Repeated Tax Amnesties

Onursal Bagirgan
Universidad Carlos III de Madrid

Job Talk

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Today

Tax amnesties:

- Recurring events

Theory:

- Studying the dynamics of tax amnesties
- Explaining some stylized facts

Some Tax Amnesty Examples

1982-2018: 130 Tax Amnesties

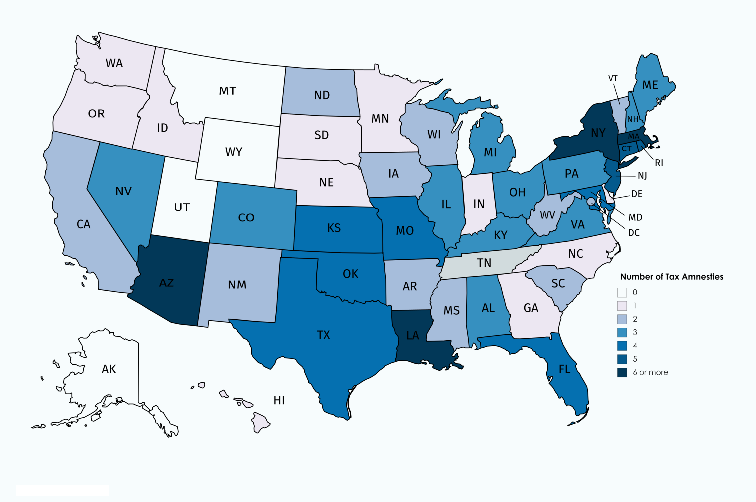
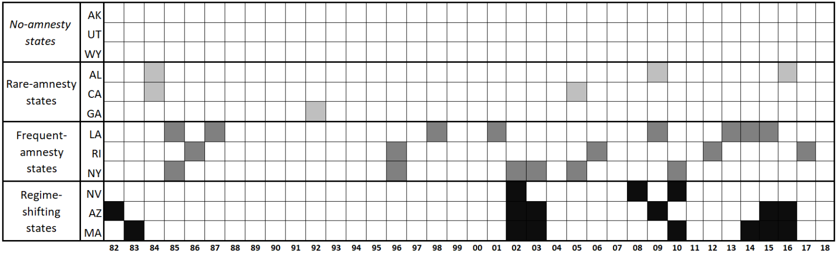


Figure: Number of Tax Amnesties by US States

State Tax Amnesties throughout the years



▸ Full Table

This Paper

Why do some governments implement tax amnesties repeatedly and frequently, while others don't?

Why did some governments that rarely implemented tax amnesties begin to use them repeatedly?

Main Mechanism

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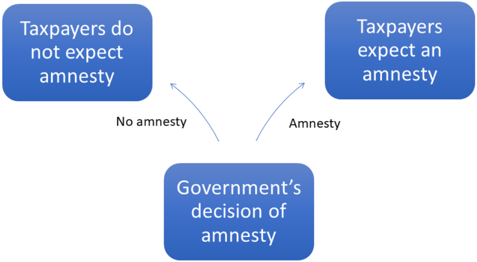

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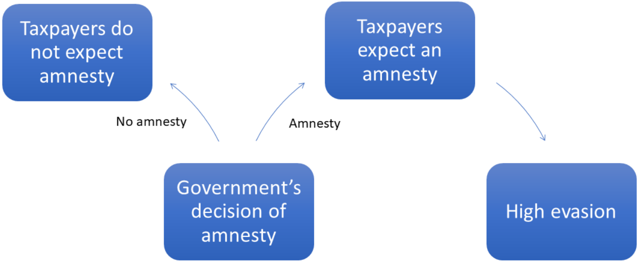

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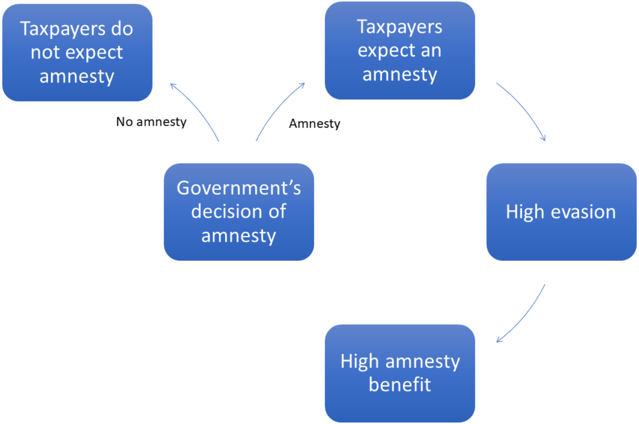

