Flexible Inflation Targeting as Optimal Stabilization Policy

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Flexible Inflation Targeting

- Svensson (1999) argues that FIT can be regarded as a type of **policy rule:** one that involves commitment to ensure fulfillment of a **target criterion** (also in the nearer term) that involves **both** inflation and a measure of real activity

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- Describes what (projected) **outcomes** should be considered acceptable, rather than prescribing the **instrument settings** that may be needed to achieve them

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    — deviation of output **from trend?** from **efficient** level of output?
  - what **relative weight** to place on real activity vs. departures from inflation target?
  - what **dynamic relationship** between output fluctuations and the inflation deviations that they justify?

    — purely **contemporaneous** relation as in simple Svensson (1999) rule?

What Kind of Flexibility?

- Approach taken here: ask what target criterion would need to be like, in order for FIT regime to implement an **optimal policy commitment,** according to a monetary DSGE model

  — doesn't assume any concern with **either** stable inflation or stable real activity, intrinsically, but only to the extent that these improve people's achievement of their **private objectives**

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- Conclusions will depend, of course, on assumed economic structure

(1) A Basic New Keynesian Model

- Assumptions (Woodford, 2011):
  - representative household
  - Dixit-Stiglitz preferences over differentiated goods
  - same production function for all goods
  - Calvo model of staggered price adjustment by monopolistically competitive suppliers

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- Solve for optimal responses to shocks, in log-linear approximation to optimal policy commitment (Ramsey policy)

  — perturbations of a long-run steady state with optimal inflation rate ($\pi^* = 0$)

(1) A Basic New Keynesian Model

- Welfare of representative household:

$$\mathrm{E}_{t_0} \sum_{t=t_0}^{\infty} \beta^{t-t_0} U_t \;\sim\; -\mathrm{E}_{t_0} \sum_{t=t_0}^{\infty} \beta^{t-t_0} L_t$$

where

$$L_t \;\equiv\; (\hat{Y}_t - \hat{Y}_t^e)^2 + \frac{\theta}{\kappa}(\pi_t)^2$$

using notation

- $Y_t^e =$ efficient level of output given real shocks
- $\kappa =$ slope of NK Phillips curve
- $\theta =$ Dixit-Stiglitz elasticity of substitution [= elasticity of demand faced by each supplier]

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- Optimal responses to all types of shocks [to log-linear approximation] achieved if and only if policy ensures satisfaction of a **target criterion:**

$$\pi_t + \theta^{-1}(x_t - x_{t-1}) = 0 \qquad \text{where} \quad x_t \equiv \hat{Y}_t - \hat{Y}_t^e$$

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- Specific answers:
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  - inflation deviation should track output-gap **change** rather than **level**
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- But how dependent on overly simple model?

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- With Dixit-Stiglitz preferences, as assumed above, θ is the elasticity of substitution between any good and **any other** good; this parameter determines **both**
  - degree of **market power** an individual supplier has
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- But these need not be the same!

(2) Nested CES Demand Structure

- Generalizing preferences: consumption aggregate

$$C_t \equiv \left[\int_0^1 (C_t^i)^{\frac{\theta-1}{\theta}} \, di \right]^{\frac{\theta}{\theta-1}}$$

where aggregate for each industry i is

$$C_t^i \equiv \left[\int_0^1 (C_t^{ij})^{\frac{\tilde{\theta}-1}{\tilde{\theta}}} \, dj \right]^{\frac{\tilde{\theta}}{\tilde{\theta}-1}}$$

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- Then optimal prices for all firms in an industry i with **perfectly flexible** prices would satisfy

$$\log \frac{P_t^{i,flex}}{P_t} = \frac{1}{1+\omega\theta} \left\{ \log \left(\frac{\tilde{\theta}}{\tilde{\theta}-1} \frac{1}{1+s_t} \right) + (\sigma^{-1} + \omega) \log \frac{Y_t}{Y_t^e} \right\}$$

