OPTIMAL MONETARY POLICY

FEBRUARY 15, 2017

OPTIMAL POLICY PROBLEMS: GENERAL FORM

- Set up economic environment
  - Household problem
  - Firm problem
  - Specification of government policy
    - Policy tools (monetary, fiscal, or both monetary and fiscal)
    - Government budget constraint(s)

KEY ISSUE: Lump-sum tax available or not? → Government budget constraint(s)

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- Solve for / define private-sector equilibrium
  - For any arbitrary policy
- Define social welfare criterion
  - Representative-consumer model: expected discounted lifetime utility
  - Heterogeneous-consumer model: not as obvious…how to weight?

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- Choose (typically state-contingent) policy rules subject to all equilibrium conditions of economy
  - Optimal policy-maker is a Social Planner with the additional restrictions imposed by decentralized equilibrium

FISCAL OR NOT?

- New Keynesian optimal-policy models
  - Typical claim: "abstracting from fiscal issues"…
  - …but monetary policy usefully thought of as a type of fiscal policy
    - Affects relative prices!
      - i.e., affects slopes of budget constraints – how different from fiscal policy?
  - (Soon…) Typical NK optimal-policy model allows sufficiently-rich set of (lump-sum and proportional) fiscal instruments to make decentralized economy Pareto-efficient
    - A very strong statement regarding fiscal policy
    - How does this abstract from fiscal policy?...

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- Ramsey optimal-policy models
  - Explicitly consider fiscal issues – either in isolation or in conjunction (jointly) with monetary policy
  - Strength: fully-specified stand on macroeconomic policy
  - Weakness: is the stand ad-hoc? (criticism by the recent "New Dynamic Public Finance" literature…see, e.g., Werning (2007 *QJE*))

OPTIMAL MONETARY POLICY: A FIRST LOOK

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  - **In environment with explicit optimization by households and firms**

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- **Sticky nominal prices**
  - **Model using Taylor staggering (two-period staggering)**
  - **(And typical Dixit-Stiglitz monopoly model underneath)**

- **No money demand**
  - **i.e., no CIA, MIU, etc.**
  - **Append a quantity equation ($P_t c_t = M_t$) to make model "monetary"**
    - **NOT a CIA constraint (i.e., appended AFTER household optimization)**

- **Lump-sum taxes/transfers finance monetary policy ($M_{t+1} = M_t + T_t$)**

- **Adopt the primal formulation**
- **Assume commitment**
- **Assume timeless perspective**

} **General issues to be aware of/take a stand on for any optimal policy analysis**

GENERAL ISSUES

- ❐ **Primal Formulation**
  - ❐ **Formulate optimal policy problem in terms of only allocations**
    - ❐ **By eliminating policy variables (and prices) using equilibrium conditions**
  - ❐ **Given optimal allocation, construct (implied) policy instruments that support allocation**
    - ❐ **Ramsey (1927)**
    - ❐ **Approach often employed in fiscal policy models**
    - ❐ **Only recently applied more frequently to monetary policy models**

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- **Commitment**
  - With initial state variable and/or forward-looking equilibrium conditions, policy FOCs for $t = 0$ differ from policy FOCs for $t > 0$
  - Assume government can bind itself to state-contingent policy paths for $t > 0$
  - (Opposite of commitment is discretion)

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- **Timeless Perspective**
  - Set $t = 0$ state to the steady-state of the $t > 0$ policy FOCs

Interpretation: the optimal policy has *already* been in operation for a long time; ignoring transition dynamics associated with initially-suboptimal policies

OPTIMAL MONETARY POLICY: A FIRST LOOK

- **Key constraint on optimal policy is the (sticky-price firm's) optimal price-setting condition – derived from two-period Taylor pricing problem**

Instantaneous profit depends on price, output, and mc

$$p_{0,t} \cdot \frac{\partial pr(p_{0,t}, y_{0,t}, mc_t)}{p_{0,t}} + E_t \left\{ \Xi_{t+1|t} p_{1,t+1} \cdot \frac{\partial pr(p_{1,t+1}, y_{1,t+1}, mc_{t+1})}{p_{1,t+1}} \right\} = 0$$

Optimal *relative* price set by sticky-price firm

Discount factor **between *t* and *t*+1 because *dynamic* firm problem; in equilibrium, = household stochastic discount factor**

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With two-period stickiness, $p_{1,t+1} = p_{0,t} / \pi_{t+1}$

Recall: Inflation erodes a sticky-price firm's *relative* price

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Use demand function to substitute out $p_{i,s}$

$$x(y_{0,t}, y_t, n_t, z_t) + E_t \left\{ \Xi_{t+1|t} x(y_{1,t+1}, y_{t+1}, n_{t+1}, z_{t+1}) \right\} = 0$$

Constraint for primal representation

Type-0 firm output

Final output

Aggregate labor

Aggregate TFP

Type-1 firm output

Firm "type" simply is number of periods since the most recent nominal price adjustment