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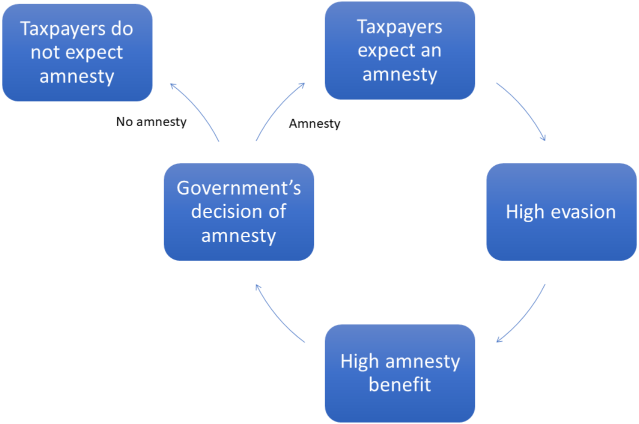
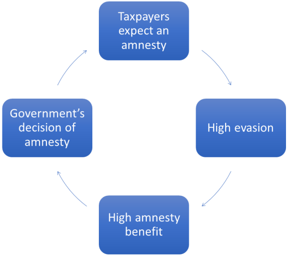


Tax Amnesty Literature



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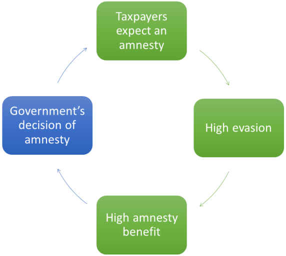

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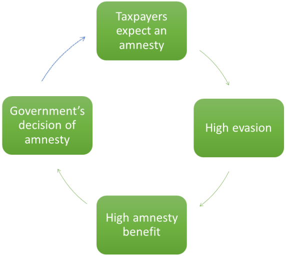

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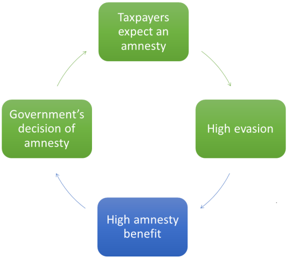

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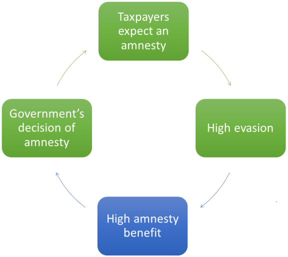

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- Langenmayr (2017): 2009 US-VDP decreased compliance, even years after its end date.

Further Related Literature

- Tax amnesties: Participation, benefits, revenue impact
  - Andreoni (1991), Malik and Schwab (1991), Stella (1991), Alm and Beck (1993), Macho-Stadler, Olivella and Perez-Castrillo (2001), Luitel and Sobel (2007), Mikesell and Ross (2012).
- Government policies: Lack of commitment, time-inconsistency
  - Kydland and Prescott (1977), Barro and Gordon (1983a, 1983b), Barro (1986), Bulow and Rogoff (1989), Stokey (1989,1991), Chari, Kehoe and Prescott (1989), Chari and Kehoe (1990), Ball (1995), Chari, Christiano and Eichenbaum (1998), Das-Gupta and Mookherjee (1998), Cole and Kehoe (2000), Alvarez, Kehoe and Neumeyer (2001), Albanesi, Chari and Christiano (2003), Phelan (2006), Armenter (2008), Amador and Phelan (2018).

THEORETICAL FRAMEWORK

The Model

- A game between a government and a continuum of taxpayers
- Infinite horizon
- Taxpayers are short-lived.
- There are two government types, $\{G_N, G_O\}$.
  - G_N (*no-amnesty*) never declares amnesty
  - G_O (*opportunistic*) maximizes discounted sum of total revenues
- Government type evolves with a Markov process.

	G_N	G_O
G_N	π_N	$1-\pi_N$
G_O	$1-\pi_O$	π_O

Timing in period t

1. Each taxpayer i draws an income and a preference parameter which are private information, $y_{i.t} \sim U\{0, w\}$ and $\epsilon_{i.t} \sim U[0, 1]$.

