3. Coherencia temporal y credibilidad. Fiscal Policy

Tax policy

Wealth taxation problem

Government offers favorable conditions for investment. If investors come and invest, government might feel tempted to tax capital later. Investors know it, so they do not invest.

Government opportunity to "cheat" is clear, what about motives? Assumption: "benevolent" government, maximizing citizens' utility.

Basic model

i) Individuals live two periods

Period 1: * Receive (exogenous) income: 1
* Consume part of income: c_1^i
* Save (= invest) the rest: k^i

$\Rightarrow$ First period families budget constraint: $c_1^i + k^i = 1$

Period 2: * Time endowment (1) devoted to labor (l^i) and leisure (x^i):

$1 = l^i + x^i$

* Receive wage earnings: $(1-\tau_L)1l^i$
* Receive capital earnings: $(1-\tau_k)Rk^i$

Unitary gross returns: R=1

$\Rightarrow$ Second period families budget constraint:

$$c_2^i = (1-\tau_k)\,k^i + (1-\tau_L)l^i$$

Individuals' decisions?

Period 1: how much to save (how much to consume).
Period 2: how much to work and to consume.

These decisions depend on:

- preferences: $U\left(c_1^i, c_2^i, x^i\right) = u\left(c_1^i\right) + c_2^i + v\left(x^i\right)$
- possibilities: budget and time constraints

ii) Government collects taxes on labor and capital income to finance a given spending (G). No lump sum taxes available.

Government budget constraint: $G \leq \tau_L l + \tau_k k$

iii) Two policy regimes

Commitment:

Period	Actions	Active player
1 (beginning)	τ_k, τ_L	Government
1 (during)	k^i	Individuals
2	l^i	Individuals

Discretion:

Period	Actions	Active player
1 (during)	k^i	Individuals
1 (end)	τ_k, τ_L	Government
2	l^i	Individuals

Key difference: taxes on capital set before (commitment) or after (discretion) investment.

Solution (Backward induction)

A) Commitment

1) Families decide in periods 1 and 2 how much to save and to work, knowing the tax rates.

$$\text{Saving} = K(\tau_K),\ K'(.) < 0$$

$$\text{Labor supply} = L(\tau_L)\ ,\ \ L'(.) < 0$$

2) At the beginning of period 1, government chooses τ_K and τ_L, to maximize families' utility:

$$\underset{\tau_K, \tau_L}{\text{Maximize}}\ W(\tau_K, \tau_L)$$

$$\text{s.t.} \qquad G \leq \tau_L l + \tau_k k$$

$\Rightarrow$ Ramsey rule: $\varepsilon_K\left(\tau_K^*\right)=\varepsilon_L\left(\tau_L^*\right)$

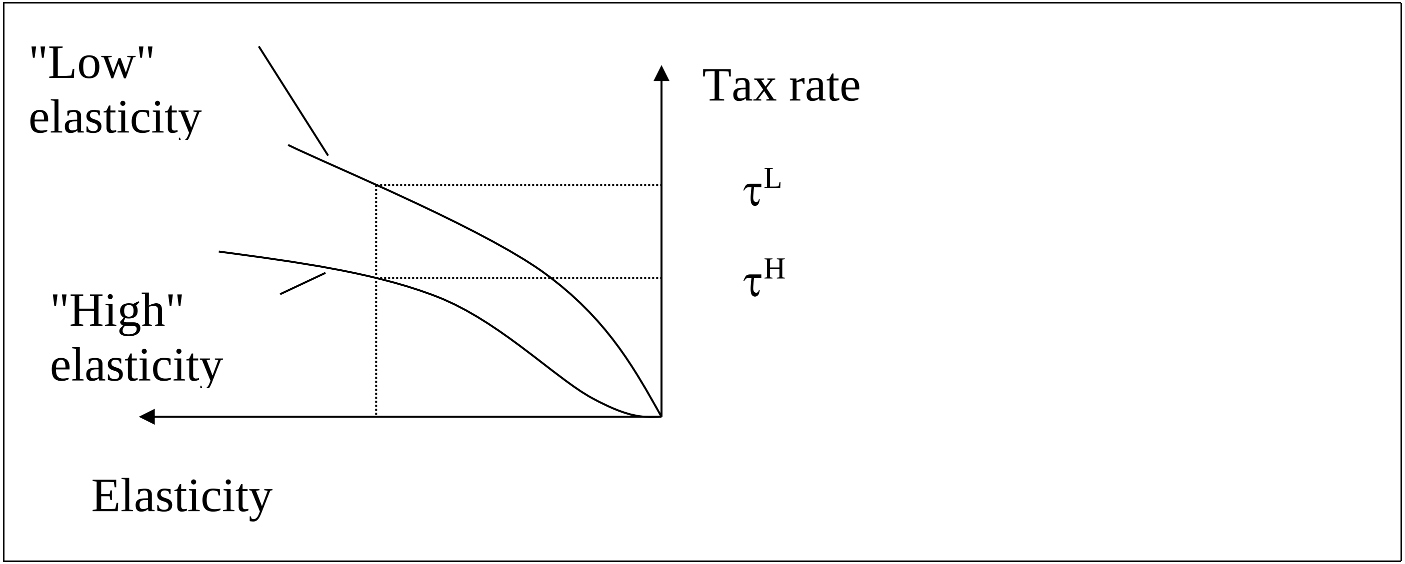
Where:

ε_L = labor supply elasticity to labor tax rate

ε_K = saving elasticity to capital tax rate

$\Rightarrow$

- With negative and finite elasticities, both tax rates must be positive.
- Optimal tax rates are higher on the more inelastic tax base.
- Higher government expenditure drives up both tax rates.



Notice: Ramsey rule is a "second best", taxes are distortionary. Lump sum taxes are assumed away.

B) Discretion

1) Period 2: Families choose labor supply knowing tax rates: $L(\tau_L)$

2) Period 1 (end of): Government solves something "similar" to what we solved with commitment:

$$\underset{\tau_K,\tau_L}{\text{Maximize}}\, W(\tau_K,\tau_L)$$

$$\text{s.t.} \qquad G \leq \tau_L l + \tau_k k$$

$\Rightarrow$ Ramsey rule again: $\varepsilon_K\left(\tau_K^d\right) = \varepsilon_L\left(\tau_L^d\right)$

τ^d is the equilibrium tax rate under discretion.

But, now capital is a given: $\varepsilon_K = 0$
$\Rightarrow \tau_K$ is not distortionary $\Rightarrow$ choose τ_K as large as necessary and τ_L as small as possible.

More formally: $$\tau_K(G, k) = \min\left(1, \frac{G}{k}\right)$$

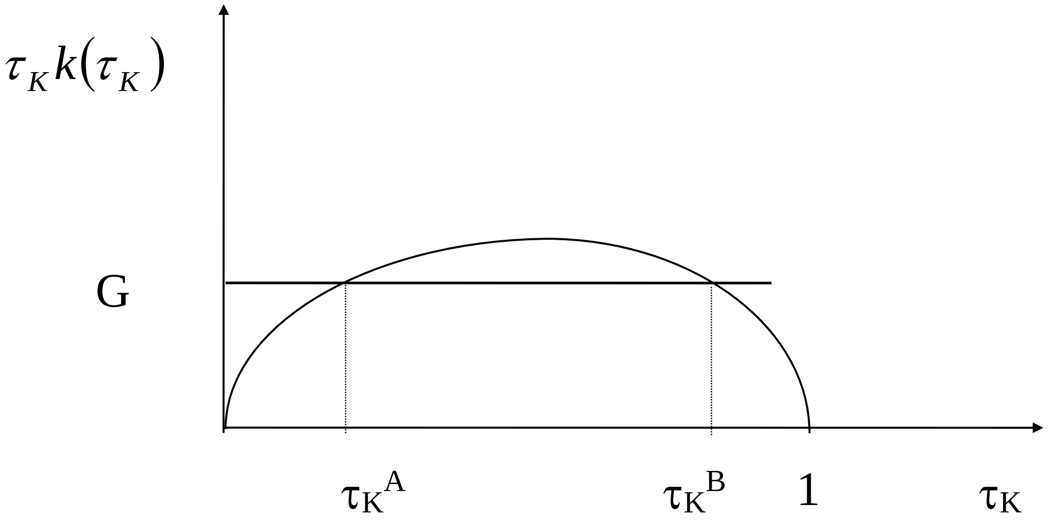
where k is aggregate capital stock.

Two cases:

- If capital stock is large enough, government chooses $\tau_K(G,k)<1$, collects just taxes on capital $G=k\tau_K(G,k)$, and does not tax labor $\tau_L=0$.

