Fiscal Policy with Heterogeneous Agents and Incomplete Markets
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Review of Economic Studies, 2005

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Motivation

- **Ricardian Equivalence**: with lump-sum taxes, perfect capital markets and dynastic households, changes in the timing of taxes should not affect households' optimal consumption decisions.
- What generates significant deviations from the Ricardian Equivalence result?
- Various alternative models featuring:
  - Distortionary taxes
  - Asset market imperfection
  - Imperfect intergenerational altruism

Empirical Evidence

Testing the Ricardian Equivalence:

- Natural experiments (1968 surtax, 1975 rebate):
  - Modigliani and Steindal (1977): MPC between 0.3 and 0.58 (1975 rebate)
  - Blinder (1981): MPC of 0.16 (1968 surtax and 1975 rebate)

- Studies based on micro data (CEX):
  - Souleles (2002): MPC between 0.6 and 0.9 (pre-announced Reagan tax cuts, non-durable)
  - Parker (1999): MPC of 0.2 (predictable changes in social security tax with-holding)

Benchmark: The Bewley Model with Distortionary Taxes

A continuum of households:

- Bond economy, borrowing constraint
- Idiosyncratic shock on productivity e_t (first-order Markov process)
  - $\mu_t(e^t)$ the probability of individual history $e^t = (e_0, ..., e_t)$

A representative firm

The government finances constant spendings G using:

- One-period bond
- Income taxes follow a stochastic process (aggregate shock)
  - $\nu_t(\tau^t)$ the probability of history $\tau^t = (\tau_0, ..., \tau_t)$

Initial state of the economy: $z_0 = (m, B_{-1})$, with m the initial distribution of agents over assets and productivity

Households

Maximization Problem

Households choose decision functions $\{n_t(e^t, \tau^t)\}_{t=0}^{\infty}$, $\{c_t(e^t, \tau^t)\}_{t=0}^{\infty}$, $\{a_t(e^t, \tau^t)\}_{t=0}^{\infty}$ to maximize:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{1-\gamma}\left[\left(c_t - \psi \frac{n_t^{1+1/\epsilon}}{1+1/\epsilon}\right)^{1-\gamma} - 1\right]$$

s. t.

$$c_t + a_t = [1 + (1-\tau_t) r_t] a_{t-1} + (1-\tau_t) w_t n_t \;\; \forall e^t \; \forall \tau^t \; \forall t$$

$$a_t \geq 0$$

Initial wealth a_{-1}, prices, taxes and probability measures, are taken as given.

Labor Supply

$$n_t(\tau^t, e^t) = \left[\frac{w_t(\tau^t) e_t (1-\tau_t)}{\psi}\right]^{\epsilon}$$

Production

A standard Cobb-Douglas production function:

$$Y_t(\tau^t) = K_{t-1}(\tau^{t-1})^{\alpha} N_t(\tau^t)^{1-\alpha}$$

Static maximization:

$$r_t(\tau^t) = \alpha K_{t-1}(\tau^{t-1})^{\alpha-1} N_t(\tau^t)^{1-\alpha} - \delta$$
$$w_t(\tau^t) = (1-\alpha) K_{t-1}(\tau^{t-1})^{\alpha} N_t(\tau^t)^{-\alpha}$$

Feasibility:

$$C_t(\tau^t) + G + K_t(\tau^t) = K_{t-1}(\tau^{t-1})^{\alpha} N_t(\tau^t)^{1-\alpha} + (1-\delta) K_{t-1}(\tau^{t-1})$$

Government

$G_t(\tau^t) = G$ and B_{-1} is given. Then, $\forall t \; \forall \tau^t$:

$$B_t = G + (1 + r_t)B_{t-1} - \tau_t[r_t A_{t-1} + w_t N_t]$$

Process for taxes:

- Assumption: $B_t(\tau^t) \in D$
- Taxes follow a Markov process: $B_{-1} \in D => B_t(\tau^t) \in D \; \forall \tau^t$

	$B \leq \underline{D}$	$\underline{D} < B < \overline{D}$	$B \geq \overline{D}$
$\pi_\tau((\tau_h, B), \tau_h)$	0	$\left[\frac{B-\underline{D}}{\overline{D}-\underline{D}}\right]^\lambda$	1
$\pi_\tau((\tau_l, B), \tau_l)$	1	$\left[\frac{\overline{D}-B}{\overline{D}-\underline{D}}\right]^\lambda$	0

Equilibrium

An equilibrium is a set of policy functions of the households c_t, n_t, a_t, government debt B_t, aggregate variables A_t, K_t and N_t, prices w_t and r_t, taxes τ_t, individual productivity shock e_t, probability measure μ^t and ν^t, and an initial state z_0 such that $\forall \tau^t \ \forall e^t \ \forall t$:

