Lack of Commitment, Retroactive Taxation, and Macroeconomic Instability

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Motivation

- **Retroactive taxation.** A tax provision is said to be retroactive if it is applicable to taxable events that occurred prior to the enactment of the provision. That is, retroactive tax legislation is a particular instance of ex post facto legislation.

- Retroactive taxation is constitutional in almost all high-income countries, including the U.S., Canada, U.K., Australia, and continental Europe
- In the U.S., According to the Congressional Research Service of the U.S., it is quite common for the U.S. Congress to enact tax legislation that applies retroactively

Motivation

- Dozens of retroactive tax bills have been approved in the U.S. during the past decades. Examples are:
  - Taxpayer Relief Act of 1997, enacted on August 5, 1997, contained provisions retroactive to May 3, 1995.
  - The Omnibus Budget Reconciliation Act of 1993, enacted on August 8, 1993, contained provisions retroactive to January 1, 1993
  - The Tax Relief Extension Act of 1999, enacted on December 17, 1999, contained provisions retroactive to February 8, 1999.
  - The Community Renewal Tax Relief of 2000, enacted on December 21, 2000, contained provisions retroactive to October 19, 1999
  - State of Connecticut's Public Act 11-06, enacted on May 4, 2011, contained provisions retroactive to January 1, 2011.

Research Question/Main Finding

- This paper shows that a fiscal authority that lacks commitment to fiscal policy and can set taxes retroactively yields multiple expectations-driven equilibria, and hence becomes a source of volatility in fiscal and macroeconomic variables
- A constitutional reform banning retroactive taxation would yield a unique equilibrium, thus removing the possibility of expectations-driven fluctuations.

Results Explained

- The multiplicity of expectations-driven equilibria under retroactive taxation results from a coordination problem between the households and the government
- When the tax rate can be set retroactively to the beginning of the year, households' decisions must be based on expected rather than on actual policy
- These decisions then shape the government's policy choice so that it becomes optimal for the government to fulfill those expectations

Results Explained (continuation)

- In the economy with debt, a key equilibrium property that makes the mechanism for multiple equilibria operational is that public debt is not households' net worth.
- This implies that the government's indifference condition between taxes and debt holds for any combination of taxes and debt that is expected by the households
- This yields a redundancy of policy instruments which is resolved by validating household expectations
- Since in our model capital accumulation is endogenous and taxes distort previous year's investment, equilibrium multiplicity implies not only multiplicity of policy instruments but also of allocations and welfare.

Implications of our results

- We show theoretically that retroactive taxation is a potential source of macroeconomic instability
- Our results provide arguments against retroactive tax legislation, and in favor of strengthening the government's within-period commitment to taxes
- Our findings challenge the dominant legal theory, which argues that retroactive taxation constitutes an efficient source of revenue for the government (Levmore 1993)
- Our findings have important policy implications in terms of the rules governing the setting of fiscal policy

Implications of our results (continuation)

- By arguing in favor of strengthening within-period commitment to taxes, our policy recommendation aligns with calls in the literature on monetary economics for strengthening the tools of monetary policy commitment
- Our proposition that under retroactive taxation households' consumption is based on policy expectations, and hence does not respond to changes in actual tax rates and debt issuances can be tested using both aggregate and household-level data exploiting episodes of major retroactive tax changes.

Roadmap

- Related literature
- The environment with government debt
  - Ramsey equilibrium (full commitment)
  - Markov-perfect equilibria under retroactive taxation
  - Markov-perfect equilibrium when retroactivity is banned
- Robustness of equilibrium multiplicity under retroactive taxation
- The environment with balanced budgets

Related literature

- While there is an extensive literature characterizing optimal fiscal policy under lack of commitment to *future* policy, less attention has been devoted to environments where the government lacks both *within*- and *inter*-period commitment
- There is no previous work on retroactive tax legislation in the economics literature
- There is work on retroactive tax legislation in the legal literature

