Monetary Economics: Macro Aspects, 3/5 2004

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Plan for today:

1. Delegation solutions to credibility problems in the "New Keynesian" model of monetary policy analysis

2. Nominal income growth targeting and other approaches

Literature: Jensen (2002, *American Economic Review*).

Introductory motivation

- Real world: Several past and future changes in monetary policy institutions ⇒ need for policy evaluation and guidance

- Academic world: Monetary policy "revival" and some **consensus** on appropriate model framework:

  – "New Neoclassical Synthesis" (Goodfriend & King, 1997; Rotemberg and Woodford, 1997; Clarida et al., 1999):

  * Forward-looking behavior (intertemporal optimization by agents)

  * Incomplete nominal adjustment

  – With some micro-foundations, models are less subject to the Lucas critique than earlier ones

- Academic controversies on

  – Appropriate design of monetary regimes

  1. "Targeting regimes" (Rogoff, 1985; Walsh, 2003; Chap. 8) or "instrument rules" (Taylor, 1993)?

  2. Which macroeconomic aggregates should determine the course of monetary policy?

- Purpose today: Contribute to answer of *second* question, while taking *first* option embedded in *first* question

- Targeting regimes is to be understood as **delegation** of monetary policy to an independent central bank with appropriately designed preferences (i.e., policy mandates)

- This may be warranted if **time-inconsistency problems plagues optimal policy**

- ...(as we indeed have seen is the case in this model framework; even in the absence of Barro-Gordon inflation bias)

- I.e., if commitment is not credible

"discretion must be constrained by a clear objective to which policy is directed" (King, 1999)

Specific purpose of today's analyses

- Purpose is thus to contribute to question of how

- Compare the performance of mainly **two** particular targeting regimes within the "consensus model-framework"

  – *Inflation targeting* of "flexible form" (i.e., the central bank also cares about output gap variability)

  – *Nominal income growth targeting*, also of "flexible form"

  – In both cases the *optimal* regime is considered

  – ...that is, the optimal variant of the given delegation arrangement is evaluated

- Why these regimes?

- Inflation targeting, because society's welfare in model depends on inflation and output gap (and because its widespread academic and real-life attention)

- Nominal income growth targeting, because it serves a new role in models with forward-looking behavior where:

  – **Prolonged contractionary monetary policy** after (an even temporary) inflationary shock is **optimal** because

    a) Expectations about future inflation go down

    b) This reduces current inflation by the model's New Keynesian "Phillips-curve"

    c) Hence, "the market" does some of the stabilization job and the contraction can be smaller $\implies$ a *better inflation-output gap trade-off is achieved* (Woodford, 1999; Clarida et al., 1999)

- Nominal income growth targeting indeed secures a continuation of a contractionary policy; i.e., **inertial** policy:

  – A contraction today is followed by reversion to steady-state associated with above-target nominal income growth; hence further contraction is needed

- **Main finding:** Even though society's welfare depends on the variability of the output gap and inflation, it may be optimal for society to adopt nominal income growth targeting rather than inflation targeting

- **Main reason:** Time-consistent policy plans under inflation targeting are in themselves *not* inertial — plans under nominal income growth targeting *are*

- **Relevance?** Depends *crucially* on whether forward-looking price setting is relevant. Recent US evidence: Galí and Gertler (1999, JME); Sbordone (2002, JME); Recent Euroland evidence: Smets (2003, JME).

Agenda for rest of lecture

1. Description of model

2. Characterization of benchmark: Optimal policy (precommitment)

3. Characterization of targeting regimes under discretion

4. Welfare comparisons for simulations based on baseline parameter values and some deviations

5. Summary of results and discussion

Description of model

Simple version of now conventional model type depicting a closed economy in periods $t = 1, 2, 3..., \infty$

- *Aggregate demand* (an intertemporal "IS-curve"):

$$y_t = \theta y_{t-1} + (1-\theta)\,\mathrm{E}_t y_{t+1} - (1-\theta)\,\sigma\,(i_t - \mathrm{E}_t\pi_{t+1}) + g_t, \quad (1)$$
$$0 \le \theta < 1, \quad \sigma > 0, \quad y_0 = 0 \text{ given,}$$

- *Aggregate supply* (a New Keynesian "Phillips curve"):

$$\pi_t = \phi\pi_{t-1} + (1-\phi)\,\beta\mathrm{E}_t\pi_{t+1} + (1-\phi)\,\kappa\,(y_t - y_t^n) + \varepsilon_t, \quad (3)$$
$$0 \le \phi < 1, \quad \kappa > 0, \quad 0 < \beta < 1, \quad \pi_0 = 0 \text{ given,}$$