— $\tilde{\theta}$ shifts **intercept,** θ the **elasticity**

(2) Nested CES Demand Structure

- We introduce this industry structure, and assume that all goods in a given industry reconsider their prices at same times

- Obtain **same equations** as for basic NK model, but now clarify that
  - $\tilde{\theta}$ determines the **output subsidy** $\bar{s}$ required for zero-inflation steady state to be efficient
  - θ determines the relative weight on output gap in the **optimal target criterion**

$$\pi_t + \theta^{-1}(x_t - x_{t-1}) = 0$$

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- How much does this matter?
  - Edmond, Midrigan and Xu (2015) estimates: $\tilde{\theta} = 10.5$, while $\theta = 1.24$
  - thus weight on output gap **more than 8 times as large** if calibrate using θ rather than $\tilde{\theta}$

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  - thus weight on output gap **more than 8 times as large** if calibrate using θ rather than $\tilde{\theta}$
  - if assume $\theta \approx 1$, then optimal target criterion becomes a **nominal GDP target**

(3) Hetero. Productivity, State-Dependent Pricing

- The basic NK model is one in which price dispersion — and hence an inefficient composition of goods produced — exists **only** to the extent that the aggregate price index isn't constant

  — and the welfare gains from price stability are attributed entirely to the **reduction of price dispersion**

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- Yet one doesn't see low-frequency **trend in price dispersion** correlated with **trend in inflation** (Nakamura *et al.*, 2018)

  — suggesting that much price dispersion reflects shocks to **desired relative prices,** not just delays in price adjustment

  — and thus may be **efficient**

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- Basic NK model also assumes that probability of any price's being reconsidered is completely **independent** of what the current price is, how closely in line with current conditions
- This simplifies aggregation, but is surely an extreme assumption
- And some have argued that the Calvo model **exaggerates** the welfare losses associated with departures from price stability, relative to a model with **state-dependent** timing of price adjustments (as in a menu-cost model)

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- If there are important **selection effects** in which prices adjust, how does this affect welfare consequences of alternative policies?

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- Hence we introduce
  1. (industry-specific) **idiosyncratic productivity shocks,** so that there would be considerable (efficient) price dispersion even with perfectly flexible price
  2. **state-dependent** timing of price changes: prices reconsidered if and only if a sufficiently large change in industry productivity

  and see how nature of optimal stabilization policy is affected

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- We consider these issues using a model of the idiosyncratic shock process under which the form of the **Phillips curve** relation between output and inflation is **the same** as in the basic NK model (following Gertler and Leahy, 2008)

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- Representative household seeks to max

$$\mathrm{E}_{t_0} \sum_{t=t_0}^{\infty} \beta^{t-t_0} \left[u(C_t;\ \xi_t) - \int_0^1 v(Y_t^i / A_t^i;\ \xi_t)\, di \right]$$

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- Then can write **welfare objective** as

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— note no longer minimized when **prices all equal!**

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- Industry-specific productivity process:
  - each period, fraction δ of industries **exit,** new ones enter

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- Prices in industry i reconsidered if and only if cumulative productivity change **since last reconsideration** moves outside *Ss* band $[\underline{a},\ \bar{a}]$

Approximate Welfare Criterion

$$\mathrm{E}_{t_0} \sum_{t=t_0}^{\infty} \beta^{t-t_0} U_t \;\sim\; -\mathrm{E}_{t_0} \sum_{t=t_0}^{\infty} \beta^{t-t_0} L_t$$

where

$$\begin{aligned} L_t \;\equiv\; & \frac{1}{2}(\sigma^{-1}+\omega)\left[(\hat{Y}_t - \hat{Y}_t^e)^2 + \frac{\theta}{\kappa}(\pi_t - \pi^*)^2\right] \\ & + (\hat{Y}_t - \hat{Y}_t^s)(\hat{\Delta}_{1t} + \hat{\Delta}_{2t}) \;+\; \theta \tilde{\pi}_t \left[\frac{\hat{\Delta}_{1t}}{1-\beta\rho_1} + \frac{\hat{\Delta}_{2t}}{1-\beta\rho_2}\right] \end{aligned}$$