Related literature

Lack of commitment in models without government debt

- Cohen and Michel (1988)
- Klein and Ríos-Rull (2003)
- Ortigueira (2006)
- Klein et al. (2008)
- Azzimonti et al. (2009)
- Laczó and Rossi (2020)

Lack of commitment in models without physical capital accumulation

- Debortoli and Nunes (2013)
- Diaz-Gimenez et al. (2008)
- Eggertsson (2008)
- Nieman et al. (2013)

Related literature (continuation)

- Our work is also related to a literature on discretionary optimal monetary policy under sticky prices
  - Albanesi et al. (2003)
  - King and Wolman (2004)
  - Blake and Kirsanova (2012)
- These works find a multiplicity of expectations-driven equilibria
- Implying that a monetary authority that lacks commitment to its policy leads to endogenous fluctuations in prices

The Environment with Government Debt

- Neoclassical model of capital accumulation
- Representative household, representative firm, and a benevolent government
- The government provides a public good, collects income taxes, and issues public debt
- We consider scenarios where the government can and cannot use retroactive tax legislation
- In case of retroactive taxation we consider only the case where the tax bill is made effective to the beginning of the period of enacment

The Environment with Government Debt

The household

$$\max_{\{c_t, k_{t+1}, b_{t+1}\}} \sum_{t=0}^{\infty} \beta^t U(c_t, G_t),$$

$$s.t.$$

$$c_t + k_{t+1} + b_{t+1} = k_t + b_t + (1 - \tau_t) \left[\omega_t + (r_t - \delta) k_t + r_t^b b_t \right]$$

$k_0 > 0$ and b_0 given,

The Environment with Government Debt

The production sector

$$Y_t = F(K_t, L_t) = F(K_t, 1) = f(K_t),$$

First-order conditions for profit maximization imply the typical demand and zero-profit equations

$$\begin{aligned} r_t &= f_K(K_t) \\ \omega_t &= f(K_t) - r_t K_t. \end{aligned}$$

The Environment with Government Debt

The government is benevolent in the sense that it seeks to maximizes social welfare, subject to its own budget constraint, to a feasibility restriction, and to the private sector's first-order conditions. In addition, government's policies may be conditioned by its lack of commitment. The budget constraint of the government is

$$G_t + (1 + r_t^b)B_t = B_{t+1} + \tau_t \left[\omega_t + (r_t - \delta) K_t + r_t^b B_t\right]$$

Optimal fiscal policy under full commitment

- With start with the well-studied case of full commitment (Judd 1985 and Chamley 1986)
- Under full commitment to policy, the benevolent government can credibly set (at the beginning of $t = 0$) the **whole sequence** of expenditure on the public good, debt issues and income taxes from the initial period onward
- This allows the government to fully anticipate the response of the private sector to its fiscal policy. The problem of the government in the Ramsey equilibrium is to set fiscal policy so that the competitive equilibrium maximizes social welfare

Optimal fiscal policy under full commitment

PROPOSITION (Ramsey). If there is no upper bound on the tax rate, or if K_0, B_0 are such that the bound is not binding, then in the steady state of the Ramsey equilibrium the income tax rate is zero, and the government holds positive assets, i.e. $B < 0$.

Markov-Perfect Optimal Fiscal Policy under no Commitment

- We now drop the assumption of government commitment to policy, and focus on differentiable Markov-perfect equilibria
- The government acts sequentially, foreseeing its future behavior when choosing current expenditure on the public good, debt issuances and the income tax rate
- We consider two scenarios that differ only in the extent of the government's inability to commit

Markov-Perfect Optimal Fiscal Policy under no Commitment

- The two scenarios yield, in turn, different timings of actions within the period
- The first scenario assumes that the government lacks commitment not only to future policy, but also to policy within the fiscal year (**retroactive taxation**)
- The second scenario continues to assume that the government lacks commitment to future policy, but introduces within-period commitment to the tax rate (**no retroactive taxation)**

