Tax Me if you Can !
Optimal Nonlinear Income Tax between Competing Governments

Etienne LEHMANN [1]
Laurent SIMULA [2]
Alain TRANNOY [3]

Mannheim
May, 16th, 2014

1. CRED (TEPP) Université Panthéon-Assas Paris II and CREST
2. Uppsala Center for Fiscal Studies and Uppsala University
3. Aix Marseille Université (Aix Marseille School of Economics) CNRS EHESS

Motivation (1.)

Few empirical studies on the magnitude of migration response to taxation. But all suggest that highly skilled are quite responsive to tax changes.

- Kleven, Landais, Saez (2012) : study tax induced mobility in Europe of football players and find substantial mobility elasticities. Mobility of domestic players with respect to domestic tax rate rather small around 0.15, but mobility of foreign players much larger, around 1.
- Kleven, Landais, Saez and Schultz (2013) : confirm that these results apply to the broader market of highly skilled foreign workers and not only to football players. Elasticity above 1 in Denmark for foreign born highly skilled.
- Because of relatively small number of foreigners at the top, translates into a (global) elasticity at the top around 0.25 (see Piketty and Saez, 2012).

Motivation (2.)

- In this article, we allow for workers to be potentially mobile.
- This mobility differ from the mobility of capital, in particular because of home attachment and mobility costs.
- Important issue because the threat of migration of net taxpayers makes redistribution more difficult.
- Mirrlees, 1971 : "Migration is supposed to be impossible. Since the threat of migration is a major influence on the degree of progression in actual tax systems, this is an assumption one would rather not make."

Motivation (3.)

- Migration corresponds to an extensive margin.
- But differs from the "usual" extensive margins (be in the labor market or not, be in one production sector or in another one, etc.).
- Associated with competition between policy designers.
- Impossible to simply use the previous studies and interpret their extensive margin as migration. Requires a specific investigation.

Addressed Issue

Main Question

How to design the income tax optimally when governments compete on a mobile tax base ?

Main Features of the Model

- Two countries (not necessarily symmetric).
- In each country,
  - individuals differ with respect to two parameters of heterogeneity : skills and migration costs, which are both private information.
  - a government sets the nonlinear income tax, taking into account intensive labor supply and migration responses.
- Focus on Nash equilibrium between two maximin governments.

Two Definitions Before Going Further

Definition

- Semi-elasticity : percentage change in the density of taxpayers of a given skill level when their consumption is increased by 1 Euro/Dollar.
- Elasticity : ... by 1% = consumption $\times$ semi-elasticity.

Main Analytical Results

- Identify key parameters to estimate : semi-elasticity of migration and how it evolves along the skill distribution.
- Compute optimal income taxes in Nash equilibrium.
- Sign optimal marginal tax rates in Nash equilibrium. Depend on whether the semi-elasticity of migration is decreasing, constant or increasing along the skill distribution.
- Show that optimal marginal tax rates may be negative for high income earners when the semi-elasticity of migration is increasing.

Main Quantitative Results

- Simulations of the optimal tax schedule in three economies that are identical but their migration responses.
- In the three economies, the elasticity of migration among the top 1% is on average equal to 0.25 (see Piketty Saez 2013).
- We show that the top tax rates are highly sensitive to the shape of the semi-elasticity of migration over the entire population.
- Potential migrations result in a welfare drop between 0.4% and 5.3% for the worst-off and an average gain between 18.9% and 29.3% for the top 1%.

$\Rightarrow$ The empirical literature should not only estimate the elasticity of migration among the top 1%. We also need to know how the semi–elasticity of migration is changing along the skill/income distribution.

Related Optimal tax literature

- Mirrlees (JPubEcon 1982), Leite-Monteiro (JPubEcon 1997) : only the migration margin.
- Brewer, Saez and Shepard (2010) and Piketty Saez (2013) : a constant *elasticity* of migration (Hence a decreasing semi-elasticity) + Pareto distribution leads to positive asymptotic Marginal Tax Rates.
- Sadka and Blumkin (2013) : Optimal asymptotic marginal tax rate is zero under independent distribution of migration cost per skill level (hence, constant semi-elasticity).
- Simula Trannoy (2010 and 2012) : One migration cost per skill level. At any skill level, the migration response is 0 or ∞ (Hence an increasing stepwise semi-elasticity). Negative marginal tax rates may be optimal.
- Bierbrauer, Brett and Weymark (2011). Two skill levels, Nash equilibrium, no migration cost, average utilitarianism on the initial population.
- Piaser (2007), Lipatov and Weichenrieder (2010) : two skill groups, identical distribution of migration costs for the two groups.