- If capital stock is not large enough, government chooses $\tau_K(G,k)=1$ and $\tau_L>0$

3) Period 1: Families analyze government budget



Three equilibria:

a) If $E[\tau_K] = \tau_K^A \Rightarrow$ government charges τ_K^A, collecting $G = \tau_K^A k(\tau_K^A) \Rightarrow$ no mistakes

b) Analogous for τ_K^B

c) If $E[\tau_K] = 1 \Rightarrow$ no savings at all: $k(1) = 0 \Rightarrow$ government charges $\tau_K = 1$, collecting nothing from capital! Hence, government collects taxes only on labor: $G = \tau_L L(\tau_L) \Rightarrow$ no mistakes

Summary of results with discretion:

Equilibrium	Capital tax rate	Capital stock	Labor tax rate
Full expropriation	1	0	$G = \tau_L L(\tau_L)$
Partial expropriation	$\tau_K{}^B$	$K\left(\tau_K^B\right)$	0
Partial expropriation	$\tau_K{}^A$	$K\left(\tau_K^A\right)$	0

Comments:

- Excessive taxation on capital, compared to Ramsey.
- Excessive taxation on labor, if $\tau_K = 1$, and insufficient taxation on labor, if τ_K^A or τ_K^B.
- Multiple Pareto-rankable equilibria, more capital is better.

Money and the inflationary tax

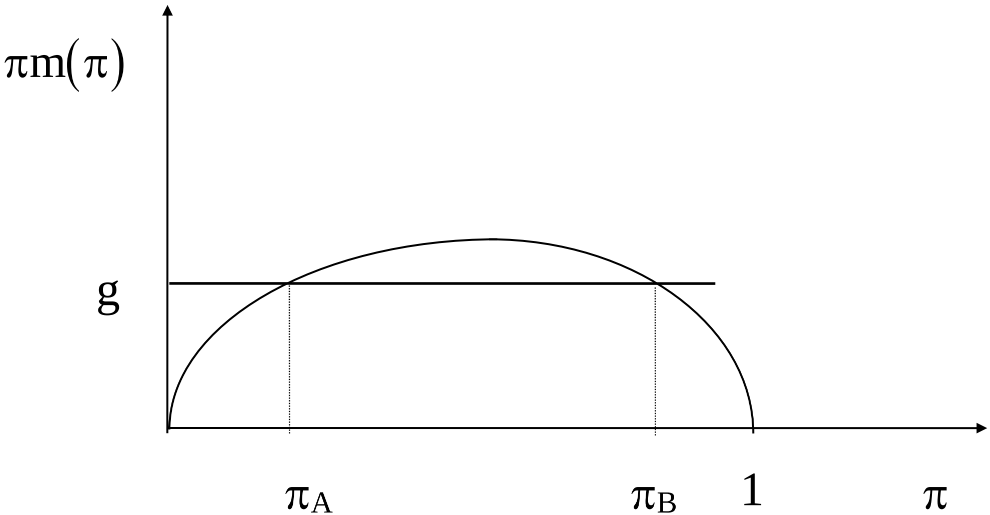
Previous model could be reinterpreted to represent money demand and inflation.

Wealth is now real money (m)

Inflationary tax rate: $\pi = \frac{\hat{p}}{1+\hat{p}}$

Money demand is decreasing in inflationary tax: $m'(\pi) < 0$

Inflationary tax collect: $\pi m(\pi)$



Low inflation equilibrium: if people expect $\pi_A \Rightarrow$ demand $m(\pi_A) \Rightarrow$ government chooses π_A

High inflation equilibrium: if people expect $\pi_B \Rightarrow$ demand $m(\pi_B) \Rightarrow$ government chooses π_B

Hyperinflation equilibrium: if people expect $\pi = 1 \Rightarrow$ demand $m(1) = 0 \Rightarrow$ government chooses $\pi = 1$, or $\hat{p} \rightarrow \infty$

Hyperinflation = full expropriation

According to this story, hyperinflation could be a self-fulfilling prophecy.

Nominal public debt (Calvo 1989)

Motivation: some Latin American countries (Argentina, Bolivia, Brazil, etc.) have experienced huge fiscal deficits due to large interest bills stemming from high interest rates.