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5. Taxpayers decide declaring income for the amnesty, $y^a_{i.t}$ and pay $a_t y^a_{i.t}$.
6. The agents who still hide income can get caught with probability p, and lose all their income to the government in that case.

Timing

1. ρ_t: the probability that government is of type G_O at period t
2. Each taxpayer i forms her belief on the probability of seeing an amnesty in this period, which we denote as $\phi_{i,t} \in [0, 1]$.
3. The game is played for period t.
4. Taxpayers update their belief on government type, assign ρ_{t+1}.

Payoffs at a period t

Taxpayer who draws income w and preference parameter ϵ_i:

$$u_i(y^d_{i,t}, y^a_{i,t}) = y - \tau y^d_{i,t}$$
$$-\phi_t[a y^a_{i,t} + \underbrace{p(y - y^d_{i,t} - y^a_{i,t}) + \epsilon_i(y - y^d_{i,t} - y^a_{i,t})]}_{\text{Cost of hiding income after an amnesty}}$$
$$-(1-\phi_t)\underbrace{\left[p(y - y^d_{i,t}) + \epsilon_i(y - y^d_{i,t})\right]}_{\text{Cost of being an evader}}.$$

The *opportunistic* government:

$$\int \mathbb{I}_{y^d_{i.t}=w} \tau w di + \int \mathbb{I}_{\{y^a_{i.t}=w\}} a y di + \int \mathbb{I}_{\{w - y^d_{i.t} - y^a_{i.t}=w\}} p y di$$

STAGE GAME ANALYSIS

Stage Game Solution

- Single period model
- ρ as a parameter

Equilibrium with Rational Expectations

- Taxpayers' initial evasion decision y_i^{d*}, given ϕ_i. Cutoff $\bar{\epsilon}$.

$$\uparrow$$

- Government's amnesty decision x^*, a^*.

$$\uparrow$$

- Tax evaders' amnesty participation decision y_i^{a*}. Cutoff $\underline{\epsilon}$.

Rational expectations: $\phi_i^* = \rho x^*$.

Solving for Equilibrium

Tax evaders' problem in case of an amnesty:

$$\max_{y_i^a \in \{0,w\}} w - a y_i^a - p(y_i - y_i^a) - \epsilon_i (y_i - y_i^a)$$

$$y_i^{a*} = \begin{cases} w & a \leq p + \epsilon_i \\ 0 & a > p + \epsilon_i \end{cases}$$

$$\underline{\epsilon} = a - p.$$

Solving for Equilibrium

Government's optimal selection of a^*, in case of an amnesty:

$$\max_{a} \int_0^{\bar{\epsilon}} \mathbb{I}_{\{p+\epsilon \geq a\}} ayd\epsilon + \int_0^{\bar{\epsilon}} \mathbb{I}_{\{p+\epsilon < a\}} pyd\epsilon$$

$$a^* = \frac{\bar{\epsilon}}{2} + p$$

Solving for Equilibrium

Taxpayers who draw w as their income:

- Expected payoff of being truthful is

$$w - \tau w$$

Solving for Equilibrium

Taxpayers who draw w as their income:

- Expected payoff of being truthful is

$$w - \tau w$$

- Expected payoff of evading taxes is

$$w - \phi[a^*(\bar{\epsilon})y^{a*}(\bar{\epsilon}) - (p + \epsilon_i)(w - y^{a*}(\bar{\epsilon}))] \\ + (1 - \phi)[-(p + \epsilon_i)(w)]$$

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- Threshold taxpayer is indifferent:

$$\tau = \phi\left(p + \frac{\bar{\epsilon}}{2}\right) + (1-\phi)(p+\epsilon_i) \implies \bar{\epsilon} = \frac{2(\tau - p)}{2-\phi}$$

under assumptions $p + 1/2 > \tau > p$.

Equilibrium with Rational Expectations

Given ϕ, initial belief on the probability of an amnesty,
Total revenues when declaring an amnesty:

$$A(\phi) = w\tau - w(\tau - p)^2 \left(\frac{3 - 2\phi}{(2 - \phi)^2} \right), \quad \text{decreasing in } \phi$$

Total revenues without declaring an amnesty:

$$R(\phi) = w\tau - w(\tau - p)^2 \frac{2}{2 - \phi}, \quad \text{decreasing in } \phi$$

Benefit of an amnesty:

$$B(\phi) = A(\phi) - R(\phi) = \frac{w(\tau - p)^2}{(2 - \phi)^2}, \quad \text{increasing in } \phi$$

Equilibrium with Rational Expectations

Benefit of an amnesty:

$$B(\phi) = A(\phi) - R(\phi) = \frac{w(\tau - p)^2}{(2-\phi)^2} > 0, \quad \text{increasing in } \phi$$

Government declares an amnesty if

$$B(\phi) \geq C_A$$

Rational expectations requires $\phi = \rho x^*$.