Roadmap

Model

- Two countries $i = A, B$ of size N_i.
- Preferences of individual of skill $w \in [w_0, w_1]$, with $w_1 \leq +\infty$, and migration cost $m \in \mathbb{R}^+$:

$$c - v\left(y; w\right) - 1 \cdot m$$

- $v(.;.)$ satisfies $v'_y > 0 > v'_w$ and $v''_{yy} > 0 > v''_{yw}$
- Initial joint distribution $g_i(m|w)\ h_i(w)$ of (m, w) in country i, with $H_i(w) \equiv \int_{w_0}^{w} h_i\left(x\right) dx$ and $G_i\left(m|w\right) \equiv \int_0^m g_i\left(x|w\right) dx$.
- Tax independent of native country. No possibility to levy taxes abroad.
- Tax is conditioned on earnings y only, and neither on (w, m) nor on the native country.

Intensive Decisions

A worker of skill w choosing to work in country i, solves :

$$U_i(w) \equiv \max_y \quad y - T_i(y) - v(y; w)$$

Independent of native country.

- FOC : $1 - T_i'(Y_i(w)) = v_y'(Y_i(w); w)$
- Elasticity of gross earnings with respect to $1 - T_i'$:

$$\varepsilon_i(w) \equiv \frac{1 - T_i'(Y_i(w))}{Y_i(w)} \frac{\partial Y_i(w)}{\partial \left(1 - T_i'(Y_i(w))\right)}.$$

Migration Decisions (1.)

- An individual of skill w and migration cost m, born in country A gets :
  - $U_A(w)$ in country A
  - $U_B(w) - m$ in country B
  - Migration to B iff $m < U_B(w) - U_A(w)$
  - The mass of movers of skill w is $G_A\left(U_B(w) - U_A(w)|w\right)\ h_A(w)\ N_A$.
- As $m \sim \mathbb{R}^+$, for each skill level w, we are assuming that there is always a mass of workers for which migration is not an option.
- Migration decisions of individuals born in B are symmetric.
- Mass of residents in country A equal to $\varphi_A\left(U_A(w) - U_B(w); w\right)$:

$$\varphi_A(\Delta; w) \equiv \underbrace{\left(1 - G_A(-\Delta|w)\right) h_A(w)\ N_A}_{\text{Non migrants in } A} + \underbrace{G_B(\Delta|w)\, h_B(w)\ N_B}_{\text{Migrants from } B}$$

Migration Decisions (2.)

Definition (Semi-elasticity of migration)

$$\eta_i\left(w;\Delta\right) \equiv \frac{1}{\varphi_i(\Delta;w)} \frac{\partial \varphi_i(\Delta;w)}{\partial C\left(w\right)}$$

$=$ Percentage change in the density of taxpayers with skill w when their consumption $C\left(w\right)$ is increased by 1 Euro/Dollar.

Definition (Elasticity of migration)

$$\nu_i\left(w;\Delta\right) \equiv C_i\left(w\right) \times \eta_i\left(w;\Delta\right)$$

$\nu_i(w;\Delta)$ can be increasing in w while $\eta_i(w)$ may be decreasing.

The Governments

- Governments are benevolent and Maximin (Rawlsian).
- Exogenous budget requirement $E \geq 0$.
- The worst-off are non-migrants of productivity w_0 (some of them never migrate because of the support of migration cost).
- Government A takes as given $T_B(.)$, thereby $U_B(\cdot) : w \mapsto U_B(w)$.
- Taxation principle : It is equivalent to select an income tax and let individuals choose their labor supply, or to select an allocation that verifies the IC constraints :

$$\forall w, x \in [w_0, w_1] \quad C_A(w) - v(Y_A(w); w) \geq C_A(x) - v(Y_A(x); w)$$

