Optimal Fiscal and Monetary Policy in a Medium-Scale Macroeconomic Model

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A medium-scale macroeconomic model

- Nominal Frictions:
  1. Sticky product prices
  2. Sticky nominal wages
     (indexed to lagged price inflation)
  3. Cash-in-advance constraint on wages
  4. Money demand by households

- Real Rigidities:
  1. Distortionary income taxation
  2. Monopolistically competitive product and factor markets
  3. Habit persistence in consumption
  4. Investment adjustment costs
  5. Variable capacity utilization

- Sources of Uncertainty

  1. Government consumption shocks

  2. Government transfer shocks

  3. Technology shocks

- Government Policy Objective: Ramsey-Optimal Stabilization

- Policy Instruments

  1. Distortionary income taxation

  2. Issuance of money and nominally risk-free bonds

Long-run Inflation: Policy Tradeoffs

- Price stickiness calls for $\pi = 0\%$
- Money demand by HH and firms calls for Friedman rule ($\pi = -3.8\%$)
- Under an income tax regime, positive nominal interest rates allow for differential taxation of capital and labor income
- Positive nominal interest rates allow for indirect taxation of transfers, n_t.

The Optimal Rate of Inflation

Environment		Ramsey Steady State			
χ	$\bar{n}$	π	R	τ^h	τ^k
0	BV	0.2	4.2	35.4	-6.3
1	BV	4.6	8.8	34.7	-6.6
1	0	-3.8	0	24.1	-5.3
0	0	-0.2	3.8	23.3	-5.2

χ = Degree of Price Indexation.
$\bar{n}$ = Government Transfers.
BM = Benchmark Value.

Note: The inflation rate, π, and the nominal interest rate, R, are expressed in percent per year. The labor income tax rate, τ^h, and the capital income tax rate, τ^k, are expressed in percent.

Capital Income Taxation: Policy Tradeoffs

- Monopolistic competition calls for a capital subsidy, $\tau^k < 0$, such that social and private return on capital are equated.

$$(1-\tau^k)(uF_k/\mu - \delta - a(u)) = uF_k - \delta - a(u).$$

- The optimal profit tax is 100%. So, when profits and capital are restricted to be taxed at same rate, the optimal level of τ_t^k increases.

	Ramsey Steady State			
τ_t^ϕ	π	R	τ^h	τ^k
τ_t^k	0.2	4.2	35.4	-6.3
1	0.3	4.3	38.2	-44.3

τ_t^ϕ = Profit Tax Rate.

Resolution of Long-run Policy Tradeoffs:

- The optimal inflation rate is **positive** but close to zero.

- The optimal capital tax rate is **negative** but close to zero.

Optimal Policy Under Income Taxation
($\tau_t^k = \tau_t^h = \tau_t^\phi$)

Short-Run Policy Tradeoffs

- Surprise inflation acts as a lump-sum tax on nominal assets

- Sticky prices make inflation volatility undesirable because it creates price dispersion

- Sticky wages: Set inflation so as to bring about efficient real wage

- Smooth income tax rates so as to smooth distortions over time.