Markov-Perfect Optimal Fiscal Policy with Retroactive Taxation

Timing of actions within each time period

Aggregate state var.	Production takes place	Households consume	Government sets policy	Households set savings portfolio	Aggregate state var.
K_t, B_t	Y_t	c_t	τ_t, B_{t+1}, G_t	k_{t+1}, b_{t+1}	K_{t+1}, B_{t+1}
t					$t+1$

The Problem of the Household

Maximization problem of the household

- Expects $\tau = \psi_\tau(K,B)$,$B' = \psi_{B'}(K,B)$ and $G = \psi_G(K,B)$
- Chooses consumption

$$\max_{c,k',b'} \left\{ U\left(c, G\right) + \beta v(k', b', K', B') \right\}$$
$$s.t.$$
$$c + k' + b' = k + b + (1-\tau)\left[\omega(K) + \left[r(K) - \delta\right] k + r^b(K) b\right]$$

The Problem of the Household

From problem above, the household consumption function can be expressed in terms of K and B, say $C(K,B)$, and satisfies the following Euler equation

$$U_C\left(C(K,B),G\right)=\beta U_{C'}\left(C(K',B'),G'\right)\Big[1+\left(1-\tau'\right)\left(f_K(K')-\delta\right)\Big],$$

where $G=\psi_G(K,B)$, $B'=\psi_{B'}(K,B)$, $G'=\psi_G(K',B')$ and $\tau'=\psi_\tau(K',B')$

The Problem of the Government

Once government policy for the period has been set policy, the household chooses its savings portfolio. This implies that $r^b(K)$ satisfies the no-arbitrage condition between physical capital and debt

$$r^b(K') = f_K(K') - \delta, \tag{1}$$

so that the household holds both capital and debt in its savings portfolio.

The Problem of the Government

The maximization problem of the government

- The period-t government sets τ, B' and G for the period, given the consumption function of the household, $C(K, B)$, and foreseeing the policy of future governments

$$\max_{\tau, K', B', G} \left\{ U(C(K,B), G) + \beta V(K', B') \right\}$$

s.t.

$$K' = (1-\delta)K + f(K) - C(K,B) - G$$

$$G = \tau \left[f(K) - \delta K + r^b(K)B \right] + B' - \left[1 + r^b(K) \right] B$$

Definition of MPE under Retroactive Taxation

Definition: *A Markov-perfect equilibrium in the economy where the government lacks within- and inter-period commitment to its policy is a consumption function, $C(K, B)$, policy functions, $\tau(K, B)$, $B'(K, B)$ and $G(K, B)$, and a value function, $V(K, B)$, such that:*

(i) If the household expects the policy $\tau(K, B)$, $B'(K, B)$ and $G(K, B)$, the consumption function $C(K, B)$ solves the household's maximization problem.

(ii) Given the consumption function $C(K, B)$, if the government expects the continuation value $V(K, B)$, the policy $\tau(K, B)$, $B'(K, B)$ and $G(K, B)$ solve the government's maximization problem, and public debt satisfies a no-Ponzi condition.

(iii) $V(K, B)$ is the value function of the government. That is

$$V(K, B) = U(C(K, B), G(K, B)) + \beta V(K'(K, B), B'(K, B))$$

Generalized Euler Equations (GEEs)

PROPOSITION (GEEs). Along a Markov-perfect equilibrium of the economy without within- and inter-period commitment to the tax rate, fiscal policy satisfies the following generalized Euler equation and no-arbitrage condition, respectively

$$U_G = \beta \left[U'_{C'} C'_{K'} + U'_{G'} (f'_{K'} + 1 - \delta - C'_{K'}) \right]$$

$$(U'_{C'} - U'_{G'}) C'_{B'} = 0.$$

MPE under Retroactive Taxation

A Markov-perfect equilibrium is thus a solution to the system of functional equations formed by:

- The household Euler equation
- The two generalized Euler equations
- Together with the resource constraint, the budget constraint of the government, the no-arbitrage condition between capital and debt, and a no-Ponzi condition on debt.