- As $v''_{yw} < 0$, IC constraints equivalent to : $Y_A(.)$ non decreasing and :

$$U'_A(w) = -v'_w(Y_A(w); w) > 0 \qquad \text{(IC1)}$$

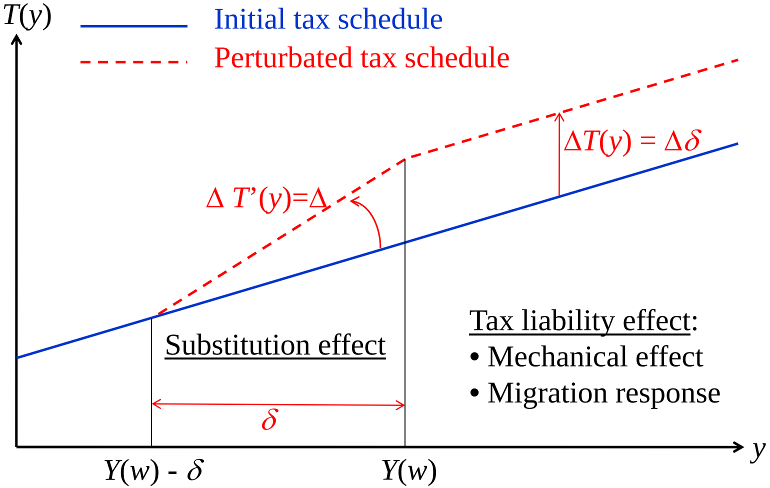
Nash Equilibrium

- Optimal control defines the best response allocation of each government to the other's government policy.
- For country i let $f^*(.) \stackrel{\text{def}}{\equiv} \varphi_i(U_i(w) - U_{-i}(w); w)$ and $\eta^*(w) = \eta_i(U_i(w) - U_{-i}(w); w)$.
- In a symmetric Nash equilibrium, $U_A(w) = U_B(w)$, so that $f^*(w) = h(w)$ and $\eta(w) = g(0|w)$ are exogenous.

Proposition 1 : Optimal Marginal Tax Rates with Competition

$$\frac{T'(Y(w))}{1 - T'(Y(w))} = \underbrace{\frac{1}{1+\varepsilon(w)}}_{\text{Elasticity}} \underbrace{\frac{1 - F^*(w)}{w\ f^*(w)}}_{\text{Distribution}} \underbrace{\left(1 - \mathbb{E}_{f*}\left[T\left(Y(x)\right)\ \eta^*(x)\,|x \geq w\right]\right)}_{\text{Social value of tax liabilities above } Y(w)}$$

- $\mathbb{E}_{f*}\left[T\left(Y(x)\right)\ \eta^*(x)\,|x \geq w\right] = 0$ in autarky or with coordination.


T(y)
Initial tax schedule
Perturbated tax schedule
ΔT(y) = Δδ
Δ T'(y)=Δ
Substitution effect
Tax liability effect:
• Mechanical effect
• Migration response
δ
y
Y(w) - δ
Y(w)

Intuitive derivation

$$T'\left(Y(w)\right) \cdot \frac{Y(w) \cdot (1 + \varepsilon(w))}{1 - T'\left(Y(w)\right)} \cdot \frac{w}{Y(w)} \cdot f^*(w) = X(w)$$

$$X(w) = \int_w^{w_1} \left[1 - T\left(Y(x)\right)\ \eta^*(x)\right]\ f^*(x)\ dx$$

Start from the best response tax policy and consider a uniform increase of $T'(Y)$ by Δ over $[Y(w) - \delta, Y(w)]$ (Piketty (1997), Saez (2001)).

- $\Rightarrow$ Substitution effects : Everyone located in $[Y(w) - \delta, Y(w)]$ decreases labor supply, which reduces tax revenues.
- $\Rightarrow$ Tax level effects $X(w)$: Everyone with skill $x \geq w$ does not change labor supply and faces a lump-sum increase $\delta\ \Delta$ in tax liability.
  - $+$ Mechanical effects : The $f^*(x)$ residents pay more taxes.
  - $-$ Migration effects : A rise in tax liability induces $\eta^*(x) f^*(x)$ residents to emigrate/ less foreigners to immigrate, thereby reducing the number of taxpayers, each of them paying $T\left(Y(x)\right)$.