Equilibrium with Rational Expectations

Benefit of an amnesty is

$$B(\phi) = \frac{w(\tau - p)^2}{(2-\phi)^2}, \quad \text{increasing in } \phi$$

- $B(\rho) < C_A \implies \phi^* = x^* = 0.$

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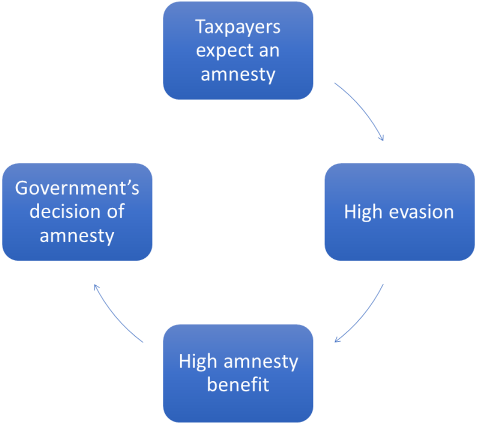
$$\phi_1^* = x_1^* = 0, \quad \phi_2^* = \rho x_2^* = \rho, \quad \phi_3^* = \rho x_3^* = \frac{2\sqrt{2C_A} - 2(\tau - p)}{\sqrt{2C_A}}.$$

Occurrence of Amnesties



Price Discrimination
Change in Revenues
Commitment

MARKOV PERFECT ANALYSIS

Dynamic Model

- ρ_t: the probability that government is of type G_O at period t.
- Taxpayers' problem is static. They form a belief ϕ.
- G_N does not have an optimization problem.
- G_O has a dynamic problem.

$$V(\rho) = \max_{x \in [0,1]} \quad x\left[A(\phi) - C_A + \beta V(\pi_O)\right] + (1-x)\left[R(\phi) + \beta V(\rho')\right]$$

where the beliefs are updated with the Bayes rule.

Markov Perfect Equilibrium

Definition 1

Given ρ, MPE is a pair of $\{\phi(\rho), x(\rho)\}$ and a law of motion $\Gamma(\rho)$ such that

- Given $\phi(\rho)$, taxpayer's evasion and amnesty participation decisions are optimal.
- $x(\rho)$ solves government's problem.
- Initial beliefs are consistent with government's decision; i.e.

$$\phi(\rho) = \rho x(\rho)$$

- At the end of the period t, beliefs are updated with

$$\rho' = \Gamma(\rho, \phi(\rho))$$

MPE in detail

Roadmap of Markov-Perfect Analysis

- Non-triviality assumption:

$$B(0) > C_A \tag{1}$$

- An example MPE
- General Results

An Example MPE

Assume:

$$B(0) - C_A \leq \beta[B(\rho^*) + C_A] \quad (2)$$

$$B(\rho^*) - C_A \geq \frac{\beta}{1-\beta}[R(0) - A(\pi_O) + C_A] \quad (3)$$

where

$$\rho^* = \frac{1-\pi_N}{(1-\pi_O)+(1-\pi_N)}$$

.

An Example MPE

Proposition 3

There exists an $R \in (1 - \pi_N, \pi_O)$ such that the following set of Markov strategies constitutes an equilibrium:

$$(\phi^*(\rho), x^*(\rho)) = (0, 0), \quad \forall \rho < R$$
$$(\phi^*(\rho), x^*(\rho)) = (\rho, 1), \quad \forall \rho \geq R$$