- *Disturbances:*

$$g_t = \gamma_g g_{t-1} + \zeta_t^g, \quad 0 \le \gamma_g < 1, \quad g_0 = 0 \text{ given,} \quad (2)$$
$$y_t^n = \gamma_y y_{t-1}^n + \zeta_t^y, \quad 0 \le \gamma_y < 1, \quad y_0^n = 0 \text{ given,} \quad (4)$$
$$\varepsilon_t = \gamma_\varepsilon \varepsilon_{t-1} + \zeta_t^\varepsilon, \quad 0 \le \gamma_\varepsilon < 1, \quad \varepsilon_0 = 0 \text{ given.} \quad (5)$$

- *Social welfare:*

$$L = \mathrm{E}_0 \sum_{t=1}^{\infty} \beta^{t-1}\left[\lambda\,(y_t - y_t^n)^2 + \pi_t^2\right], \quad \lambda > 0. \quad (6)$$

Characterization of benchmark: Optimal policy (precommitment)

- Assume the policymaker can precommit to a policy sequence at the start of the planning horizon

- In models with RE and forward-looking variables, solution is not time-consistent, but defines a relevant benchmark for ensuing targeting regimes

- Closed-form solution is unavailable so numerical solution methods are applied

- Main properties of precommitment policy:

  – Full stabilization of output gap and inflation against demand and technology shocks. These shocks pose *no trade-off* for monetary policy (equivalent of "composite" IS-shocks in Clarida et al., 1999)

  – A cost-push shock creates a trade-off between stabilizing inflation and the output gap

  – The *optimal response* to a temporary positive cost push shock involves a "mild," but *prolonged* contraction. This lowers inflation expectations and "buys" a given inflation reduction at a less severe real slump

- Precommitment policy is *time inconsistent*: when shock has passed it is no longer optimal to contract. Any promise to do so, is *not credible* under discretion

(note again: credibility problem arises in *stabilization* policy; *no* Barro-Gordon inflation bias here)

Characterization of targeting regimes under discretion

- Targeting regime is defined as:

  – Delegation of monetary policy to an instrument independent central bank

  – The central bank is assigned a loss function to be minimized, assuming discretionary behavior

  – An optimal targeting regime is one that — given the macro-economic aggregates to be targeted — minimizes society's loss (by proper relative weights on macro-goals)

- The general assigned loss function:

$$L^T = \mathrm{E}_0 \sum_{t=1}^{\infty} \beta^{t-1} \left[\lambda \left(y_t - y_t^n \right)^2 + (1+f) \, \pi_t^2 + \psi n_t^2 \right], \quad (10)$$

$$n_t \equiv \pi_t + y_t - y_{t-1}$$

with f and ψ being chosen at the institutional design stage

- Targeting regimes to be considered:

  – *Pure discretion:* $f = \psi = 0$

  – *Inflation targeting:* $-1 < f < \infty$, $\psi = 0$

  – *Nominal income growth targeting:* $f = -1$, $0 < \psi < \infty$

- Model is solved by numerical methods, and for last two regimes, **the socially optimal values** of f and ψ are determined

- Optimal time-consistent behavior under *pure discretion:*

  – Full stabilization of output gap and inflation against demand and technology shocks (the "composite" IS-shock in Clarida et. al., 1999)

  – A cost-push shock creates a trade-off between stabilizing inflation and the output gap

  – The optimal discretionary response to a temporary positive cost push shock is temporary (*the credibility problem*)

- Without endogenous inflation persistence and without persistent cost-push shocks, $f = 0$ is optimal under *inflation targeting*; it corresponds to pure discretion

- Under optimal *nominal income growth targeting,*

  – Full stabilization of output gap and inflation against demand shocks

  – Imperfect stabilization of output gap and inflation against technology shock (e.g., $y^n > 0$ decreases output gap; full stabilization will create positive nominal income growth $\Longrightarrow$ too little expansion is made)

  – **Inertial response towards temporary cost-push shocks** (*potential less credibility problem*)

- Assessment of pros and cons through numerical analyses (for a baseline configuration and deviations) comparing the social loss under various optimal regimes

Baseline parameter values

- No estimation or calibration performed. Merely choice of "plausible parameter values" based on (subjective) weighted averages of findings in literature

- *Aggregate demand:*

  – Endogenous persistence in demand, $\theta = 0.5$

  – Rate of intertemporal substitution $= 0.75 \Longrightarrow \sigma = 1.5$

- *Aggregate supply:*

  – Endogenous inflation persistence, $\phi = 0.3$

  – Sensitivity of inflation to output gap $= 0.1 \Longrightarrow \kappa = 0.142$

- *Social loss function:*

  – Discount factor, $\beta = 0.99$

  – Relative weight on output gap in social loss function, $\lambda = 0.25$

- *Disturbances:*

  – Demand shock: $\sigma_g = 0.015$ and $\gamma_g = 0.3$

  – Technology shocks: $\sigma_y = 0.005$ and $\gamma_y = 0.97$

  – Cost-push shocks: $\sigma_\varepsilon = 0.015$ and $\gamma_\varepsilon = 0$

Results for the baseline parameter values

- **Non-trivial difference** between precommitment and pure discretion. In welfare terms, equivalent of a **permanent** change in inflation (output gap) of 0.9 (2) percent.

