsilon(\epsilon_t | r)}$$

Reputation and Outcomes

- Output is determined by **beliefs** $\mathbb{E}_t\left[\pi_{t+1}\right]$ and **actual inflation** $\pi_t = g_t + \epsilon_t$

$$\pi_t = \kappa y_t + \beta \mathbb{E}_t\left[\pi_{t+1}\right] = \kappa y_t + \beta \mathbb{E}_t\left[\mathbb{1}_c a^c_{t+1} + (1 - \mathbb{1}_c) g^\star_{t+1}\right]$$

- Private sector solves a **signal extraction** problem to update beliefs

$$p_{t+1} = \frac{p_t \cdot f_\epsilon(\pi_t - a^c_t)}{p_t \cdot f_\epsilon(\pi_t - a^c_t) + (1 - p_t) \cdot f_\epsilon(\pi_t - g^\star_t)}$$

Rational type's problem

Given an announcement c,

- The problem of the rational type is, given expectations $g_c^\star$

$$\begin{aligned}
\mathcal{L}^c(p,a) &= \min_g \mathbb{E}\left[(y^\star - y)^2 + \gamma\pi^2 + \beta\mathcal{L}^c(p', \phi_c(a))\right] \\
\text{subject to } \pi &= g + \epsilon \\
\pi &= \kappa y + \beta\left[p'\phi_c(a) + (1-p')g_c^\star(p', \phi_c(a))\right] \\
p' &= p + p(1-p)\frac{f_\epsilon(\pi - a) - f_\epsilon(\pi - g_c^\star(p,a))}{pf_\epsilon(\pi - a) + (1-p)f_\epsilon(\pi - g_c^\star(p,a))}
\end{aligned}$$

- Rational expectations requires $g_c^\star$ to be the policy associated with $\mathcal{L}^c$

A First Look at Different Plans

Observation

- Plans $c \in \mathcal{C}$ are

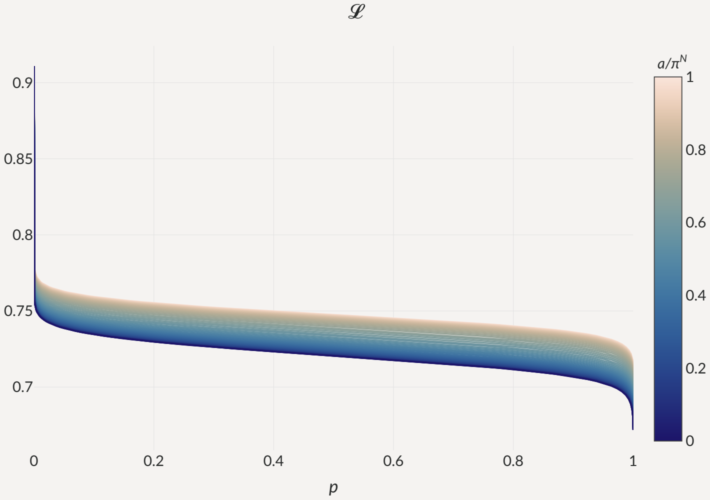
$$c = (a_0, \chi, \omega)$$

- For $a, b \in \mathbb{R}$

$(\mathcal{L}, g^\star)$ is a continuation equilibrium for (a, χ, ω) $\iff$ $(\mathcal{L}, g^\star)$ is a continuation equilibrium for (b, χ, ω)

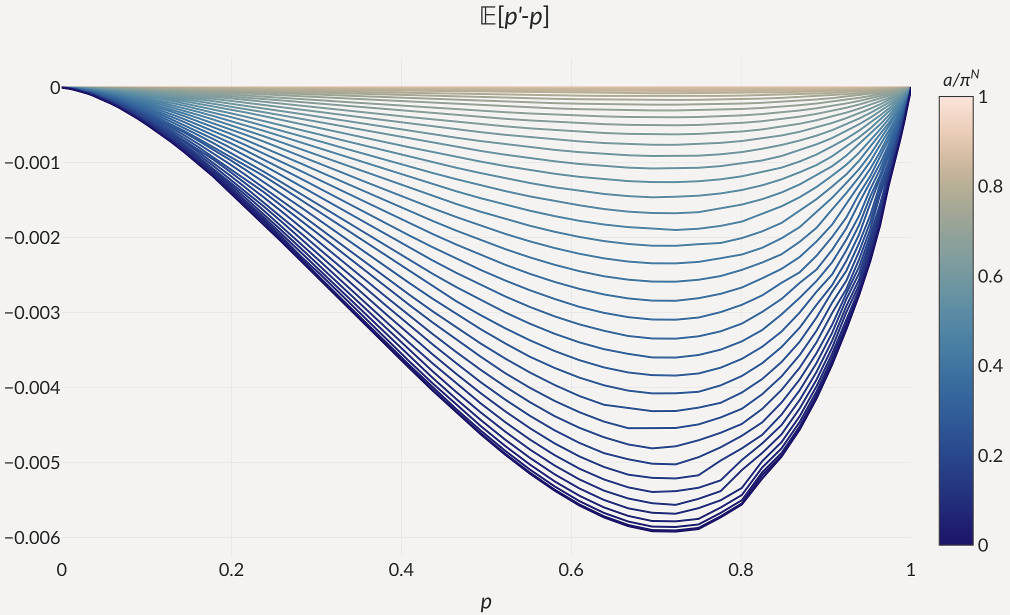
- Means $a \mapsto \mathcal{L}^c(p, a)$ compares the same plan at **different** plans and **different** times