See the details of Bayesian Update

G_O's Equilibrium Strategy

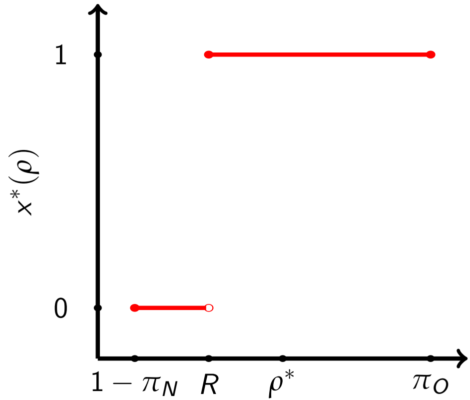
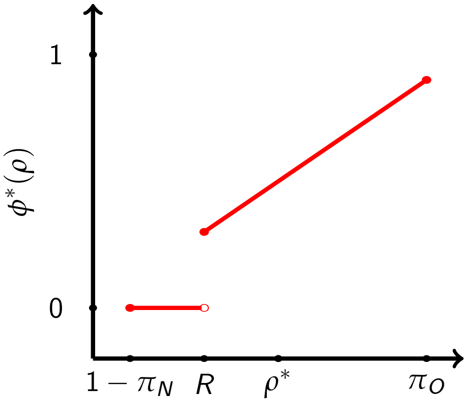


Figure: A Switching Strategy Markov Perfect Equilibria

Probability of Amnesty at the Equilibrium



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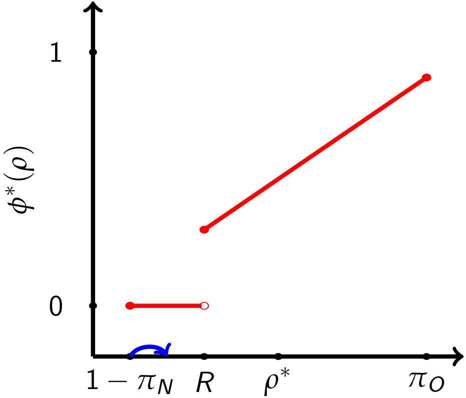

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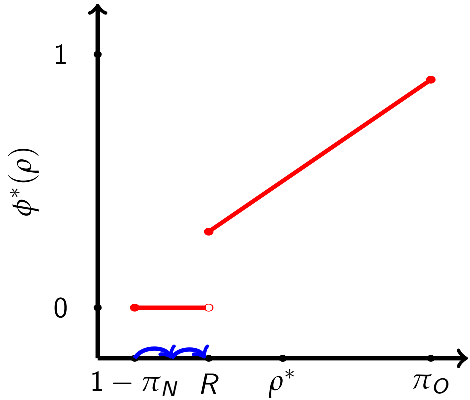

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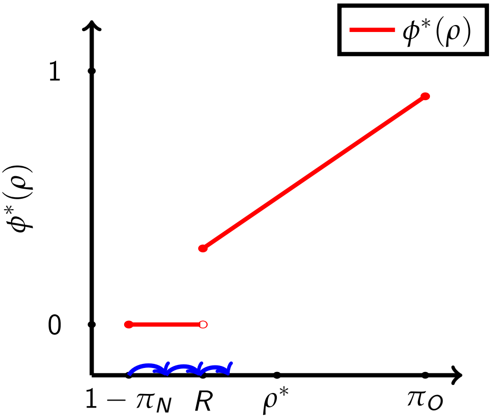

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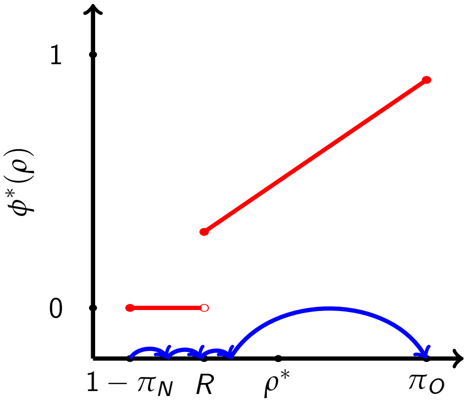

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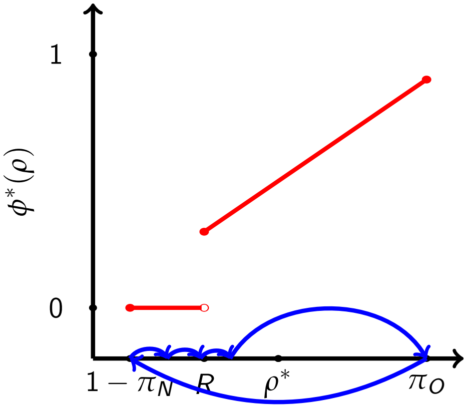

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General Properties of MPE

Theorem 1

Consider a game with initial reputation $\rho_0 \in [1 - \pi_N, \pi_O]$. Take any Markov-perfect equilibrium $\{\rho^*(.), x^*(.)\}$.

$$\phi^*(\pi_O) > \phi^*(\rho_t), \quad \forall \rho_t \neq \pi_O, \, \forall t \geq 1$$

Starting from period 1, an outside observer assigns the highest probability of amnesty to periods right after an amnesty realization.

