The Perils of Nominal Targets

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Introduction

- Nominal targets have taken center stage in the design of monetary policy frameworks:
  - Inflation,
  - Price level,
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  - Inflation,
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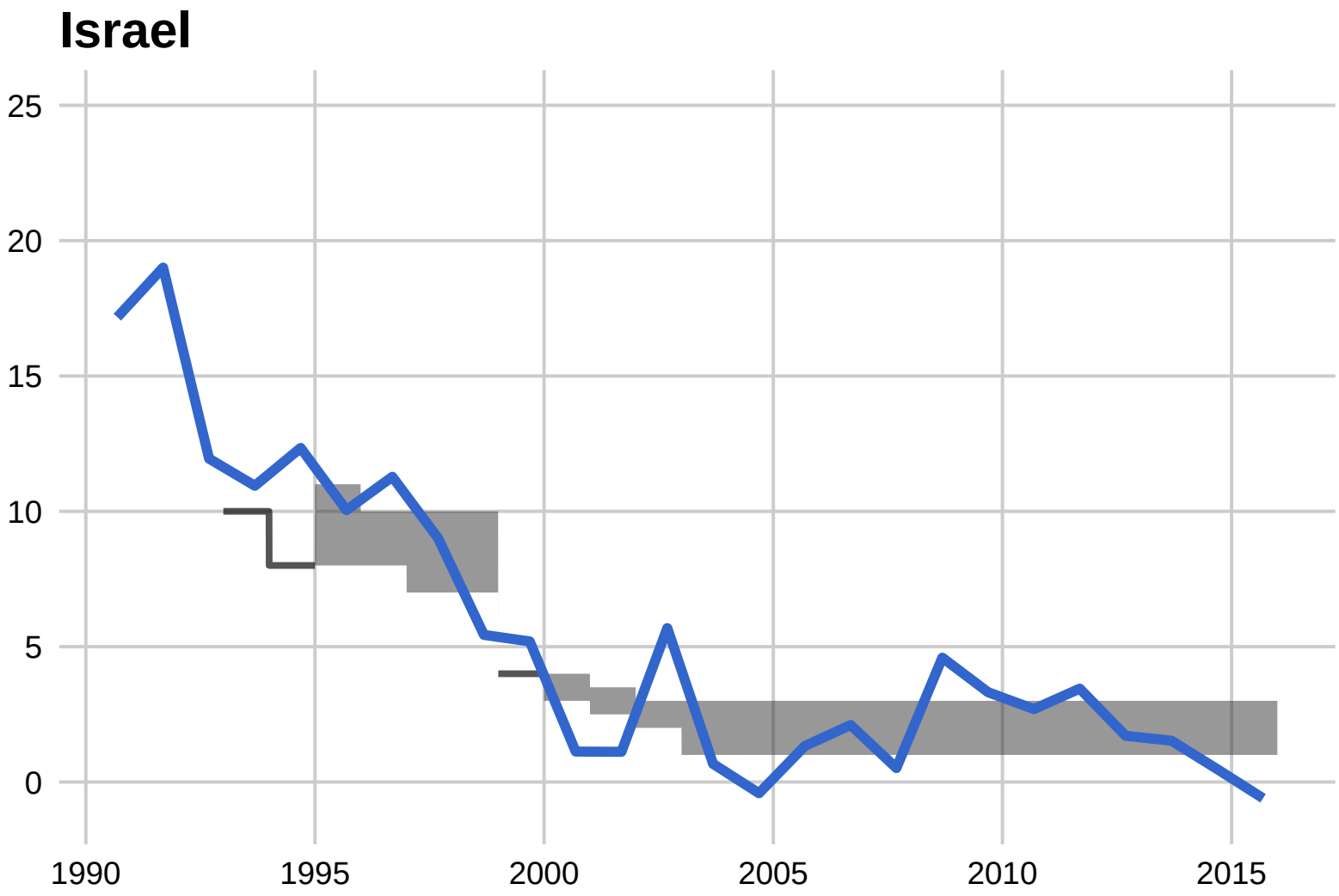
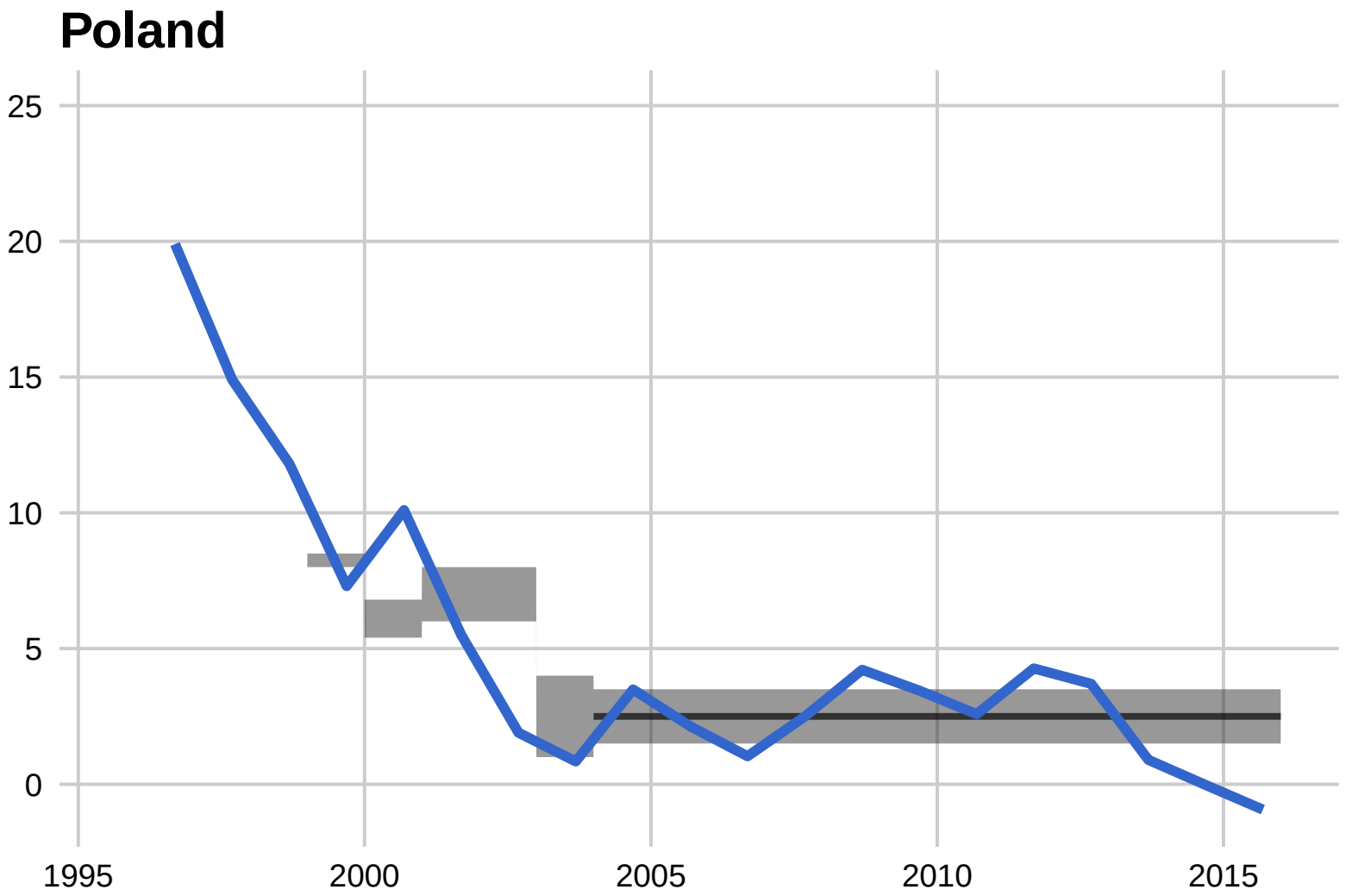
  - Nominal GDP ...
- Inflation targeting, in particular, has proven very successful at curbing high inflation rates in both developed and developing economies.
  - Yet to be seen whether IT can redress *low* inflation.