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- Here $\hat{Y}_t^s$ is output variation required in order to hold $v(Y_t; \xi_t)$ fixed
- Max this subject to laws of motion for distortion factors

$$\hat{\Delta}_{\ell,t}\ \rho_\ell \hat{\Delta}_{\ell,t-1} + \psi_\ell \tilde{\pi}_t \qquad \text{for } \ell = 1, 2$$

Optimal Target Criterion

$$\begin{aligned}\pi_t \quad &+ \quad \theta^{-1}(x_t - x_{t-1}) \\ &+ \quad \zeta \left[(\hat{\Delta}_{1t} - \hat{\Delta}_{1,t-1}) + (\hat{\Delta}_{2,t} - \hat{\Delta}_{2,t-1})\right] \\ &+ \quad \mathrm{E}_t \sum_{j=1}^{\infty} c_j \left[\tilde{\pi}_{t+j} + \theta^{-1}(x^s_{t+j} - x^s_{t+j-1})\right] \quad = \quad \pi^*,\end{aligned}$$

where the two welfare-relevant "output gaps" are now

$$x_t \equiv \hat{Y}_t - \hat{Y}^e_t, \qquad x^s_t \equiv \hat{Y}_t - \hat{Y}^s_t$$

and $\zeta > 0$, $c_j > 0$ for all j

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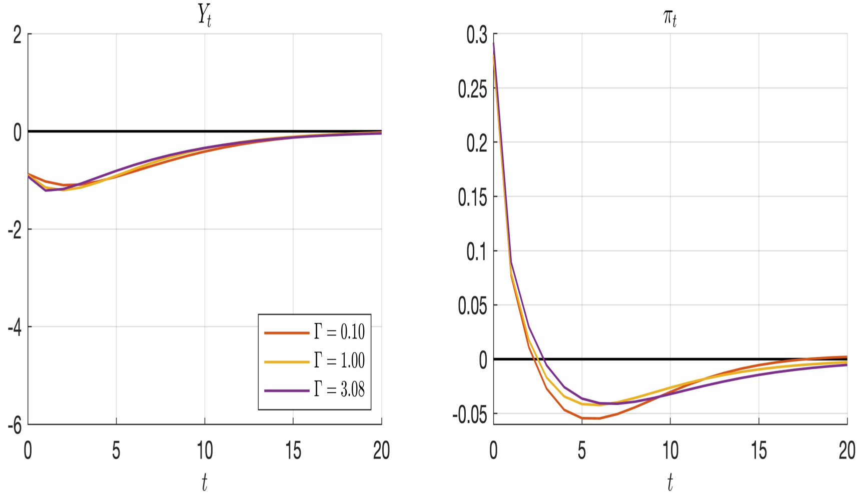
- Now disturbances that result in **efficient** variation in flexible-price output (shocks to impatience, productivity, etc.) will generally require inflation to deviate from its long-run target: because $\hat{Y}^s_t \neq \hat{Y}^e_t$ — but by how much?