Sketch of the proof

Main Result

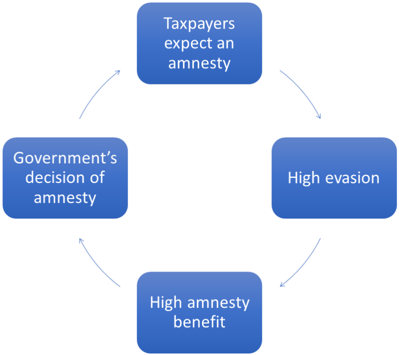


Figure: The mechanism of an expectation trap

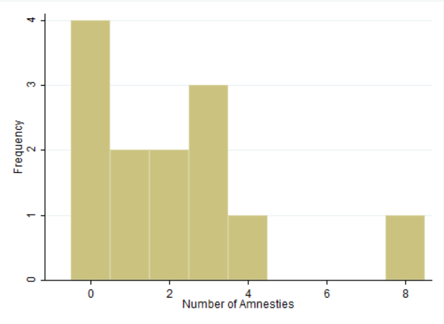
ANALYSIS OF RESULTS

Explaining Heterogeneity

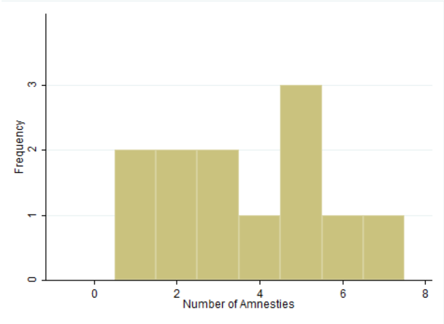
$$\frac{w(\tau - p)^2}{C_A} \approx w\tau^2$$
$$\approx (PersonalIncomePerCapita) \times (DomesticTaxBurden)^2$$

- Order US states in terms of $w\tau^2$.
- Compare the highest quartile to the lowest quartile.
- We expect to see more amnesties in the highest quartile.

Explaining Heterogeneity



(a) Lowest quartile of $w\tau^2$



(b) Highest quartile of $w\tau^2$

Figure: Histogram of number of amnesties in US states by quartiles

Averages: 2.08 (a) and 3.67 (b).

Explaining Heterogeneity

VARIABLES	OLS *Number of Amnesties*	Negative Binomial *Number of Amnesties*
Personal Income $\times$ (*Domestic Tax Burden*)^2	0.00136**	0.000403**
	(0.000622)	(0.000201)
Personal Income	0.0490***	0.0198***
	(0.0175)	(0.00680)
(*Domestic Tax Burden*)^2	-0.0289	-0.00793
	(0.0251)	(0.00850)
State Debt-to-GDP Ratio	-0.134**	-0.0660**
	(0.0591)	(0.0265)
Republican Dummy	-0.318	-0.133
	(0.622)	(0.272)
Swing − state Dummy	0.908	0.355
	(0.626)	(0.231)
Observations	50	50
R-squared	0.773	

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

EXTENSIONS

Special Cases

- Private Permanent Type
  (Kreps and Wilson (1982), Backus and Driffill (1985)) ▸ Details
- Public Permanent Type.
  (Barro and Gordon (1983)) ▸ Details
- Stochastic Cost.

US Tax Amnesties Through Time

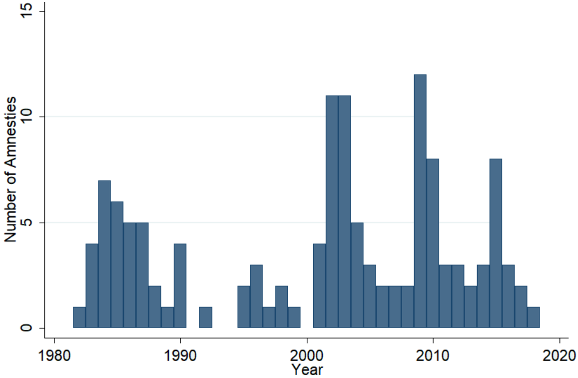


Figure: Number of Tax Amnesties in US States Throughout Years

Extension: Stochastic Cost

- Cost can be C_L, C_A.
- C_L with probability p_L.
- Cost is drawn at the beginning of the period.
- Cost is public knowledge.
- Draw is i.i.d.