Inflation targeting: Israel



Inflation targeting: Poland



Commitment is necessary...

- It is well understood that nominal targets require a firm commitment by the monetary authority.
  - "An institutional commitment to inflation targeting appears essential for inflation targeting to have much meaning," Svensson (EER, 2002)
  - "[It is necessary] for the central bank to be committed (and be understood to be committed)," Eggertsson and Woodford (*Brookings*, 2003).
  - Most IT countries have formalized their commitment in legislation or in their communications.

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Due to the zero lower bound (ZLB), there may be no policy rate that achieves the targets when private-sector expectations stray from them in the first place.

- The central bank may only be able to disprove the expectations by drifting further away from the target.
- There exist an additional equilibrium where the central bank undershoots its nominal targets systematically and output averages below the efficient level.

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- There exist an additional equilibrium where the central bank undershoots its nominal targets systematically and output averages below the efficient level.

Commitment to pursue a nominal target is a *necessary but not sufficient* condition for the monetary authority to achieve it.

Interest-rate stabilization

- Inflation expectations *are* anchored on a single equilibrium if the monetary authority has a strong goal for *interest-rate stabilization*.
- Ideally, a *long-term* interest rate should be targeted since it is mainly determined by inflation expectations and would not interfere with stabilization policy.

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- Ideally, a *long-term* interest rate should be targeted since it is mainly determined by inflation expectations and would not interfere with stabilization policy.
- Interest-rate stabilization, though, may enable other, non-stationary equilibria (e.g., sunspots).

1-2-3 New Keynesian model

New Keynesian Phillips curve (NKPC)

$$\pi_t = \kappa y_t + \beta \pi^e_{t+1} + u_t, \tag{1}$$

Euler equation,

$$R_t = \sigma \left(y^e_{t+1} - y_t \right) + \pi^e_{t+1} + v_t, \tag{2}$$

The ZLB for the nominal interest rate

$$R_t \geq -Z. \tag{3}$$

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- Assume the private sector expects inflation to be constant at π^e from date t onward.
  - Expected output gap set accordingly to the NKPC

$$y^e = (1 - \beta)\pi^e/\kappa.$$

- I solve for the *correspondence* between expectations π^e and what the central bank can achieve at date t.