Public Debt is not Household's Net Worth along a MPE

PROPOSITION (debt is not household's net worth). Along a Markov-perfect equilibrium, government bonds are not households' net worth, i.e., the consumption function, $C(K, B)$, does not depend on debt holdings, B.

From this equilibrium property of the household consumption function and from the no-arbitrage condition between taxes and debt (the second generalized Euler equation shown above) the multiplicity of Markov-perfect equilibria follows quite straightforwardly.

Public Debt is not Household's Net Worth along a MPE

PROPOSITION (Multiciplity of MPE) In the economy where the government lacks both within- and inter-period commitment to policy, if a Markov-perfect equilibrium exists then there is a continuum of such equilibria, indexed by a family of functions $\Omega(K)$. Moreover, the families of equilibrium policy functions for taxes and debt issues, indexed by $\Omega(K)$, take the form

$$\tau(K,B;\Omega) = \frac{\Big(f_K(K)+1-\delta\Big)B-\Omega(K)}{f(K)-\delta K+\Big(f_K(K)-\delta\Big)B}$$

$$B'(K;\Omega) = G(K;\Omega)+\Omega(K),$$

where $G(K;\Omega)$ is the family of policy functions for government spending on the public good. The family of equilibrium policy functions for household consumption is also indexed by $\Omega(K)$.

An Example Economy with a Closed-Form Family of Equilibria

Multiplicity of MPE in closed form solution. If $U(C,G) = \ln C + \theta \ln G$ with $\theta > 0$, $f(K) = K^{\alpha}$ with $0 < \alpha < 1$, $\delta = 1$, and capital depreciation is not tax-deductible, then there exists a continuum of Markov-perfect equilibria, where the family of policy and value functions are indexed by $a_1 \in (0,1)$

$$
\begin{aligned}
C(K; a_1) &= a_1 K^{\alpha} \\
\tau(K, B; a_1) &= \frac{\alpha \frac{B}{K} + \frac{(1-a_1)\theta}{\theta+\beta a_3} - \frac{\beta}{\beta-1}\left[\frac{(1-a_1-\alpha\beta)a_3 - \alpha\theta a_1}{(\theta+\beta a_3)\alpha}\right]}{1+\alpha\frac{B}{K}} \\
B'(K; a_1) &= \frac{\beta}{\beta-1}\left[\frac{(1-a_1-\alpha\beta)a_3 - \alpha\theta a_1}{(\theta+\beta a_3)\alpha}\right] K^{\alpha} \\
G(K; a_1) &= \frac{(1-a_1)\theta}{\theta+\beta a_3} K^{\alpha}
\end{aligned}
$$

Multiplicity of MPE in a Calibrated Economy

- Model under standard parameter values values
- We use a global projection method to solve for the Markov-perfect equilibria
- We approximate the family of equilibrium policy functions by high-order polynomials, and determine the polynomial coefficients so that the household's Euler equation, the generalized Euler equations hold on a relevant grid of points in the state space
- Here presentation is limited to steady states. (The online Appendix contains a detailed presentation of the numerical approach, along with the computed policy functions. It also shows the stability of the steady states, checks that the equilibria we compute satisfy second-order conditions, and presents accuracy measures of our numerical computations.)