Optimal Response to a Tax Shock



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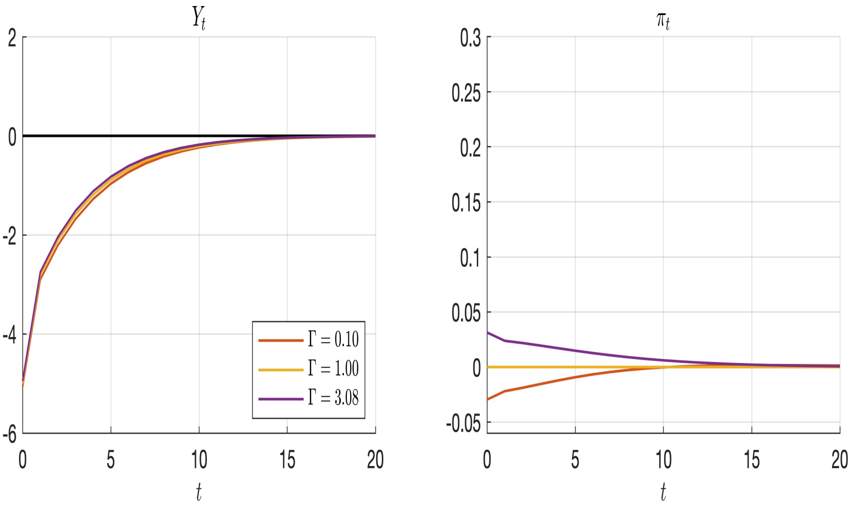

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  — not true in reality, and arguably the abstraction from uninsurable income heterogeneity **under-estimates** the welfare losses from business fluctuations

  — hence under-estimates the degree to which temporary departures from inflation target are desirable?

(4) Household Income Heterogeneity

- Will consider here a simple extension of basic model in which the uninsurable income risk is **perfectly correlated** with **aggregate** income fluctuations

  — in this model, groups **differ** in the degree to which their incomes are cyclical

- See the paper for alternative case of idiosyncratic income risk ("HANK" model)

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  - wage set each period so that wage times **average** m.u. income = (common) disutility of work

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  - wage set each period so that wage times **average** m.u. income = (common) disutility of work
  - income of type $j = w \cdot H^j$ plus equal share of profits [more cyclical for type v]

  — log-linearizing:

$$\hat{Y}_t^j = \omega^j \hat{Y}_t, \qquad \omega^v > \omega^s$$

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- We consider local approximation around a steady state in which two types' incomes and consumptions are identical

  — but shocks can result in differing spending levels for the two types, owing to their separate budget constraints, and **absence of insurance** for business-cycle risk

(4) Household Income Heterogeneity

- Optimal expenditure by each type:

$$\hat{C}_t^j = (1-\beta)a_t^j + \omega^j \cdot \hat{Y}_t^p - \sigma r_t^L,$$

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- Implied evolution of consumption disparity:

$$\hat{C}_t^v - \hat{C}_t^s \;=\; \hat{C}_{t-1}^v - \hat{C}_{t-1}^s + (\omega^v - \omega^s) \cdot \left[\hat{Y}_t^p - \mathrm{E}_{t-1}\hat{Y}_t^p\right]$$

Optimal Target Criterion

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- A reason to allow **larger increase in inflation** in response to cost-push shock: not only because $x_t < x_{t-1}$, but also because $\hat{Y}_t^p < \mathrm{E}_{t-1}\hat{Y}_t^p$

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- And a reason for inflation to respond even to offset **efficient** output reductions (e.g., reduced impatience to consume): distortion created by $\hat{Y}_t^p$ reduction, even if $\hat{Y}_t^e$ lower
- But again, effect need not be **quantitatively** large: standard TC still approximates optimal responses

Conclusions

- Under a variety of assumptions, optimal policy can be characterized by commitment to fulfillment of a **target criterion** of general form proposed by Svensson (1997, 1999):
  - a specific numerical target for (broad) inflation measure, in absence of offsetting factors (that must equal zero in medium-to-long run)
  - precise specification of near-term real factors that justify projected temporary departure from long-run inflation target — deviation of aggregate activity from reference path

Conclusions

- Precise criterion depends on economic structure:
  - **substantial weight on output growth** may be appropriate, even if firms have little market power
  - can be reason to place some weight on stabilization of activity even in response to reasons for **efficient** output variation
  - can be reason to offset output declines more when expected to be **more persistent**

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  - can be reason to offset output declines more when expected to be **more persistent**
- But one conclusion seems relatively robust: negative output gap not a reason in itself for continuing inflation above target

  — overshooting justified only when output gap becoming **more** negative, or is **lower than expected**