Upper bounds on π and y

- The ZLB at date t implies a lower bound on the real rate,

$$\begin{aligned} R_t &= \sigma\left(y^e - y_t\right) + \pi^e \geq -Z, \\ r_t &\geq \underline{r}\left(\pi^e\right) \equiv -Z - \pi^e. \end{aligned}$$

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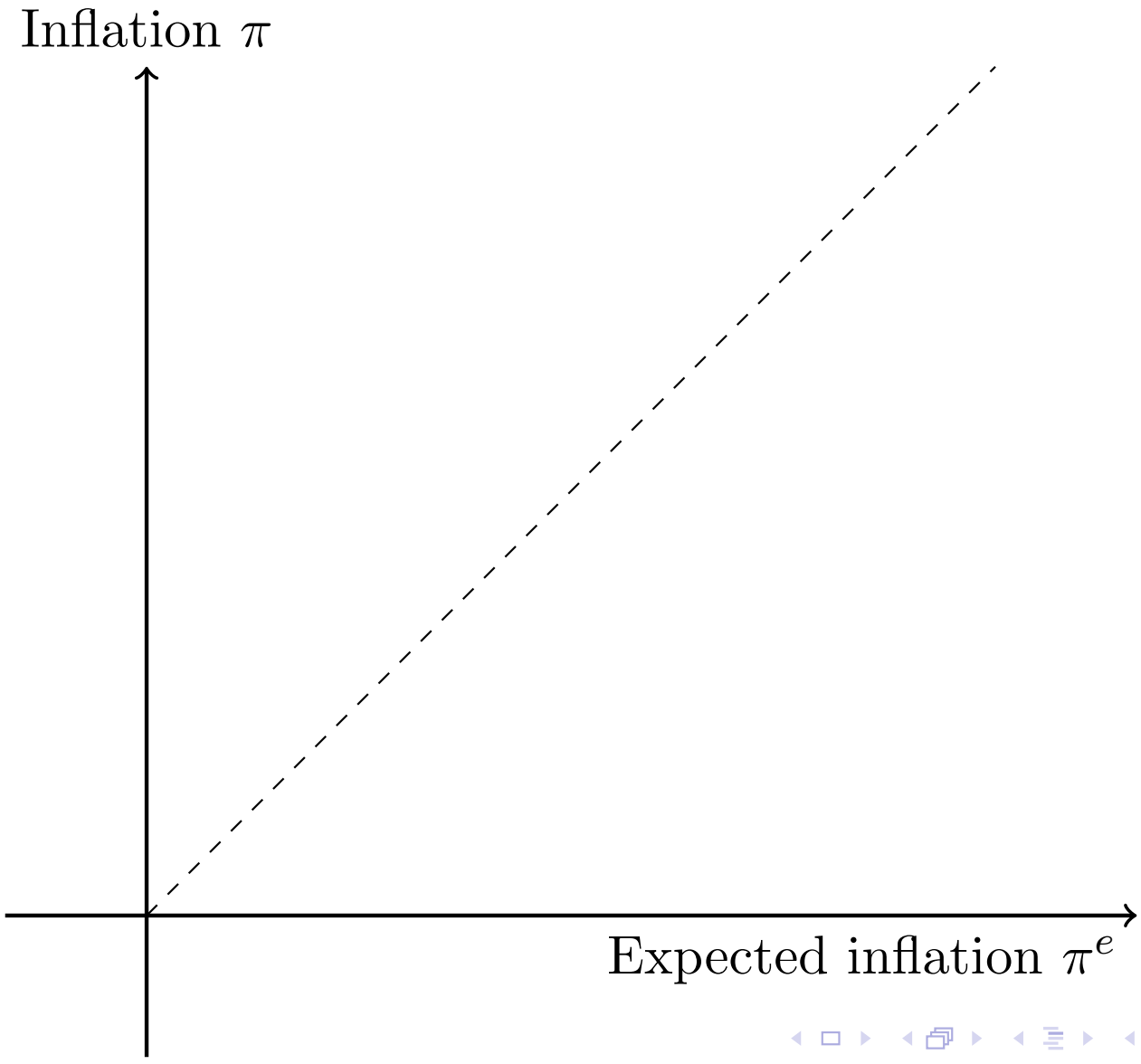
  which in turn is an upper bound inflation and output:

$$\begin{aligned} y_t &\leq \bar{y}\left(\pi^e\right) \equiv \frac{1}{\sigma} Z + \left(\frac{1}{\sigma} + \frac{1-\beta}{\kappa}\right)\pi^e, \\ \pi_t &\leq \bar{\pi}\left(\pi^e\right) \equiv \frac{\kappa}{\sigma} Z + \left(\frac{\kappa}{\sigma} + 1\right)\pi^e. \end{aligned}$$

- The lower inflation expectations are, the smaller the central bank's choice set for date t.