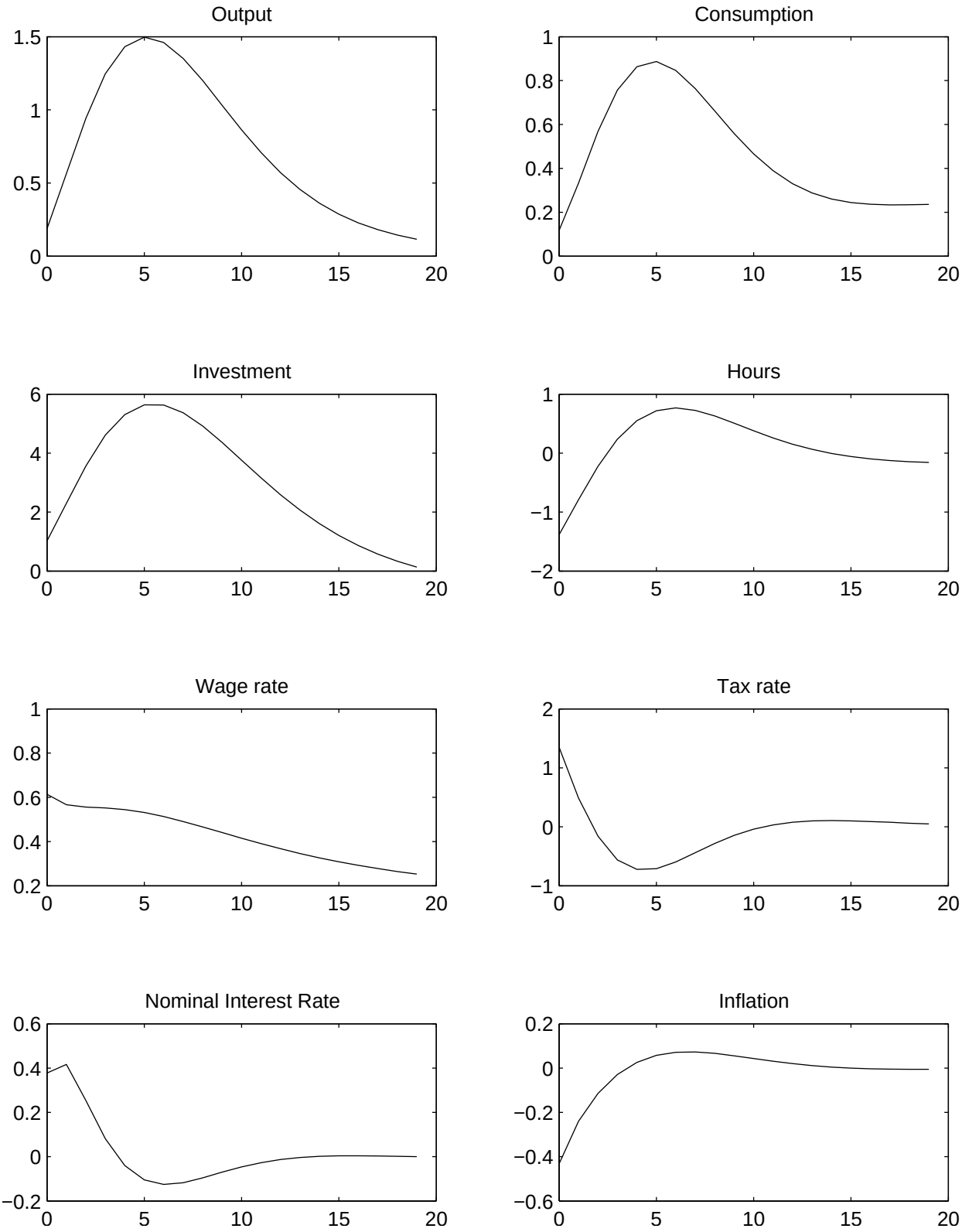
Ramsey Dynamics under Income Taxation

$\tau_t^k = \tau_t^h = \tau_t^\phi \equiv \tau_t^y$

No Transfers ($n_t = 0$)

α	$\tilde{\alpha}$		τ_t^y	R_t	π_t	w_t	a_t
		Mean	19.0	4.0	0.02	1.2	0.8
0.6	0.64	Std. dev.	1.0	1.3	1.1	1	3.6
		Ser. corr.	0.6	0.7	0.6	0.9	0.99
		Mean	19.0	4.4	0.4	1.2	0.8
0	0.64	Std. dev.	1.5	3.1	5.8	1.7	5.1
		Ser. corr	0.5	0.9	0.8	0.8	0.99
		Mean	19.0	4.0	0.02	1.2	0.8
0.6	0	Std. dev.	0.4	0.7	0.1	1.4	6.3
		Ser. corr.	0.6	0.9	0.1	0.9	1
		Mean	19.0	4.4	0.4	1.2	0.8
0	0	Std. dev.	0.1	0.2	5.8	1.4	2.5
		Ser. corr.	0.6	0.8	-0.1	0.8	0.84

Technology Shock (1 std)



Resolution of Short-run Policy Tradeoffs:

- The optimal volatility of inflation is **small**.
- Tax **smoothing** is optimal.
- **Near-random walk** in government debt.

Welfare Losses of NOT conduction optimal fiscal policy

Ad-hoc fiscal policy: zero (secondary) fiscal deficits, $a_t = a$

Ramsey Optimal Monetary and Fiscal Policy:

$$\text{Consumption and labor: } \{c_t^r, h_t^r\}_{t=0}$$
$$\text{Welfare: } E_0 U(\{c_t^r, h_t^r\}_{t=0}^{\infty})$$

Ramsey Optimal Monetary BUT ad hoc Fiscal Policy:

$$\text{Welfare: } W^a = E_0 U(\{c_t^a, h_t^a\}_{t=0}^{\infty})$$

Welfare Cost, λ:

$$W^a = E_0 U(\{(1-\lambda) c_t^r, h_t^r\}_{t=0}^{\infty})$$

$\lambda = 0.0088$ percent (or 19 cents per month per person)