Alternative views on the fiscal deficit-interest rate relationship:

(i) Traditional: deficit $\Rightarrow$ high inflation $\Rightarrow$ high interest rates

(ii) Calvo: high interest rates $\Rightarrow$ deficit $\Rightarrow$ high inflation

Key element in Calvo’s story: nominal debt (b)

$$\text{Real debt service} = \frac{B_0(1+i)}{p_1} = \frac{b(1+i)}{1+\hat{p}}$$

$\Rightarrow$ Government is tempted to inflate to erode public debt.

Ex-ante: low inflation to induce low interest rate…

Ex-post: interest rate is a given, hence inflation becomes a non distortionary tax $\Rightarrow$ full expropriation of public debt!

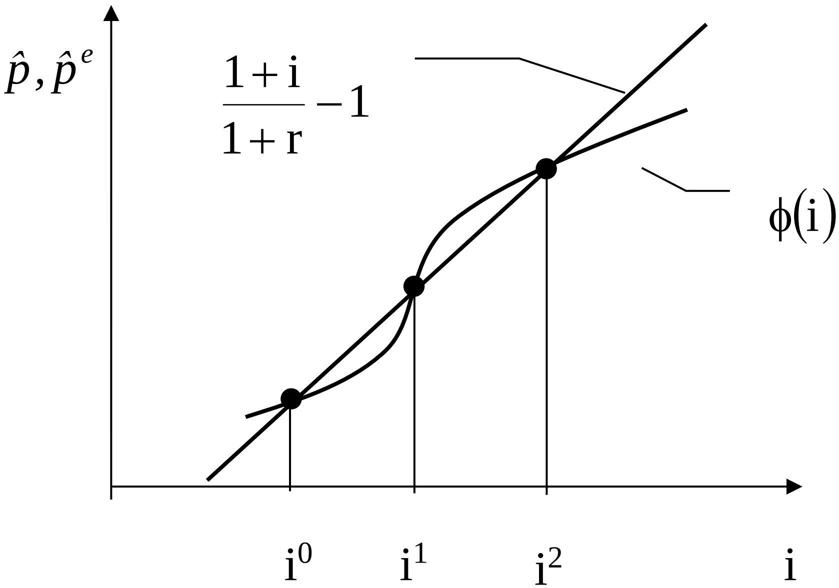
Assumption: there is a cost associated to inflation…

$\Rightarrow$ partial expropriation of public debt.

$\Rightarrow$ ex-post optimal inflation increasing in interest rate:

$$\hat{p} = \phi(i) \quad , \quad \phi'(i) > 0$$

Fisher equation: $1 + i = (1 + r)(1 + \hat{p}^e)$

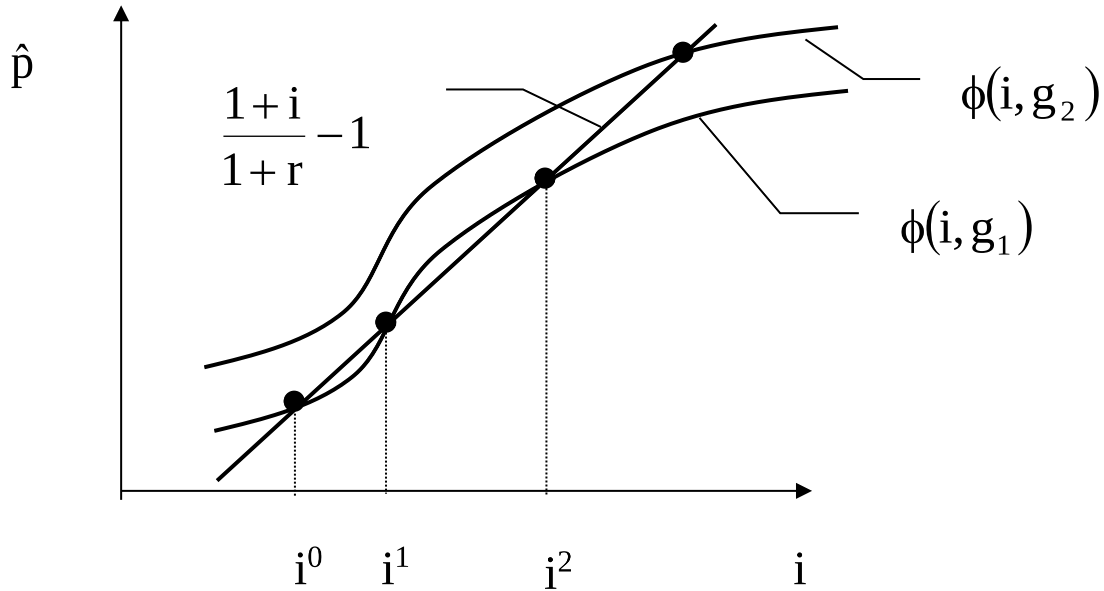

$\hat{p}, \hat{p}^e$
$\frac{1+i}{1+r} - 1$
$\phi(i)$
i^0
i^1
i^2
i

$\Rightarrow$ Three equilibria with the same fundamentals.

How could government spending affect these results?

$\hat{p} = \phi(i, g) \quad , \partial\phi/\partial i > 0 , \quad \partial\phi/\partial g > 0$

The larger g, the larger government necessity of fund raising, the larger the optimum ex-post inflation…


$\hat{p}$
$\frac{1+i}{1+r}-1$
$\phi(i, g_2)$
$\phi(i, g_1)$
i^0
i^1
i^2
i

$\Rightarrow$ low inflation equilibria could disappear due to fiscal expansion.

Notice: no surprises in equilibrium.

What would happen if debt were fully indexed?

$$\text{Real indexed debt service} = \frac{b(1+r)(1+\hat{p})}{1+\hat{p}} = b(1+r)$$

$\Rightarrow$ no incentives to inflate, if *indexed debt*.

Puzzle: if debt indexing solves the credibility problem, why do governments usually issue nominal debt?

Answer: uncertainty… (Calvo and Guidotti, 1993)

Assume government expenditure is random:
Negative shock $\Rightarrow$ large g $\Rightarrow$ increase distortionary taxes, including inflationary tax…

Tradeoff credibility (indexed debt) – flexibility (nominal debt).
Similar to contemporaneous wage indexation.

Public sector net position in domestic currency (Persson, Persson, and Svensson (1987)

Three assets:

- Money = central bank liability in domestic currency.
- Indexed government bonds.
- Nominal (domestic currency) private bonds.

Problem: Money creates incentives to inflate.

Solution: zero net position in domestic currency.

How? Government sells indexed bonds in exchange for nominal private bonds $\Rightarrow$

Government holdings of nominal private bonds = money

Qualification: under uncertainty, it could be optimal to hold a net debtor position.

Capital vs labor

Wealth taxation problem overstated in 2.1.1 and 2.1.2…?

Strategic delegation: Could voters avoid the capital levy problem electing a "conservative" politician?

2.1.5.1. *The model*

i) **Individuals** live two periods

Period 1: * Initial wealth: $1\text{-}e^i$, $E\left[e^i\right] = 0,\ e^m > 0$,

* Consume part of initial wealth: c_1^i
* Save (= invest) the rest: k^i

$\Rightarrow$ First period families budget constraint: $c_1^i + k^i = 1 - e^i$

Period 2:

* Time endowment ($1+e^i$) devoted to labor (l^i) and leisure (x^i):

$$1 + e^i = l^i + x^i$$

* Notice: e^i captures the relative importance of labor and capital in income. Initial wealth and time endowment are perfectly negatively correlated.

* Receive wage earnings: $(1-\tau_L)1l^i$
* Receive capital earnings: $(1-\tau_k)Rk^i$

  Unitary gross returns: R=1

$\Rightarrow$ Second period families budget constraint:

$$c_2^i = (1-\tau_k)\, k^i + (1-\tau_L) l^i$$

Individuals' decisions?
Period 1: how much to save (how much to consume).
Period 2: how much to work and to consume.

These decisions depend on:

- preferences: $U\left(c_1^i, c_2^i, x^i\right) = u\left(c_1^i\right) + c_2^i + v\left(x^i\right)$
- possibilities: budget and time constraints

ii) **Government** collects taxes on labor and capital income to finance a given spending (G). No lump sum taxes available.
Government budget constraint: $G \leq \tau_L l + \tau_k k$

iii) Alternative assumptions on politicians:

- office-seeking candidates
- citizen candidates

2.1.5.2. *Equilibrium taxation with office-seeking candidates*

i) Ex-ante elections

Period	Actions	Active player
0	τ_k, τ_L	Politicians
1	Vote	Citizens
2	k^i	Citizens
3	l^i	Citizens