Feasible set and best response functions



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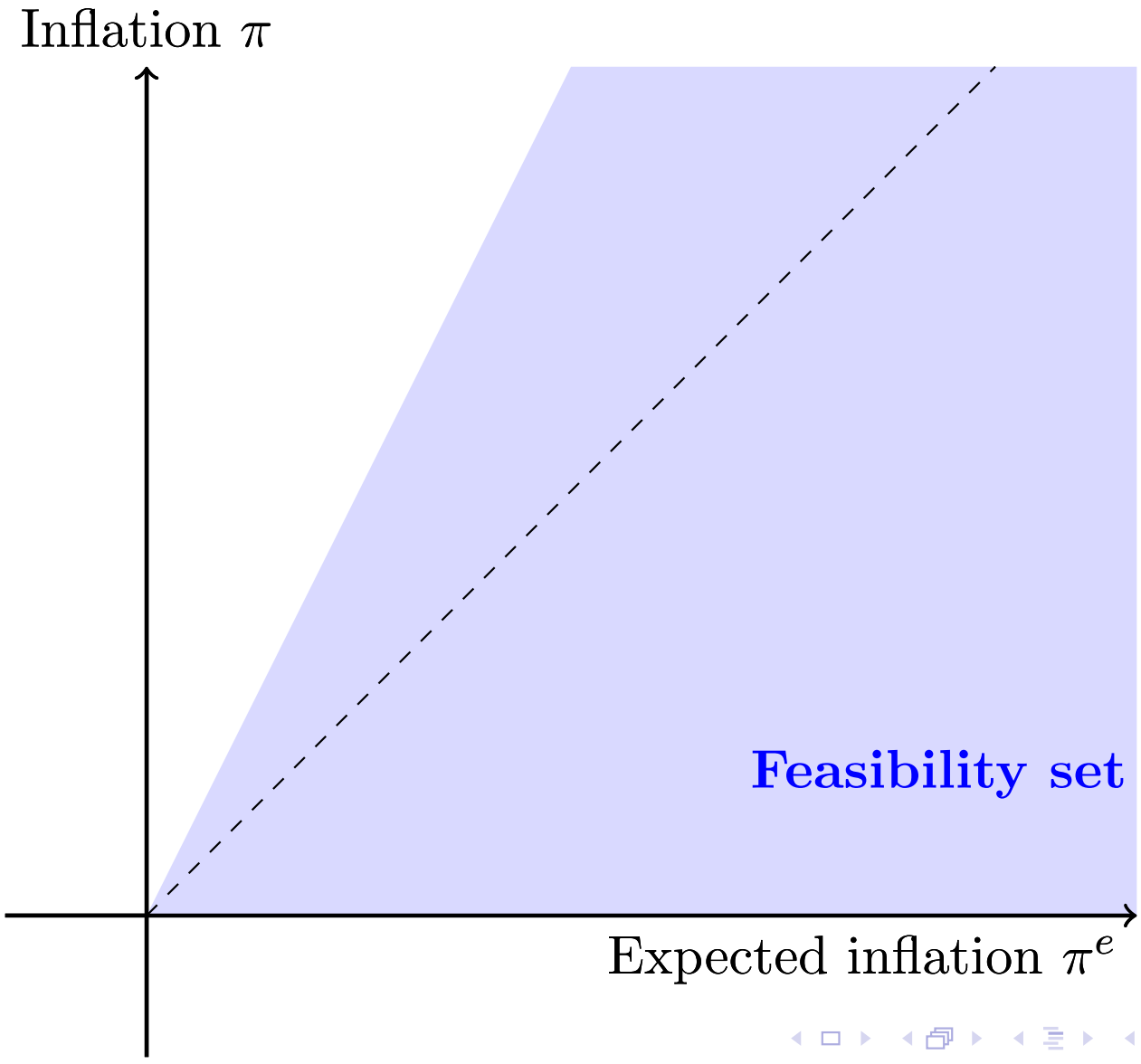

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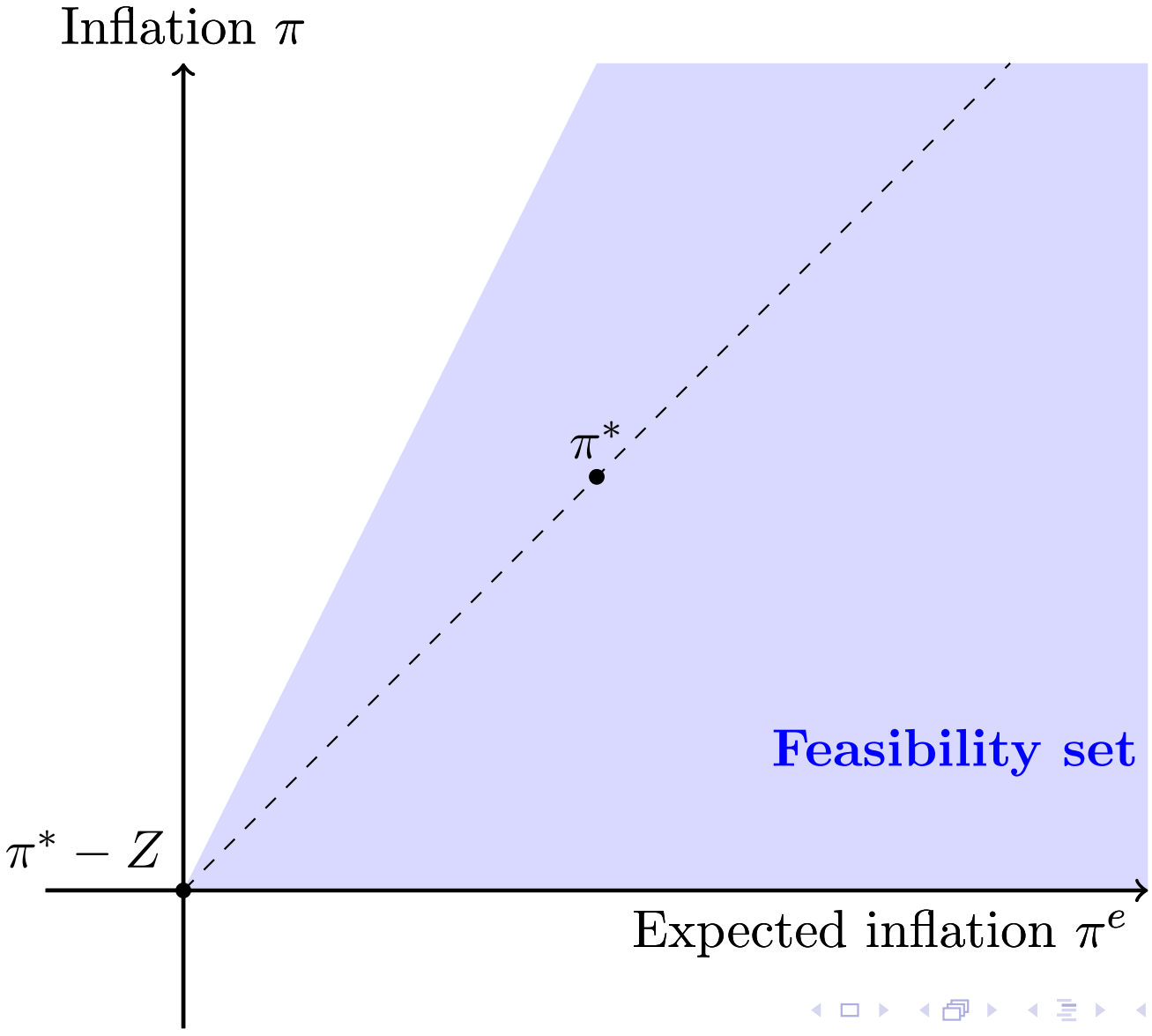