Multiplicity of MPE in a Calibrated Economy

Steady-State Equilibria

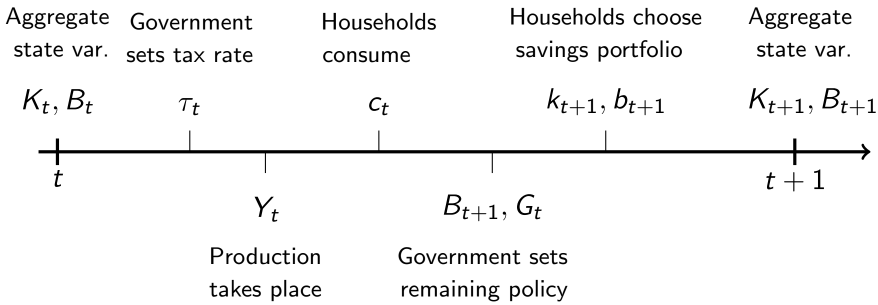
	[1] Efficient	[2] No taxation	[3] Positive taxation	[4] Positive taxation
		Three Markov-perfect equilibria		
Y	1.7608	1.7608	1.6934	1.7053
K	4.8144	4.8144	4.3201	4.4045
C	1.1063	1.1063	1.1017	1.1044
G	0.2213	0.2213	0.2032	0.2045
G/C	0.2	0.2	0.1844	0.1852
τ	indet.	0	0.1905	0.1562
B/Y	indet.	-3.015	0.5639	0
V	-5.0157	-5.0157	-5.5525	-5.4533

The Government Has Within-period Commitment to the Tax Rate (no Retroactive Taxation)

- The analysis now switches to the scenario where retroactive taxation is uncontitutional
- The government sets the tax rate at the beginning of each time period
- The government remains unable to commit to a level of government spending on the public good and to debt issues within the fiscal fiscal, and to future fiscal policy

The Government Has Within-period Commitment to the Tax Rate (no Retroactive Taxation)

Timing of actions within each time period



The Household Problem under no Retroactive Taxation

- At the time the household makes its consumption/savings decision the tax rate for the period has already been set
- However, the household must still foresee both the current government's debt and spending policies, B' and G, and future governments' policy
- The household consumption function can then be expressed as $C(K, B, \tau)$, which solves the Euler equation

$$U_C\left(C(K,B,\tau),G\right) = \beta U_{C'}\left(C(K',B',\tau'),G'\right) \times \left[1 + (1-\tau') \times (f_K(K') - \delta)\right].$$

The Government Problem under no Retroactive Taxation

- Within-period commitment to the tax rate allows the government to be first to move to set τ, and hence to take into account the effect of the tax rate on the level of household consumption
- In a second stage, and after the household's consumption/savings decision has been made, the government sets debt issues, B', and public spending, G

The Government Problem under no Retroactive Taxation

The problem of the government in the second stage (when τ has already been set)

$$\max_{K',B',G} \left\{ U(C(K,B,\tau),G) + \beta V(K',B') \right\}$$

s.t.

$$K' = (1-\delta)K + f(K) - C(K,B,\tau) - G$$

$$G = \tau \left[f(K) - \delta K + r^b(K)B \right] + B' - \left[1 + r^b(K) \right] B,$$

The Government Problem under no Retroactive Taxation

In the first stage the tax rate is set by solving

$$\max_{\tau} \left\{ U(C(K,B,\tau), G(K,B,\tau)) + \beta V(K', B'(K,B,\tau)) \right\}$$

s.t.

$$K' = (1-\delta)K + f(K) - C(K,B,\tau) - G(K,B,\tau).$$

We denote the solution to this problem by $\tau(K,B)$.

Definition of MPE under no Retroactive Taxation

Definition: *A Markov-perfect equilibrium in the economy where the government lacks inter-period commitment but has within-period commitment to the tax rate is a consumption function, $C(K, B, \tau)$, policy functions, $\tau(K, B)$, $B'(K, B, \tau)$, $G(K, B, \tau)$, and a value function, $V(K, B)$, such that:*

(i) *Given a tax rate τ, if the household expects the policy $B'(K, B)$, $G(K, B)$, and $\tau(K', B')$, the consumption function $C(K, B, \tau)$ solves the household's maximization problem.*

(ii) *If the government expects the consumption function, $C(K, B, \tau)$, and the continuation value, $V(K, B)$, the policy $\tau(K, B)$, $B'(K, B)$ and $G(K, B)$ solve the government's maximization problem, and public debt satisfies a no-Ponzi condition.*