Welfare Losses of NOT conduction optimal monetary policy

Ad hoc monetary policy: $\widehat{R}_t = 0.5\widehat{\pi}_t$

$\lambda = 0.0130$ percent (or 28 cents per month per person)

Implementing the Ramsey equilibrium with policy rules

$$\widehat{R} = \alpha_\pi \widehat{\pi}_t + \alpha_W \widehat{\pi}_t^W + \alpha_y \widehat{y}_t + \alpha_R \widehat{R}_{t-1}$$

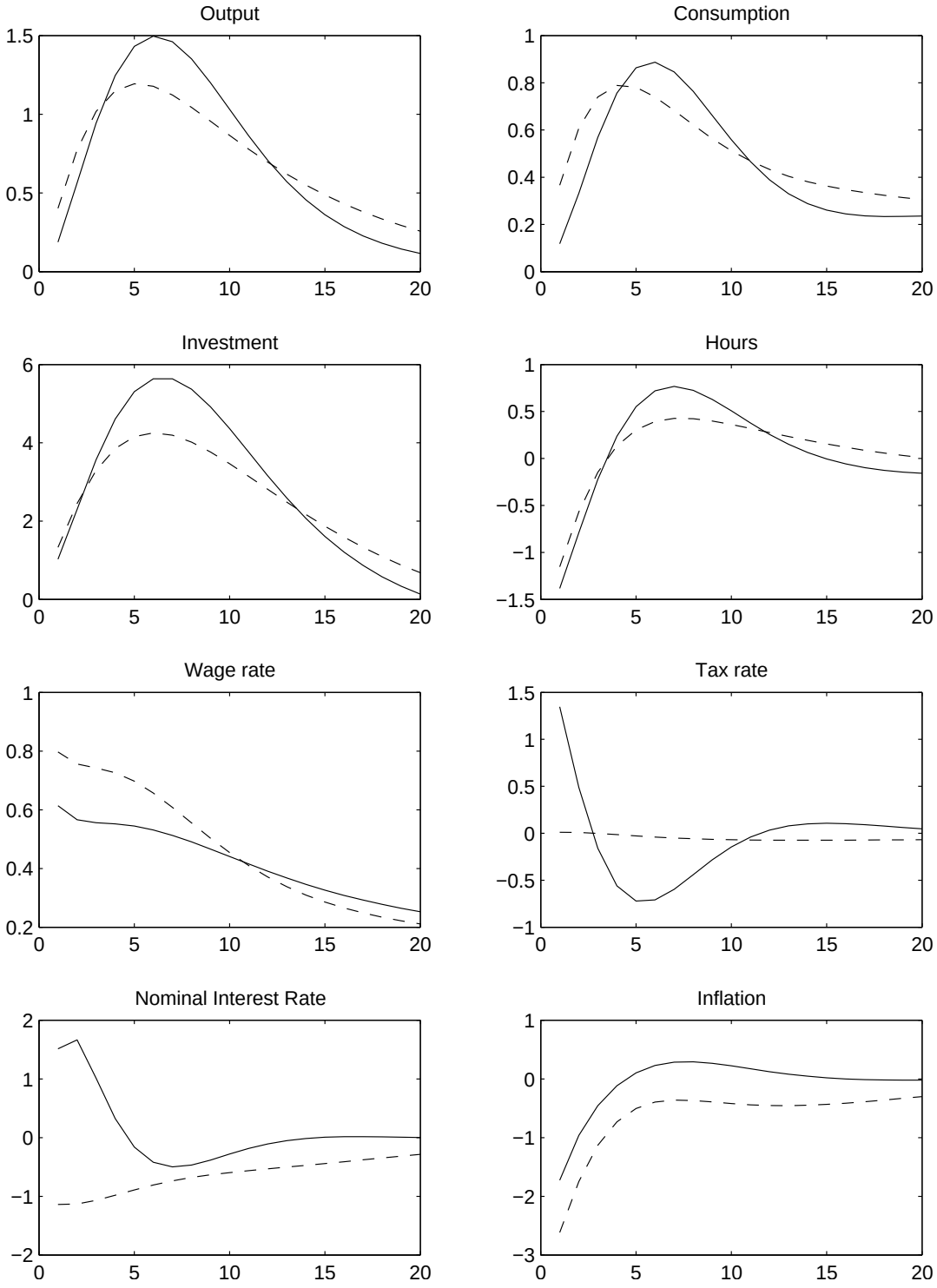
and

$$\widehat{\tau}_t^y = \beta_a \widehat{a}_t + \beta_y \widehat{y}_t + \beta_\tau \widehat{\tau}_{t-1}^y$$

Pick 7 policy coefficients so as to match the impulse response functions of all endogenous variables for 20 periods for each of the 3 shocks.