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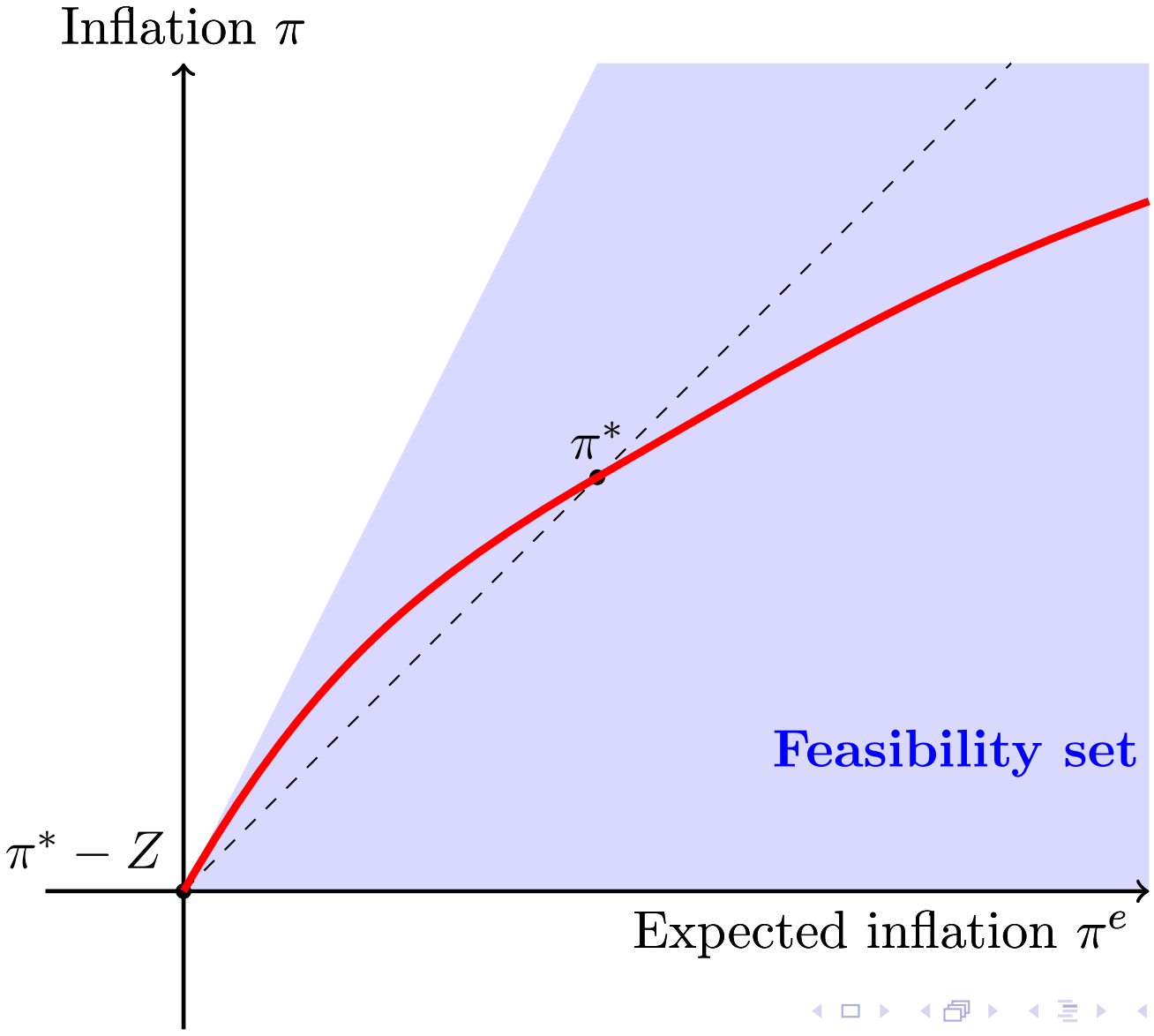