The Value Function

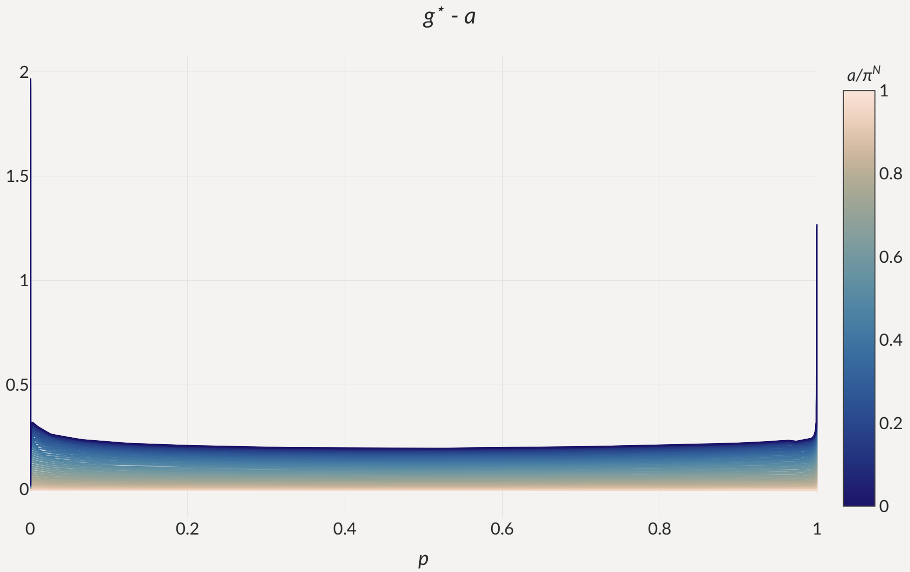


- $\mathcal{L}$ decreasing in p
- $\mathcal{L}$ convex-concave in p
- $\mathcal{L}$ increasing in a for large p only

Reputation Dynamics



Equilibrium Deviations



Credibility

- Let π^N be the Nash equilibrium inflation of the stage game. Then

$$\forall c \in \mathcal{C}: \qquad g_c^\star(p,a) \leq \pi^N$$

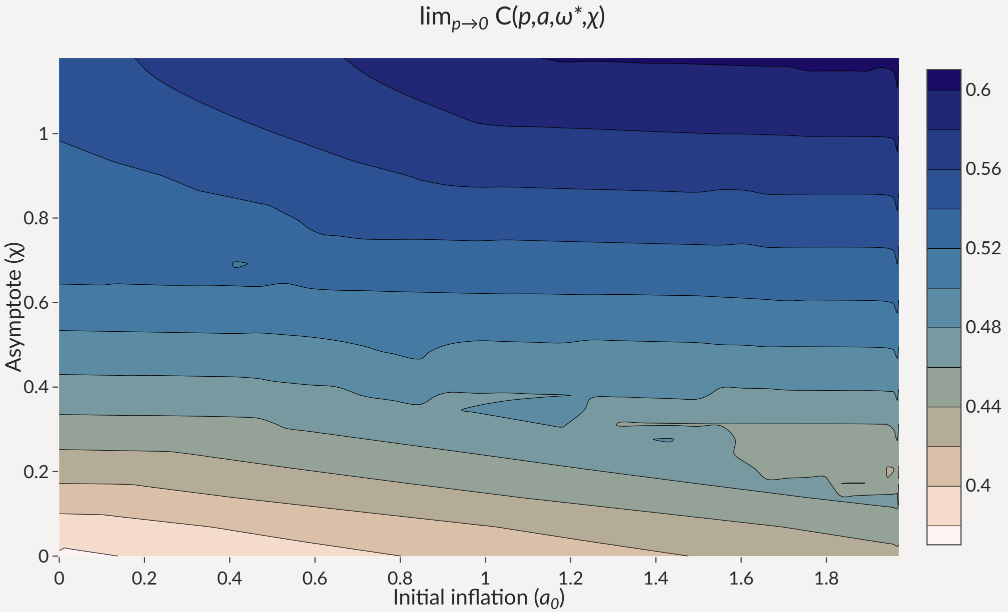
- Define the *remaining credibility* of a plan as

$$C_c(p,a) = (1-\beta)\frac{\pi^N - g_c^\star(p,a)}{\pi^N - a} + \beta\mathbb{E}\left[C_c(p_c'(p,a),\phi_c(a))\right]$$