(1) a_t, c_t, n_t solve the households' maximization problem
(2) $\{\mu^t\}$ and $\{\nu^t\}$ are consistent with the stochastic process for productivity and taxes
(3) Aggregate quantities A_t, C_t, N_t are consistent with individual decision rules
(4) The market for savings clears:

$$K_t(\tau^t) + B_t(\tau^t) = A_t(\tau^t) \tag{1}$$

(5) Given prices, N_t and K_t are consistent with firm's policy functions
(6) Goods market clear
(7) The government budget constraint is satisfied

Calibration & Algorithm

Calibration

TABLE 1

Parameter values and simulation targets common across economies

		Parameters set outside the model			
Preferences	β	0·96	*Production*	α	0·36
	γ	1·0		δ	0·10
	ε	0·3			
		Simulation targets*			
Wealth distribution			*Debt/GDP*		
Mean Gini	0·78		Mean		0·67
Mean wealth poorest 40%	1·35%				
			Tax revenue/GDP		
Log household productivity			Mean		0·26
Standard deviation	0·51		Standard deviation		0·01
Autocorrelation	0·9		Autocorrelation		0·63

*These target values apply to a 10,000 period simulation. In the complete-markets and overlapping-generations economies, household productivity is constant and the wealth distribution targets do not apply.

Algorithm: Krusell and Smith (1998)

Outline

Propensity to Consume out of Tax (**when tax switch from high to low**):

$$\text{PCT} = 100 * \frac{C_t - C_{t-1}}{T_t - T_{t-1}}$$

- Imperfect asset market: incomplete market with borrowing constraint (lump-sum taxes, infinitely-lived agents)
- Distortionary taxes (complete market, infinitely-lived agents)
- OLG (complete market, lump-sum taxes)

Incomplete Markets

Budget constraint with **lump-sum taxes**, $\forall t$, $\forall \tau^t$, $\forall e^t$:

$$c_t + a_t = (1 + r_t)a_{t+1} + w_t e_t n_t - \tau_t$$

Two exercises:

- Fixed prices/open economy: constant interest rate r^* (implies constant $(K/N)^*$, w^*, N^*, K^*, Y^*). The feasibility constraint is now:
$$C_t(\tau^t) + X_t(\tau^t) + I + G = Y$$
- Closed economy.

Incomplete Markets (Lump-Sum, Infinitely-Lived Agents)

Percentage Change on Impact Tax rev						PCT
	Tax rev.	Hours	GDP	C	I	$\frac{100*(C_t - C_{t-1})}{T_t - T_{t-1}}$
Open Economy	-7.12	0.0	0.0	**0.40**	0.0	-14.9
Closed Economy	-6.97	0.00	0.02	**0.30**	-0.66	-11.4

Consumption sensitivity to the tax rate: $\frac{C_{i,\tau_h} - C_{i,\tau_l}}{T_{i,\tau_h} - T_{i,\tau_l}}$

Open Economy				Closed Economy			
(Wealth,Productivity)	e_1	e_2	e_3	(Wealth,Productivity)	e_1	e_2	e_3
Zero	**-1.00**	-0.43	-0.03	Zero	-1.00	-0.40	**0.08**
Median	-0.40	-0.21	-0.03	Median	-0.38	-0.18	**0.08**
Mean	-0.05	-0.03	**-0.01**	Mean	-0.02	**0.03**	**0.12**

Distortionary Taxes

Distortionary Taxes (Complete Markets, Infinitely-lived agents)					
Percentage Change on Impact Tax rev					PCT
Tax rev.	Hours	GDP	C	I	$\frac{100*(C_t - C_{t-1})}{T_t - T_{t-1}}$
-6.39	0.91	0.57	0.71	0.80	-23.2

OLG Model

OLG (Lump-Sum Taxes, Complete Markets) - **Fixed Prices**					
Percentage Change on Impact Tax rev					PCT
Tax rev.	Hours	GDP	C	I	$\frac{100*(C_t - C_{t-1})}{T_t - T_{t-1}}$
-7.19	0.0	0.0	0.15	0.0	-4.9

- Endogenizing prices would reduce the consumption response.

Distortionary Taxes & Incomplete Markets

Percentage Change on Impact Tax rev					PCT
Tax rev.	Hours	GDP	C	I	$\frac{100*(C_t - C_{t-1})}{T_t - T_{t-1}}$
-6.24	0.97	0.62	**0.92**	0.56	-28.8

Consumption sensitivity to the tax rate: $\frac{C_{i,\tau_h} - C_{i,\tau_l}}{T_{i,\tau_h} - T_{i,\tau_l}}$

(Wealth,Productivity)	e_1	e_2	e_3
Zero	-1.28	-0.58	-0.36
Median	-0.51	-0.40	-0.36
Mean	-0.01	-0.21	-0.34

Conclusion

- Income taxes and Incomplete Markets/Borrowing Constraint are both significant
- Wide variation in the response at the household level