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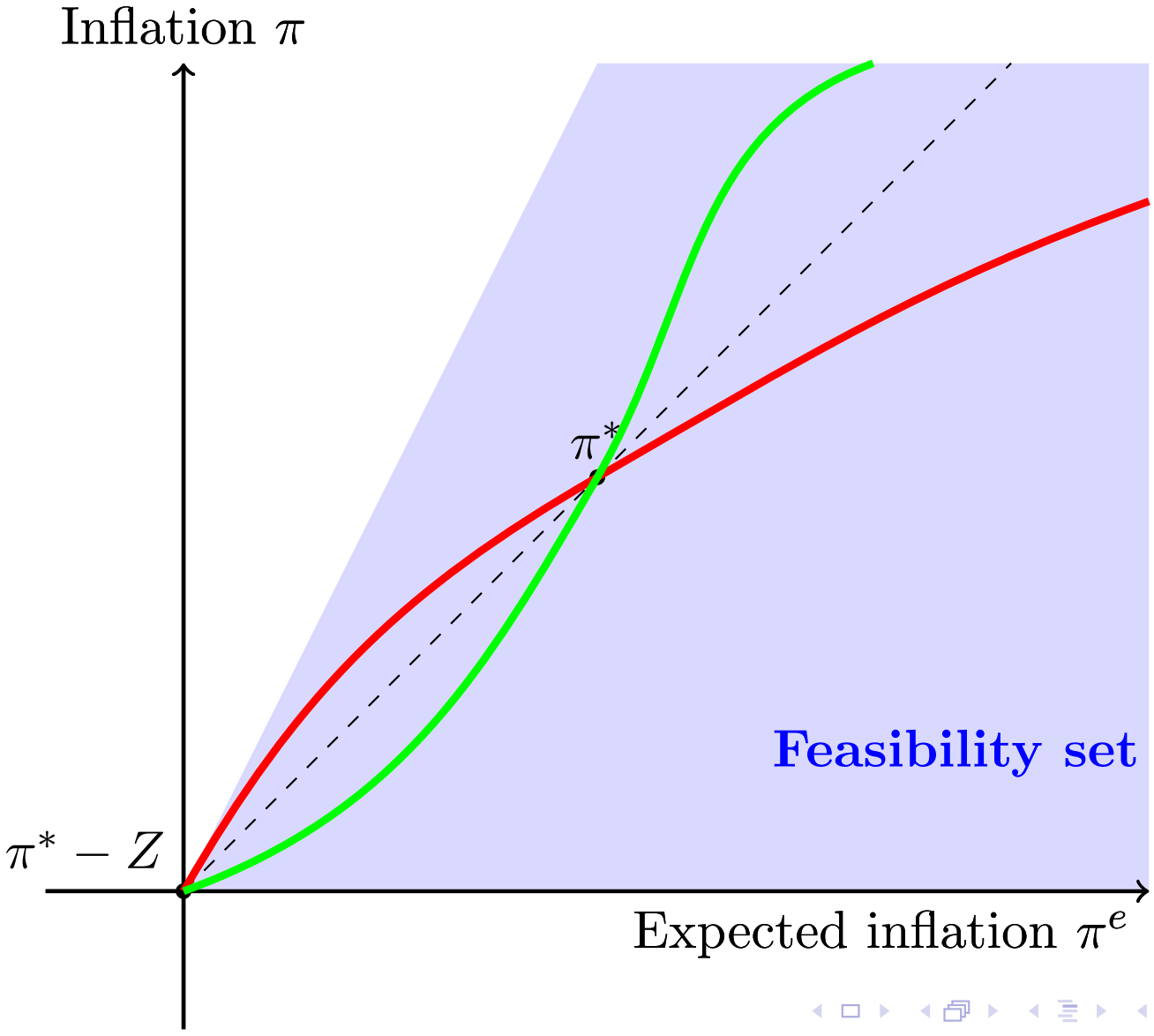