α_π	0.37
α_W	-0.16
α_y	-0.06
α_R	0.55
β_a	-0.06
β_y	0.02
β_τ	1.88

Impulse Response to a Technology Shock
Solid line: Ramsey, dashed line: optimized rule



Welfare Costs of the Optimized Rule

Consumption and labor processes under the Ramsey Policy:

$$\{c_t^r, h_t^r\}_{t=0}$$

Welfare under the Ramsey Policy:

$$E_0 U(\{c_t^r, h_t^r\}_{t=0}^{\infty})$$

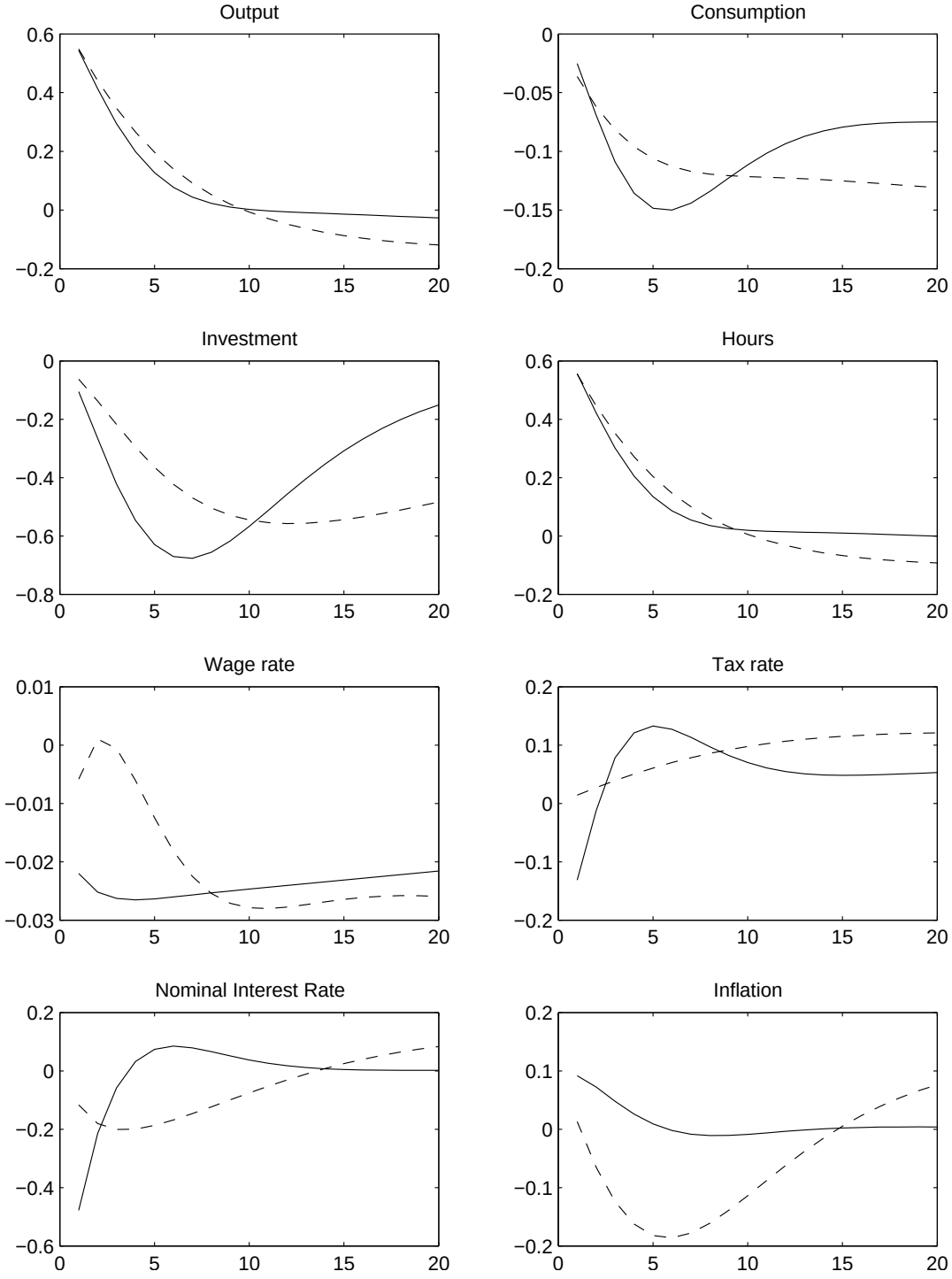
Welfare Cost of the **Optimized** Rule, λ:

$$E_0 U(\{c_t^o, h_t^o\}_{t=0}^{\infty}) = E_0 U(\{(1-\lambda)c_t^r, h_t^r\}_{t=0}^{\infty})$$