- If $0 \leq g^\star(p,a) \leq \pi^N$ always, then $C_c \in [0,1]$

Plans

Credibility

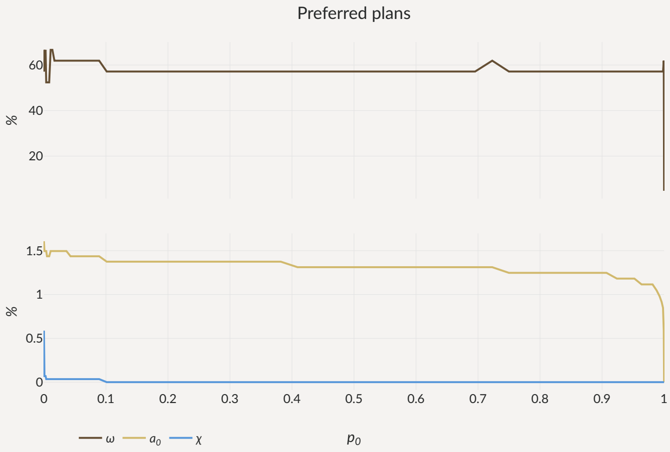


Plans

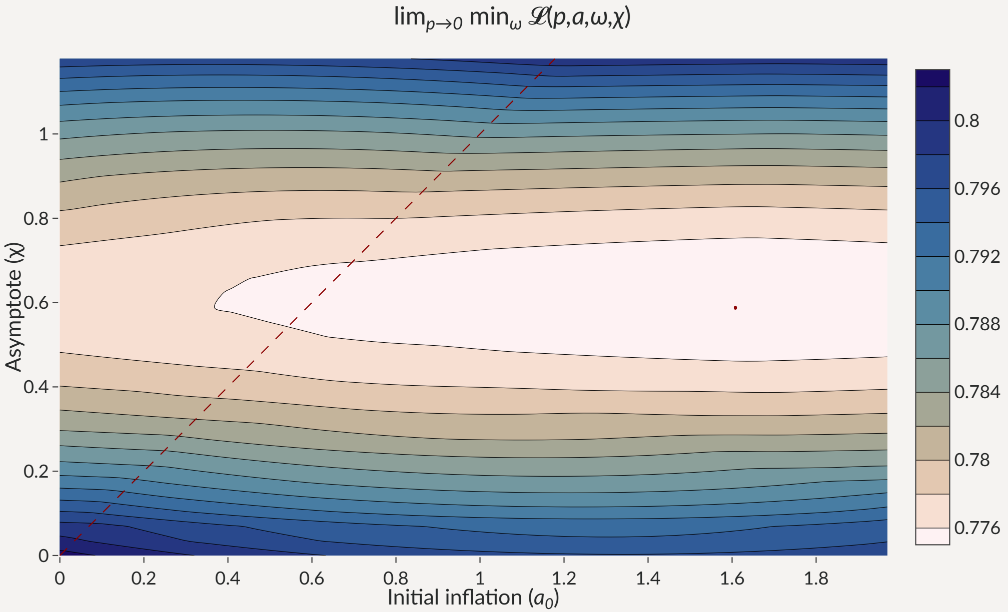
- For each $c \in \mathcal{C}$, find $\mathcal{L}^c(p, a), g_c^\star(p, a)$.
- Generates big matrix $\mathcal{L}(p, a; \omega, \chi)$
- First pass: preferred plan at each p

Plans

- For each $c \in \mathcal{C}$, find $\mathcal{L}^c(p,a), g^\star_c(p,a)$.
- Generates big matrix $\mathcal{L}(p,a;\omega,\chi)$
- First pass: preferred plan at each p



K-equilibrium



Concluding remarks

Concluding remarks

- Model of reputational dynamics and policy
  - Simple environment
  - Focus on low reputation limit

- Credibility dynamics concerns influence choice of policy
  - Tradeoff between promises and incentives
  - Gradual plans boost reputation-building incentives for future decision-makers

- Structure of reputation maps into the incentive constraint of a planner's problem

  … creating large option values of complying

  … which are larger when the plan is backloaded

Scan to find the paper