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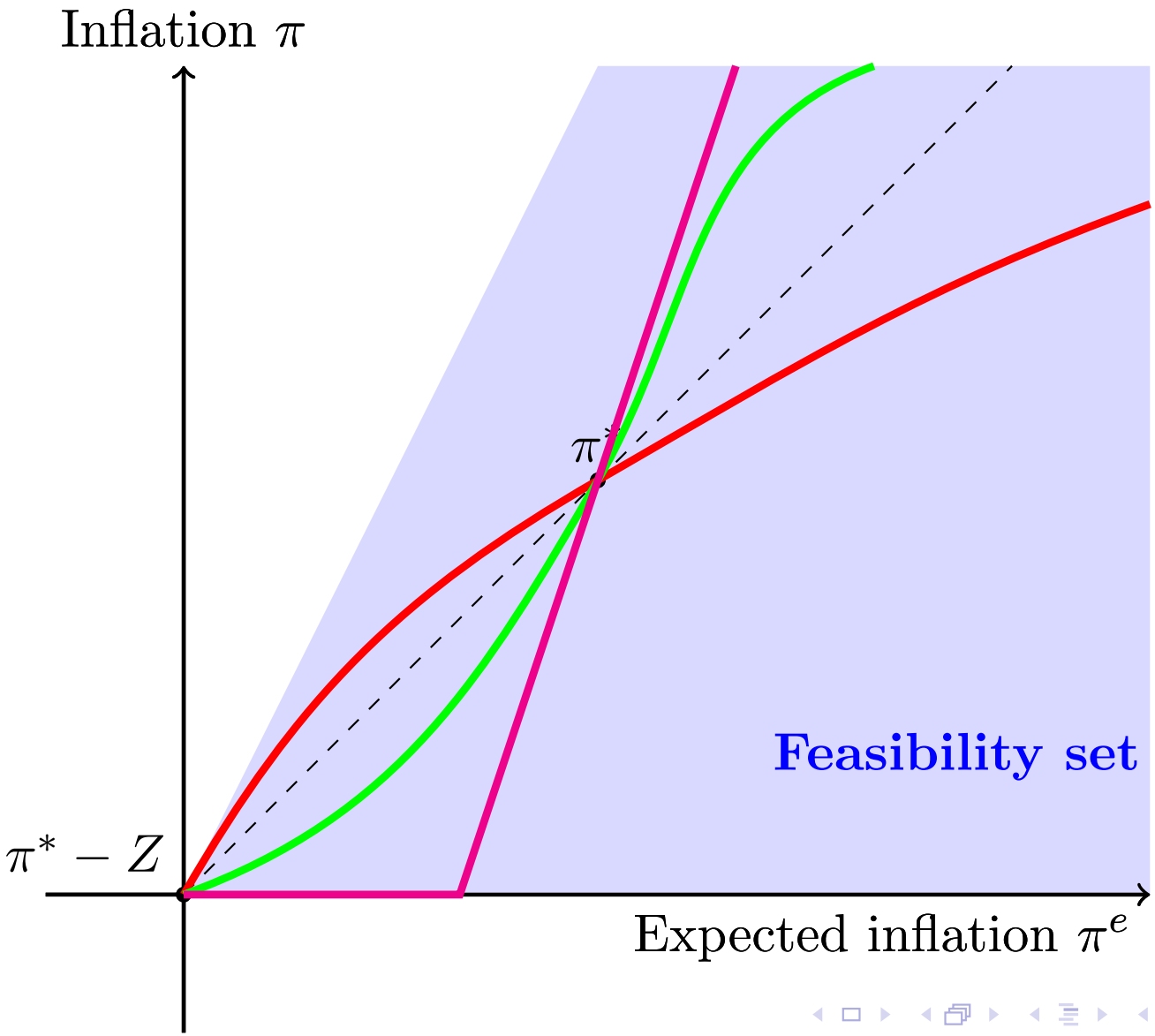

(Wishful?) Forward guidance

- Price-level targeting, forward guidance...work by promising higher inflation, say, $\hat{\pi} > \pi^e$.
- If inflation expectations adjust $\pi^e \to \hat{\pi}$, the central bank's feasibility set expands:

$$\begin{aligned} y_t &\leq \bar{y}\left(\pi^e\right) < \bar{y}\left(\hat{\pi}\right) \\ \pi_t &\leq \bar{\pi}\left(\pi^e\right) < \bar{\pi}\left(\hat{\pi}\right). \end{aligned}$$

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  and the central bank can deliver inflation $\pi_t = \hat{\pi}$ as promised, along with higher output.
- If π^e stays put, it may not be possible to deliver the promised inflation $\hat{\pi}$ if

$$\bar{\pi}\left(\pi^e\right) < \hat{\pi}.$$

The good equilibrium: Stabilization

- If the private sector expects full stabilization, $\pi^e = y^e = 0$, then full stabilization can indeed be implemented:

$$\begin{aligned} y_t = 0 &\leq \bar{y}(0) = \frac{1}{\sigma} Z, \\ \pi_t = 0 &\leq \bar{\pi}(0) = \frac{\kappa}{\sigma} Z. \end{aligned}$$

- This will be the basis of the "good" or "stabilization" equilibrium.

The bad equilibrium: Low inflation

- If inflation expectations are low enough, $\pi^e = -Z$, then

$$\begin{aligned} y_t &\leq \bar{y}(-Z) = y^e < 0, \\ \pi_t &\leq \bar{\pi}(-Z) = \pi^e < 0. \end{aligned}$$

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- The central bank can only disprove expectations on the downside, and thus further from any inflation and output stabilization goals.
- Unless given a compelling reason to *increase* the policy rate despite $y_t, \pi_t < 0$, the central bank will end up validating the expectations and missing on its target.

Social welfare and monetary policy objectives

- Social welfare loss function (per period) is

$$l_t = \pi_t^2 + \lambda y_t^2.$$

- The central bank is given an objective function l_t^p.
  - Say, for inflation targeting, $l_t^p = \pi_t^2 + \psi y_t^2$, $\psi \neq \lambda$.
  - Or price-level targeting, $l_t^p = p_t^2 + \psi y_t^2$ ...
- The central bank retains discretion/independence in setting the policy rate R_t.
  - As in Rogoff (1985), Walsh (1995), Svensson (1997)... Arguably an accurate representation of actual monetary frameworks.