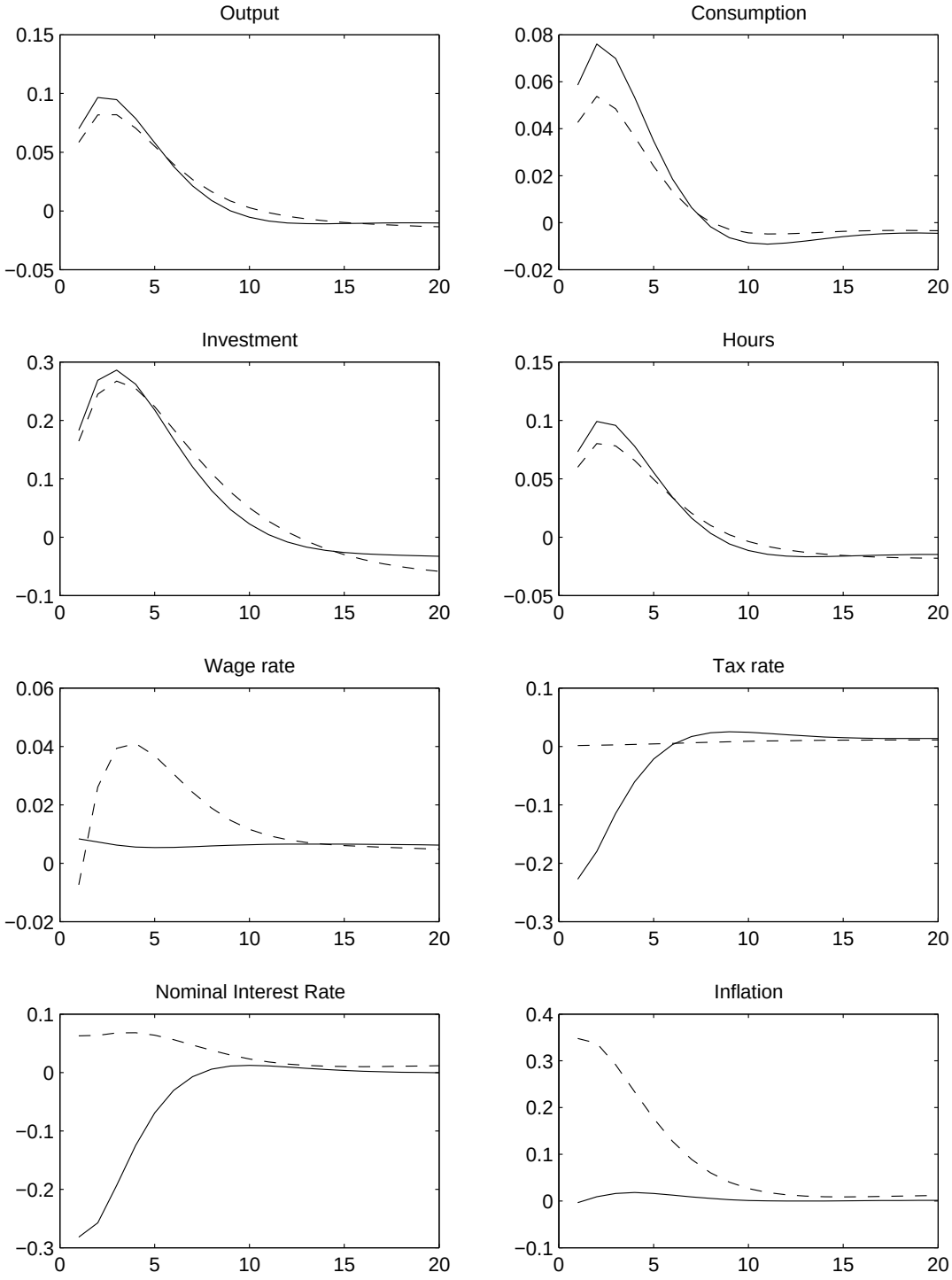
$\lambda = 0.017$ percent (or 39 cents per month per person)

Impulse Response to a Government Purchases Shock

Solid line: Ramsey, dashed line: optimized rule



Impulse Response to a Transfer Shock
Solid line: Ramsey, dashed line: optimized rule



Last, by not least, ...

The paper makes a **methodological** contribution by showing how to find the equilibrium conditions of Ramsey problems for a quite general class of models **analytically** using symbolic algebra tools.

The programs used for this paper, illustrating the use of this technique, are posted at the authors's websites.