

Transmission Lags and Optimal Monetary Policy

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The views expressed are those of the authors and are not necessarily shared by their respective institutions.

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- ▶ Optimal policy requires commitment since private-sector decisions depend on expectations (about the future)
- ▶ Challenge: Produces time-inconsistency and credibility problems.

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- ▶ Monetary policy studied in models without transmission lags

Transmission lags

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- ▶ An unexpected change in the interest rate has a maximum effect on output after 4-8 quarters and inflation after about 8-16 quarters (Christiano et al., 2005; Rudebusch, 2002; Angeloni et al., 2003)

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- ▶ Introduce transmission lags of monetary policy through implementation lags. Consumption and pricing behaviour are determined m and j periods in advance. We assume that pricing *decisions* are subject to *longer* lags than consumption decisions.
- ▶ Studies how transmission lags affect the efficiency of discretionary flexible inflation targeting compared to the alternatives.

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 - ▶ The optimal discretionary strategy does not produce any policy-induced stabilization of inflation.
- ▶ Price-level targeting does not constitute a remedy
- ▶ The relative efficiency of money growth targeting increases.

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New Keynesian Model



$$\pi_t = \delta \pi_{t+1|t} + \gamma x_t + \varepsilon_t$$

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- ▶ Changes in monetary policy affect inflation with a j -period lag and output with a m -period lag.
- ▶ Implementation lags create transmission lags. We assume that $j \geq m$. Svensson and Woodford (2005) and Woodford (2003) have studied the cases where $j = m$.

Monetary policy

- ▶ The monetary policy chooses a path for interest rate $\{i_{t+k}\}_{k=0}^{\infty}$ that minimises the intertemporal quadratic loss function:

$$\min_{\{i_{t+k}\}_{k=0}^{\infty}} (1 - \delta) E_{t_0} \sum_{k=1}^{\infty} \delta^{t-t_0} [\pi_t^2 + \lambda x_t^2]$$

subject to (1) and (2).

- ▶ $\lambda = \psi^{-1}\gamma$ is a function of the elasticity of substitution between alternative differentiated goods (ψ) and elasticity of inflation with respect to output gap (γ).

Monetary policy

Forming the Lagrangian

$$L_{t_0} = E_{t_0} \sum_{t=t_0}^{\infty} \delta^{t-t_0} \left[\begin{array}{l} \frac{1}{2} (\pi_t^2 + \lambda x_t^2) \\ -\mu_{t+j} (\pi_{t+j} - \delta \pi_{t+j+1} - \gamma x_{t+j} - \varepsilon_{t+j}) \\ -v_{t+m} (x_{t+m} - x_{t+m+1} + \sigma (i_{t+m} - \pi_{t+m+1} - r_{t+m}^n)) \end{array} \right]$$

First-order conditions under commitment

$$\frac{\partial L}{\partial \pi_{t+j}} = E_{t_0} \delta^{t-t_0} \left(\begin{array}{c} \delta^j \pi_{t+j} - \mu_{t+j} + \mu_{t+j-1} \\ + v_{t+j-1} \sigma \delta^{j-m-1} \end{array} \right) = 0, \quad (3)$$

$$\frac{\partial L}{\partial x_{t+m}} = E_{t_0} \delta^{t-t_0} \left(\begin{array}{c} \delta^m \lambda x_{t+m} - \gamma \mu_{t+m} \delta^{m-j} \\ - v_{t+m} + v_{t+m-1} \delta^{-1} \end{array} \right) = 0, \quad (4)$$

$$\frac{\partial L}{\partial i_{t+m}} = E_{t_0} \delta^{t-t_0} (-v_{t+m} \sigma) = 0, \quad (5)$$

where $\mu_{t_0+u-1} = v_{t_0+n-1} = 0$ for $u \in [0, \dots, j]$ and $n \in [0, \dots, m]$.

Optimality conditions under commitment

For $\lambda > 0$ (flexible targeting):

- ▶ The initial planning period: inflation is predetermined, set the output gap to zero.

$$x_{t|t_0} = 0, \text{ for } t \in [t_0 + m, t_0 + j - 1] \text{ and } j > m, \quad (6)$$

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- ▶ The second phase: choose the best possible trade-off given no-more reoptimization.

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- ▶ The third phase: the timeless-perspective, honouring prior commitment.

$$\Delta x_{t|t_0} = -\frac{\gamma}{\lambda} \pi_{t|t_0}, \text{ for } t > t_0 + j. \quad (8)$$

First-order conditions under discretion

- ▶ For every period the first-order conditions for the discretionary equilibrium are

$$\frac{\partial L}{\partial \pi_{t+j}} = E_{t_0} \delta^{t-t_0} \left(\delta^j \pi_{t+j} - \mu_{t+j} \right) = 0, \quad (9)$$

$$\frac{\partial L}{\partial x_{t+m}} = E_{t_0} \delta^{t-t_0} \left(\delta^m \lambda_{x_{t+m}} - v_{t+m} \right) = 0, \text{ for } j > m, \quad (10)$$

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$$\frac{\partial L}{\partial i_{t+m}} = E_{t_0} \delta^{t-t_0} \left(-\sigma \delta^m v_{t+m} \right) = 0. \quad (12)$$

- ▶ Note: FOCs are different when $j > m$ and when $j = m$.

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$$\begin{aligned}x_{t+m|t} &= 0, \text{ for } j > m, \text{ and} \\x_{t+m|t} &= -\frac{\gamma}{\lambda}\pi_{t+m|t}, \text{ for } j = m.\end{aligned}\tag{13}$$

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- ▶ Note that price-level targeting is hampered with the same extreme stabilization bias.

What about strict inflation targeting?

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- ▶ "Augmented strict targeting": put a small weight on output.

Money growth targeting

- ▶ Standard money demand equation

$$m_t - p_t = x_t - \kappa i_t + v_t.$$

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- ▶ Introduces history dependence in interest-rate setting.

Calibration

Calibration follows Giannoni and Woodford (2003)

$$\beta = 0.99, \quad \gamma = 0.024$$

$$\rho_r = 0.35, \quad \sigma_{\hat{r}} = 0.0372$$

$$\lambda = \psi^{-1} \gamma = 0.13 \times 0.024.$$

- ▶ And Kilponen and Leitemo (2007) for money demand

$$\kappa = 0.43$$

$$\rho_v = 0.77$$

$$\sigma_v = 0.0116$$

Welfare Comparisons

<i>Equilibrium</i>	$j = 0$	$j = 1$	$j = 0$	$j = 1$
	$\rho_\varepsilon = 0.5$		$\rho_\varepsilon = 0.7$	
Commitment	0.142	0.109	0.216	0.155
Discretion	0.246 (73%)	0.170 (55%)	0.481 (123%)	0.555 (258%)
Money growth targeting	0.216 (52%)	0.122 (12%)	0.382 (77%)	0.216 (39%)
Strict inflation targeting	0.534 (276%)	0.207* (90%)	0.531 (146%)	0.308* (99%)
Strict price-level targeting	0.534 (276%)	1.076* (887%)	0.531 (146%)	1.008* (550%)

Note: Social loss. (*) denotes an augmented strict targeting regime where the weight on the output gap is 10^{-10} .

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 - ▶ Money demand shocks have a smaller impact on inflation due to the implementation lag
- ▶ Money growth targeting deteriorates if weight on output increases.

Conclusions

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- ▶ The relative efficiency of money growth targeting increases with implementation lags in prices
 - ▶ Supports the Friedman critique of discretionary (inflation targeting) policy under transmission lags (but for other reasons)