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  - The central bank's willingness to pursue the specified goals is beyond any doubt.
- We still have to view the economy as a game between the private sector and the monetary authority.
  - I focus on Markov equilibria, where allocations and policy are a function of the exogenous state $s = \{u, v\} \in S \subset \Re^n$.
  - History-dependent, sunspot equilibria... are ruled out.

Monetary policy

At every date t, the central bank sets the policy rate to solve

$$\min_{R_t \geq -Z} l^p(\pi_t, y_t)$$

subject to equilibrium conditions (1)-(3) and taking as given private-sector expectations,

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A Markov equilibrium is is a set of vectors in $\Re^n$, $\{R, \pi, y, \pi^e, y^e\}$, or functions $S \to \Re$, with $\pi = \pi^e, y = y^e$.

Inflation targeting

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- Equilibria can be characterized in terms of inflation:

$$\pi(s) = \min\left\{\pi^u(s;\pi), \pi^b(s;\pi)\right\}. \tag{4}$$

- Akin to a vertex enumeration problem in convex geometry.
  - Provides both analytic results as well as an algorithm to compute all Markov equilibria.

Analytic results: Multiplicity

Proposition

Let $\pi^* \in \Re^n$ be a Markov equilibrium. Then, generically, there exists at least an additional distinct Markov equilibrium, $\tilde{\pi} \neq \pi^*$.

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Let $\pi^* \in \Re^n$ be a Markov equilibrium. Then, generically, there exists at least an additional distinct Markov equilibrium, $\tilde{\pi} \neq \pi^*$.

- There are no additional restrictions on the structural or monetary-policy parameters; or on the shock processes.
- A companion result takes care of the i.d.d. case.
- Unfortunately, the proposition is silent regarding the actual number of equilibria—there may be none.

Analytic results: Properties

Proposition

For any Markov equilibrium $\{\pi^*, y^*, R^*\}$*, the unconditional expectations are non-positive,* $E\pi^* \leq 0$*,* $Ey^* \leq 0$ *and* $ER^* \leq 0$*. Moreover, for at least one Markov equilibrium, the unconditional expectations are, generically, strictly negative* $E\pi^* < 0$*,* $Ey^* < 0$ *and* $ER^* < 0$*.*

Corollary

Let $\{\pi^*, y^*, R^*\}, \{\pi^{**}, y^{**}, R^{**}\}$ *be two distinct Markov equilibria with* $E\pi^* < E\pi^{**}$*. Then* $Ey^* < Ey^{**}$ *and* $ER^* < ER^{**}$*.*

Price-level targeting

- Price-level targeting pins down policy to a the price level, given by, in terms of deviations from some trend,

$$p_t = \pi_t + p_{t-1}. \tag{5}$$

- Monetary authority's loss function:

$$l_t^p = p_t^2 + \psi y_t^2, \tag{6}$$

  (This includes nominal GDP targeting as a special case)

- Let p_0 be the initial price level.

Multiple equilibria remains

Proposition

Consider a perfect-foresight economy, $F(\{0,0\}) = 1$. There exists a Markov equilibrium and a finite time $t^*(p_0)$ such that, for all $t \geq t^*(p_0)$, the nominal interest rate is at the ZLB, $R_t = -Z$, and both inflation and output are below target, $\pi_t, y_t < 0$.

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- There also exists a "stabilization" equilibrium.
- It does not matter where the price level is initialized, the economy may converge to a liquidity trap.

Interest rate stabilization

Let R_t^j be the nominal rate return paid at maturity after $j \geq 1$ periods, in annualized rate:

$$R_t^j = \frac{1}{j} E_t \left(\sum_{i=0}^{j-1} R_{t+i} \right). \tag{7}$$

Consider the following central bank goals:

$$l_t^p = \pi_t^2 + \psi y_t^2 + \rho \left(R_t^j \sqrt{j} \right)^2, \tag{8}$$

where $\psi, \rho \geq 0$.

Analytic results

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Let $F(s'|s) = F(s')$ for all $s, s' \in S$. If $\rho > \frac{\kappa^2+\psi(1-\beta)}{\sigma\kappa}$, then there is, generically, a unique Markov equilibrium.

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- There may be other non-Markov equilibria, e.g., sunspots.

Maturity does matter

- Using the policy rate ($j = 1$) hinders stabilization policy.
  - Attenuates policy response to fundamental shocks.
- However, long-term rates are determined by the long-run inflation expectations. As $j \to \infty$,

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- Fundamentals are unlikely to move long-term inflation expectations, but shifts in beliefs would do so.
- The central bank can then respond aggressively and rule out the low-inflation equilibrium without hindering stabilization.

Conclusions

- Inflation targeting has a proven record at curbing high inflation.
- Despite rates being at the ZLB, inflation expectations have remained mostly anchored.
- But if trust on a nominal target wavered, then the central bank would find itself *unable* to implement the target and restore confidence.
- A long-term nominal rate goal, perhaps in the name of financial stability, can effectively anchor inflation expectations.