Extension: Stochastic Cost

Proposition 4

There exists a small enough $p_L \in (0, 1)$ such that the following is an equilibrium.

$$\{\phi(\rho, C_L), x(\rho, C_L)\} = \{\rho, 1\}$$
$$\{\phi(\pi_O, C_A), x(\pi_O, C_A)\} = \{\pi_O, 1\},$$
$$\{\phi(\rho, C_A), x(\rho, C_A)\} = \{0, 0\}, \quad \forall \rho \in [1 - \pi_N, \pi_O).$$

Probability of amnesty when cost is C_A

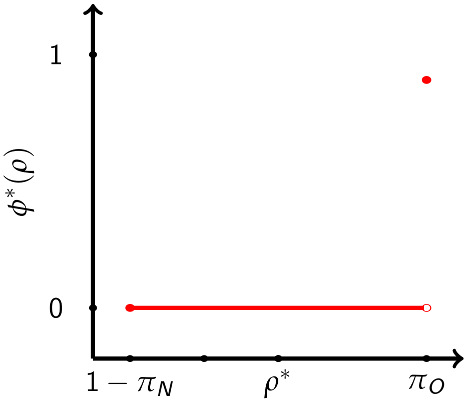


Figure: Probability of amnesty if C_A is drawn

Conclusion

- Data suggests that tax amnesties tend to be repetitive.
- A theory that can explain some simple facts from data: Heterogeneity, regime shifts.
- Repeated amnesties may arise as a result of an expectation trap.
- Future works: Evasion accumulation, assets in tax havens, effects on wealth inequality.

Thank You

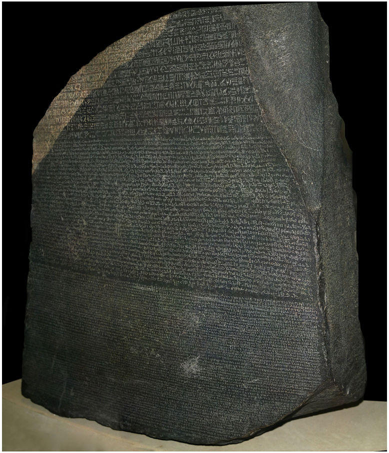


Figure: Rosetta Stone (196 BC)

Tax Amnesties

Raising revenues:

- Illinois 2003: Collected **532 millions** of dollars, **2.2%** of yearly total tax revenue.

Uncovering taxable assets:

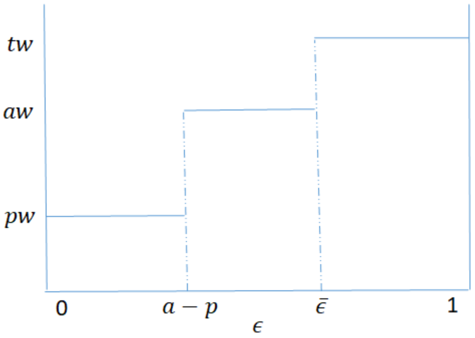
- Italy 2009: **80 billion** dollars worth of assets, **5%** of GDP
- Indonesia 2016: **359 billion** dollars worth of assets, **38%** of GDP

First Slide

Price discrimination

Remark

Tax amnesties are a price discrimination tool, $t \geq a^* \geq p$.



Stage Game Result

Revenues

Remark

Higher $\phi \implies$ Higher amnesty revenues, Lower total revenues.

$$\phi_1 > \phi_2 \implies B(\phi_1) > B(\phi_2) \text{ and } A(\phi_1) < A(\phi_2)$$

▸ Stage Game Result

Commitment

Proposition 5

Assume $C_A \geq A(\rho) - R(0)$. If a commitment technology exists, committing to not declaring an amnesty is optimal for the government.

A government with bad reputation may benefit from a commitment technology.