Solving (Backward induction)

1) Families decide in periods 2 and 3 how much to save and to work, knowing the tax rates.

$$\underset{c_1^i, c_2^i, x^i}{\text{Max}}\ U\left(c_1^i\right) + c_2^i + V\left(x^i\right)$$

$$\text{s.t.}\ \ c_1^i + k^i = 1 - e^i$$

$$c_2^i = \left(1 - \tau_K\right)k^i + \left(1 - \tau_L\right)l^i$$

$$l^i + x^i = 1 + e^i$$

or:

$$\underset{k^i, l^i}{\text{Max}}\, U\left(1 - e^i - k^i\right) + \left(1 - \tau_K\right)k^i + \left(1 - \tau_L\right)l^i + V\left(1 + e^i - l^i\right)$$

FOCs:

$$-U_c\left(1 - e^i - k^i(\tau_K)\right) + \left(1 - \tau_K\right) = 0$$

$$-V_x\left(1 + e^i - l^i(\tau_L)\right) + \left(1 - \tau_L\right) = 0$$

$\Rightarrow$

$$k^i(\tau_K) = 1 - U_c^{-1}(1 - \tau_K) - e^i = K(\tau_K) - e^i \quad , \quad K'(.) < 0$$

$$l^i(\tau_L) = 1 - V_x^{-1}(1 - \tau_L) + e^i = L(\tau_L) + e^i \quad , \quad L'(.) < 0$$

2) Citizens vote in period 1. Citizen i's preferred tax rates:

$$\max_{\tau_K,\tau_L} U\left(1-e^i-k^i(\tau_K)\right)+(1-\tau_K)k^i(\tau_K)+(1-\tau_L)l^i(\tau_L)+$$
$$+V\left(1+e^i-l^i(\tau_L)\right)$$

$$\text{s.t.} \qquad G \le \tau_L L(\tau_L)+\tau_k K(\tau_K)$$

Notice:

- Citizens are aware of the government's budget constraint.
- This constraint depends on aggregate labor and capital supply.

Hence, the Lagrangian is:

$$\mathcal{L} = U\left(1 - K\left(\tau_K\right)\right) + \left(1 - \tau_K\right)K\left(\tau_K\right) + \left(1 - \tau_L\right)L\left(\tau_L\right) + \\ + V\left(1 - L\left(\tau_L\right)\right) + \left(\tau_K - \tau_L\right)e^i + \lambda\left(G - \tau_L L\left(\tau_L\right) - \tau_k K\left(\tau_K\right)\right)$$

FOCs (using the envelope theorem):

$$\frac{\partial \mathsf{L}}{\partial \tau_L} = -L(\tau_L) - e^i + \lambda\left(-L(\tau_L) - \tau_L L_\tau(\tau_L)\right) = 0$$

$$\frac{\partial \mathsf{L}}{\partial \tau_K} = -K(\tau_K) + e^i + \lambda\left(-K(\tau_K) - \tau_K K_\tau(\tau_K)\right) = 0$$

$$\frac{\partial \mathsf{L}}{\partial \lambda} = G - \tau_L L(\tau_L) - \tau_k K(\tau_K) = 0$$

$\Rightarrow$ "Modified" Ramsey rule:

$$\frac{K(\tau_K^i) - e^i}{K(\tau_K^i)}\left[1 + \varepsilon_L(\tau_L^i)\right] = \frac{L(\tau_L^i) + e^i}{L(\tau_L^i)}\left[1 + \varepsilon_K(\tau_K^i)\right] \qquad (1)$$

Consider the preferred tax rates of different individuals:

a) Individual with average relative income from labor and capital

$$e^{i} = 0 \Rightarrow \varepsilon_K\left(\tau_K^*\right) = \varepsilon_L\left(\tau_L^*\right)$$

the individual with average relative income prefers the tax rates associated with commitment in the model without redistribution (section 2.1.1).