- Inflation targeting improves (a little) on pure discretion and features "conservatism." Due to endogenous inflation persistence, conservatism is a "promise" of more contraction to the aftermaths of the shock.

- Nominal income growth targeting improves *more*. Due to the implicit commitment to inertial behavior inflation stabilization is superior. Output gap volatility goes up, but this means less ($\lambda = 0.25$).

  – An improvement — relative to pure discretion — in welfare terms corresponding to a permanent change in the inflation rate (output gap) of around 0.75 (1.5) percent.

Deviations from baseline

- Changes in endogenous persistence of demand, the intertemporal rate of substitution and the process of g, (θ, σ, $\sigma_g \gamma_g$), have *no* effects

- *More endogenous inflation persistence* ($\phi = 0.5$) strengthens the case for nominal income growth targeting

  – Temporary cost-push shocks have longer lasting effects, so ability of signalling future contractive behavior is even better (so, both optimal f and ψ increases)

  – ....or, inflation-output gap is further deteriorated such that an improvement through policy inertia is warranted

  – ϕ must not become too high though; forward-looking price-setting is of essence

- *Persistence of cost-push shocks* (higher γ_ε) strengthens the case for nominal income growth targeting for the same reason

  => The more persistent are effects of inflation shocks, the better may nominal income growth targeting be **in stabilizing inflation relative to inflation targeting**

- *Less societal concern for inflation* (higher λ) **weakens** the case for nominal income growth targeting

  - At $\lambda = 10$, inflation targeting is superior (but quantitatively rather little "superiority")
  - When inflation stability is valued (very) little, the virtues of nominal income growth targeting in stabilizing inflation is of little importance

- *Higher elasticity of inflation w.r.t. output gap* (higher κ) has non-monotonic consequences

  - Small elasticity favors nominal income growth targeting (at $\kappa \approx 0$ both regimes are "equally bad"). Increasing κ little, creates the monetary policy trade-off that can be improved by nominal income growth targeting
  - Large elasticity favors inflation targeting. For high values (well above 0.3) inflation targeting becomes superior because
    * Inefficient response to technology shocks under nominal income growth targeting is worsened
    * Less need for inertial behavior (pre-commitment solution exhibits little inertia)
    * ....the inflation-output gap trade-off is sufficiently good so no improvement is needed

- *Higher variance of technology shocks* (higher σ_y) weakens the case for nominal income growth targeting

  - For $\sigma_y = 0.03$ (implying that output would have an unconditional standard deviation of 12 percent), then inflation targeting is superior.

Concluding remarks

- Optimal monetary policy in models of the "New Neoclassical Synthesis"/"New Keynesian framework" with forward-looking pricing behavior features *inertial behavior*, which improves the inflation-output gap trade-off

- Inflation targeting with discretionary behavior does not have this feature but nominal income growth targeting has

- When the economy has features which necessitate an improvement of the inflation-output gap trade-off in monetary policy conduct, nominal income growth targeting is superior

- This superiority is generally strengthened when

  – The main sources of variability are shocks creating a trade-off

  – Inflation generating shocks are more persistent

  – The propagation of inflation shocks exhibits more persistence (up to a point where forward-looking inflation determination does not become immaterial)

  – The elasticity of inflation with respect to the output gap is not too high

  – Society cares a lot about inflation

- Obvious implication: Nominal income growth targeting (of the form analyzed here) deserves more serious attention in discussions on monetary policy design

Could other targeting regimes/delegation forms play similar role?

- Yes; their relative performance is, however, not settled (depends on structural characteristics of the economy)

- Interest rate "smoothing" objective (Woodford, 1999)

- Nominal money growth targeting (Söderström, 2001)

- A price **level** target, (Clarida et al.,1999, and Vestin, 2000)

- A **real growth** target (Walsh, 2003, AER)

  – Any of the above/All of the above.....

Plan for next lectures

Wednesday, May 5, 12-14

Open-economy Aspects (I)

1. The Obstfeld and Rogoff two-country model

2. Solution under flexible prices

Literature: Walsh (2003, Chap. 6, pp. 269-282).

Monday, May 10, 12-14

Open-economy Aspects (II)

1. The Obstfeld and Rogoff two-country model with sticky prices

2. An example of international monetary policy coordination

Literature: Walsh (2003, Chap. 6, pp. 282-297). Read also (small)

Section 6.4 on the small open economy.

As supplementary recent readings on policy coordination, I recommend Benigno (2002, *Journal of International Economics*) and Clarida et al. (2002, *Journal of Monetary Economics*)