(iii) *$V(K, B)$ is the value function of the government.*

The MPE under no Retroactive Taxation

- The government's ability to commit to a tax rate for the fiscal year means that it can steer household consumption within that period
- Hence, the government can anchor household expectations and remove the possibility of multiple equilibria

The MPE under no Retroactive Taxation

PROPOSITION In the economy where the government has within-period commitment to the tax rate, the Markov-perfect equilibrium is unique. Moreover, (i) the government does not make use of distortionary taxation—taxes are zero after the initial period, i.e. $\tau(K', B') = 0$; and (ii) the government accumulates assets to finance the provision of the public consumption good. The steady state implied by this equilibrium coincides with the long-run Ramsey outcome, featuring a zero income tax and negative government debt.

Robustness

- The results shown above are to deviations from the assumption of no within-period commitment to the tax rate
- Consider the following two scenarios:
  - One, the government is assumed to face alternating periods of commitment and no commitment. In a commitment period, the tax rate is credibly set at the beginning of the period; in a no-commitment period the tax rate is set retroactively at the end of the period.
  - Two, assume instead that the ability to commit of successive governments follows a stochastic process
- We show that equilibrium multiplicity is robust to these deviations from the framework used above

Multiplicity in an Economy without Public Debt

- Retroactive taxation also yields a multiplicity of equilibria under balanced budgets—that is, when the government cannot issue debt and must balance its budget on a period-by-period basis
- This can be shown using the model studied by Klein et al. (2008) and Martin (2010) to characterize the Markov-perfect equilibrium assuming that the government has within-period commitment but lacks commitment to future policy
- These authors find a unique equilibrium
- We show that removing the assumption of within-period commitment—and hence allowing for retroactive taxation—generates a continuum of equilibria, with different paths for consumption, investment, fiscal policy and welfare

The Household Problem

A household expecting current and future tax rates on capital and labor income to be set according to the policies $\tau_k = \psi_{\tau_k}(K)$, $\tau_n = \psi_{\tau_n}(K)$, respectively, and government spending according to $G = \psi_G(K)$, solves the problem

$$\max_{c,\ell,n,k'} \left\{ U\left(c,\ell,G\right) + \beta v(k',K') \right\}$$

$$s.t.$$

$$c + k' = k + (1-\tau_k)\left[r(K) - \delta\right] k + (1-\tau_n)\,\omega(K) n$$

$$\ell + n = 1,$$

The Government Problem

The maximization problem of the government lacking within-period commitment

$$\max_{\tau_k, \tau_n, K', G} \left\{ U(C(K), L(K), G) + \beta V(K') \right\}$$

s.t.

$$K' = (1-\delta)K + f(K, N(K)) - C(K) - G$$

$$G = \tau_k \left[f_K(K, N(K)) - \delta \right] K + \tau_n f_N(K, N(K)) N(K),$$

Multiple MPE in closed form in an Example Economy

PROPOSITION Assume $U(c,\ell,G) = \ln c + \varrho \ln(1-n) + \theta \ln G$, $f(K,N) = K^{\alpha} N^{1-\alpha}$, $\delta = 1$, and that capital depreciation is not tax deductable. In the economy without government debt and with differentiated taxes on capital and labor income, there exists a continuum of Markov-perfect equilibria, where the family of policy functions is indexed by $a_4 \in (0,1)$

$$
\begin{aligned}
N(K;a_4) &= a_4; \qquad C(K;a_4) = a_1 K^{\alpha} \\
\tau_k(K;a_4) &= \frac{(1+\theta)a_1 a_4^{\alpha-1} - (1-\beta\alpha)}{\beta\alpha+\theta} \\
\tau_n(K;a_4) &= 1 - \left(\frac{\varrho a_1 a_4^{\alpha-1}}{1-\alpha}\right)\left(\frac{a_4}{1-a_4}\right) \\
G(K;a_4) &= \left(\frac{(1-\beta\alpha)\theta(a_4^{1-\alpha} - a_1)}{\beta\alpha+\theta}\right) K^{\alpha},
\end{aligned}
$$