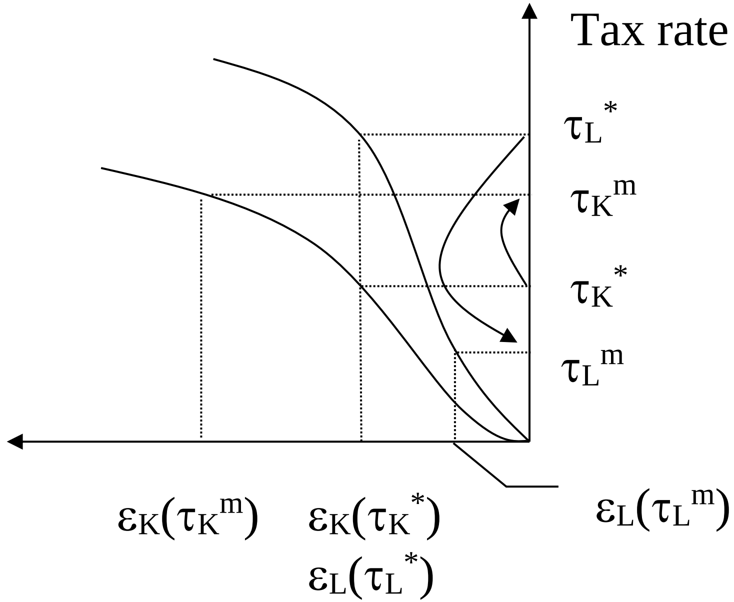
b) The median voter has relative income $e^{m} > 0$
(he is more a worker than the individual with average relative income)

Hence, from (1):

$$\frac{\left[1+\varepsilon_L\left(\tau_L^*\right)\right]}{\left[1+\varepsilon_K\left(\tau_K^*\right)\right]}=1<\frac{\left[L\left(\tau_L^m\right)+e^m\right]/L\left(\tau_L^m\right)}{\left[K\left(\tau_K^m\right)-e^m\right]/K\left(\tau_K^m\right)}=\frac{\left[1+\varepsilon_L\left(\tau_L^m\right)\right]}{\left[1+\varepsilon_K\left(\tau_K^m\right)\right]}$$

... implying that the redistributive motive raises taxes on capital and reduces taxes on labor:

$$\tau_K^* < \tau_K^m ; \tau_L^* > \tau_L^m$$


Tax rate
τ_L^*
τ_K^m
τ_K^*
τ_L^m
$\varepsilon_K(\tau_K^m)$
$\varepsilon_K(\tau_K^*)$
$\varepsilon_L(\tau_L^*)$
$\varepsilon_L(\tau_L^m)$

Nota: en este ejemplo se supuso que el trabajo es menos elástico que el capital, pero este supuesto es irrelevante para el argumento

ii) Ex-post elections

Period	Actions	Active player
0	k^i	Citizens
1	τ_k, τ_L	Politicians
2	Vote	Citizens
3	l^i	Citizens

Solving (Backward induction)

1) In period 3, individuals decide how much to work as before:

$$l^{i}(\tau_L) = 1 - V_x^{-1}(1-\tau_L) + e^{i} = L(\tau_L) + e^{i} \quad , \quad L'(.) < 0$$

2) Citizens vote. At this stage, $\varepsilon_K(\tau_K) = 0$

Hence, the median voter ($e^m > 0$) prefers taxes on capital as high as needed to finance government expenditures.

Assuming G is "large": $\tau_K^m = 1$,i.e. full expropriation!

3) In period 1, office-seeking politicians choose political platforms to please the median voter. Full convergence to $\tau_K^m = 1$.

4) In period 0, individuals save nothing: $k^{i}(\tau_{K}=1)=0$

2.1.5.3. *Equilibrium taxation with citizen candidates*

Distinctive assumptions:

- Motivation of "citizen candidates": ideology.
- No commitment ability.

Main implication:

Strategic delegation = each citizen votes for someone more "conservative" than himself. Citizen i, with endowment e^i, would vote for someone with less labor relative to capital than himself:

$$e^{iP} < e^i$$

Puzzle: individual with endowment e^{iP} does not want to be in office, he votes for someone else! An endless story?

Entry of candidates: add a previous stage in which citizens decide whether to run as candidates. Assume there is a cost of being candidate.

Two-candidates equilibrium: two candidates with e^R and e^L, each providing the other with a reason to enter.

Candidates must have a chance to win (otherwise they would not incur in the cost of being candidate),

$\Rightarrow$ The median voter must be indifferent between both candidates

$\Rightarrow$ They must be on the opposite sides of the median voter preferred candidate: $e^{R} < e^{mP} < e^{L}$

Notice:

- Many equilibria
- No convergence of political platforms, (no commitment).
- Strategic delegation ameliorates the capital-levy problem.