Stage Game Result

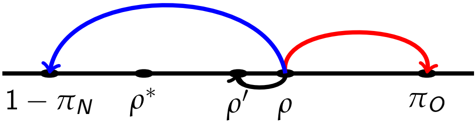
Bayesian Belief Update and Pure Strategies

Remember that

	G_N	G_O
G_N	π_N	$1-\pi_N$
G_O	$1-\pi_O$	π_O

- $x^*(\rho) = 1 \implies$ Next period's reputation is π_O.
- $(\phi^*(\rho), x^*(\rho)) = (\rho, 0) \implies$ Next period's reputation is $1-\pi_N$.
- $(\phi^*(\rho), x^*(\rho)) = (0, 0) \implies$ Next period's reputation is ρ'.

$$\rho^* = \Gamma(\rho^*, 0).$$



Go back to Switching Strategy

Public Permanent Type

$$\phi_t = \begin{cases} \phi_{t-1} & \text{if there was no amnesty in the past} \\ 1 & \text{if there was an amnesty in the past} \end{cases}$$

Proposition 6

Under the condition

$$(1-\beta)B(0) < C_A < B(1),$$

there exists a real number $\phi^* \in (0,1)$ such that;

$$\phi_0 = \phi^*, \quad x_t^* = \begin{cases} \phi^* & \text{if there was no amnesty in the past} \\ 1 & \text{if there was an amnesty in the past} \end{cases}$$

is an equilibrium.

Go back to extensions

Private Permanent Type

Assume $\pi_N = \pi_O = 1$.

In the first period, the net benefit of declaring amnesty:

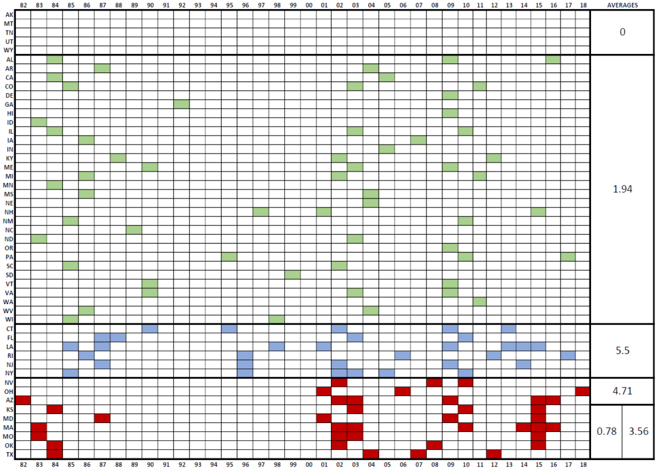
$$B(0) - C_A.$$

The present discounted value of the revenue loss of revealing the type:

$$\beta \frac{R(0) - A(1) + C_A}{1-\beta} = \beta \frac{C_A}{1-\beta}.$$

Go back to extensions

State Tax Amnesties throughout the years



▸ Examples Table

Markov Perfect Equilibrium

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- The equilibrium requires that

$$\phi^*(\rho) = \rho x^*(\rho)$$

MPE definition

General Properties of MPE

Consider the relevant continuation after a tax amnesty realization.
ϕ_t: the probability of an amnesty in period t: $\phi_0 = \phi(\pi_O)$.

Lemma 2

In any MPE, there exists a period $t \in \mathbb{Z}_{\geq 0}$ such that $\phi_t > 0$.

Intuition: If taxpayers do no expect an amnesty forever in this subgame, declaring an amnesty is a profitable deviation.

$$\text{At period 1: } A(0) - C_A + \beta V(\pi_O) = R(0) + \beta V(\phi_2)$$

General Properties of MPE

Consider the relevant continuation after a tax amnesty realization. Denote ϕ_t as the probability of an amnesty in period t. Then, $\phi_0 = \phi(\pi_O)$.

Lemma 3

In the relevant continuation game, in any MPE, $\phi_0 > 0$.

Intuition: If taxpayers will expect an amnesty with high probability, there is no incentive to wait for that period.

Remark

In any MPE in pure strategies, $\phi(\pi_O) = \pi_O$.

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Lemma 4

In any MPE, $\phi(\pi_O) > \phi(1 - \pi_N)$.

General Properties of MPE

Consider the relevant continuation after a tax amnesty realization. Denote ϕ_t as the probability of an amnesty in period t. Then, $\phi_0 = \phi(\pi_O)$.

Lemma 5

In any MPE, $\phi(\pi_O) > \phi(\rho_t)$.

▸ Theorem