Optimal Monetary Policy: A First Look

- **Optimal Policy Problem**

$$\max_{\{y_{0,t}, y_{1,t}, y_t, c_t, n_{0,t}, n_{1,t}, n_t\}} E_0\left[\sum_{t=0}^{\infty} \beta^t u(c_t, n_t)\right]$$ **subject to sequences**

$$c_t = y_t$$

Final goods market clearing (consumption the only source of absorption)

$$n_t = \frac{1}{2} n_{0,t} + \frac{1}{2} n_{1,t}$$

Labor-market clearing (each firm "type" has measure ½)

$$y_{0,t} = z_t n_{0,t}$$

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Production functions symmetric across the two "types" of firms

$$y_t = \left[0.5 \cdot y_{0,t}^{(\varepsilon-1)/\varepsilon} + 0.5 \cdot y_{1,t}^{(\varepsilon-1)/\varepsilon}\right]^{\varepsilon/(\varepsilon-1)}$$

Dixit-Stiglitz final-goods aggregator

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Optimal Monetary Policy: Analysis

- **Key constraint on optimal policy is the (sticky-price firm's) optimal price-setting condition – derived from two-period Taylor pricing problem**

multiplier

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- **FOC on n_t (to illustrate commitment problem)**

$$u_n(c_t, n_t) + \phi_t \frac{\partial x(y_{0,t}, y_t, n_t, z_t)}{\partial n_t} + \frac{1}{\beta}\phi_{t-1} E_{t-1}\left\{\Xi_{t|t-1} \frac{\partial x(y_{1,t}, y_t, n_t, z_t)}{\partial n_t}\right\} = \omega_t$$

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Note *t*-1 subscripts!

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- **Time *t*-1 decisions (hence equilibrium) based on *t*-1 information set**
  - **Including expectation of period-*t* policy**
  - **Source of time-inconsistency problems in policy models with forward-looking equilibrium conditions**
    - **Kydland and Prescott (1977)**

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- **Importance of Φ_{t-1}**
  - **From perspective of period-*t* policy optimization: measures the gain to period-*t*–1 price-setters of a period-*t* policy**
  - **From perspective of computing the optimal-policy equilibrium of economy: a state variable**

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  - **From perspective of period-*t* policy optimization: measures the gain to period-*t*-1 price-setters of a period-*t* policy**
  - **From perspective of computing the optimal-policy equilibrium of economy: a state variable**
  - **In period *t*, "temptation" exists for policy-maker to "forget about" period *t*-1 – i.e., can implement a one-shot Pareto-superior equilibrium in period *t* by "supposing $\Phi_{t\text{-}1}$ = 0"**
    - **Basic idea of Kydland and Prescott (1977) example**
  - **General: optimal policy problems with commitment and forward-looking equilibrium conditions feature lagged Lagrange multipliers**

See King and Wolman (1999, p. 384)

OPTIMAL MONETARY POLICY: RESULTS

- **Policy FOCs imply $y_{0,t} = y_{1,t}$ for all t (assuming $\Phi_{-1} = \Phi_{infinity}$)**
  - **Output should be equated across firms adjusting price and firms not adjusting price**
    - **Follows from symmetry and concavity of Dixit-Stiglitz aggregator**
    - **Achieves Pareto optimum**
  - **In equilibrium, can only be achieved if relative price across types of goods = 1**

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  - In equilibrium, can only be achieved if relative price across types of goods = 1
  - In monetary economy with sticky nominal price-setting, requires zero inflation at all dates and in all states
    - Induce an allocation in which when firms DO have an opportunity to reset nominal price, they optimally choose to NOT change price at all
    - Completely eliminates any deadweight loss stemming from nominal rigidities (dispersion in Calvo and Taylor models, direct resource cost in Rotemberg model)

LOW AND STABLE INFLATION

- **Zero inflation** the benchmark optimal policy in **sticky-price models**
  - In the long run (steady state)…
  - …and in the short run (business-cycle magnitude shocks)

- **Small (Friedman Rule) deflation** the benchmark optimal policy in **flexible-price models with money demand distortions**
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- **Sticky-price + money demand distortions**
  - Long-run optimal policy: deflation between zero and the Friedman Rule
    - Khan, King, and Wolman (2003 *ReStud*)
    - Schmitt-Grohe and Uribe (2004 *JET*)
    - Siu (2004 *JME*)
  - Short-run optimal policy: small inflation fluctuations in all dates/states
    - Same references…

IMPLEMENTATION OF OPTIMAL POLICY?

- **King and Wolman use primal approach**
  - **Allows for characterizing optimal policy (optimal allocations) without describing how policy should be implemented**
  - **Primal approach largely silent on implementation**

- **Implementation: how should / can *X* percent inflation be achieved?**
  - **Long-run: set *X* percent money growth (monetarist)**
  - **Short-run: ?...**

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- **Typical New Keynesian optimal-policy analysis**
  - **Assume a simple Taylor Rule as the operational rule by which policy is implemented**

$$\hat{R}_t = \delta_\pi \hat{\pi}_t + \delta_y \hat{y}_t$$

  - **Characterize constrained-optimal allocations**
  - **Find coefficients of Taylor Rule that deliver allocations very close to the constrained-optimal allocations**