The "Tiebout" Best as a Benchmark

- Each government maximizes $U(w_0)$ subject to budget constraint and observes the skill level w, but not the migration cost m.
- Tax distortions only come from the migration margin.
- A tax reform perturbation has no substitution effect, hence $X(w) = 0$ for any w. Implies that for $w > w_0$, $\tilde{T}(w) = \dfrac{1}{\eta^*(w)}$:
- Collected tax revenues redistributed to w_0-individuals. Hence, upwards jump discontinuity of $\tilde{T}(\cdot)$ at w_0.

From the Tiebout Best to the Second Best

- The Tiebout-best tax schedule provides insights into the second-best solution, where both skills and migration costs are private information.
- The tax level effect in the second best can be rewritten as :

$$X(w) = \int_{w}^{w_1} \left[\tilde{T}(x) - T\left(Y(x)\right) \right] \eta^*(x) f^*(x) \; dx. \tag{1}$$

- The Tiebout-best tax schedule defines a *target* for the policymaker in the second best, where distortions along the intensive margin have also to be minimized.

Proposition

Let $E = 0$. In a Nash equilibrium :

i) *if $\eta^{*\prime}(\cdot) = 0$, marginal tax rates are positive $T'(Y(w)) > 0$ for $w \in (w_0, w_1)$;*

ii) *if $\eta^{*\prime}(\cdot) < 0$, marginal tax rates are positive $T'(Y(w)) > 0$ for $w \in (w_0, w_1)$;*

iii) *if $\eta^{*\prime}(\cdot) > 0$, then :*
   a) *$T'(Y(w)) \geq 0$ for $w \in (w_0, w_1)$;*
   b) *or there exists a threshold $\breve{w} \in [w_0, w_1)$ such that $T'(Y(w)) \geq 0$ for $w \in (w_0, \breve{w})$ and $T'(Y(w)) < 0$ for $w \in (\breve{w}, w_1)$.*

iv) *if $\eta^{*\prime}(w) > 0$ and $\lim_{w_1 \to \infty} \eta^*(w) = \infty$, then there exists a threshold $\breve{w} \in (w_0, w_1)$ below which $T'(Y(w)) > 0$ and above which $T'(Y(w)) < 0$.*

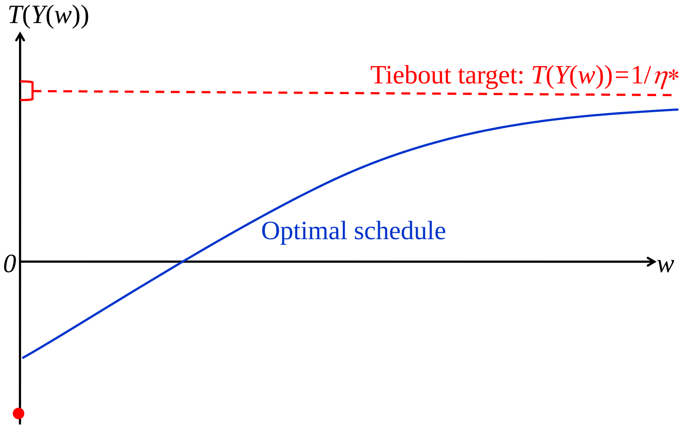


FIGURE : Constant Semi-Elasticity of Migration

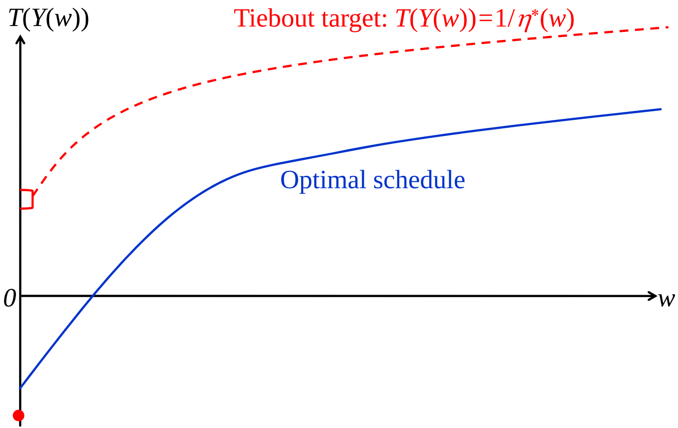


FIGURE : Decreasing Semi-Elasticity of Migration

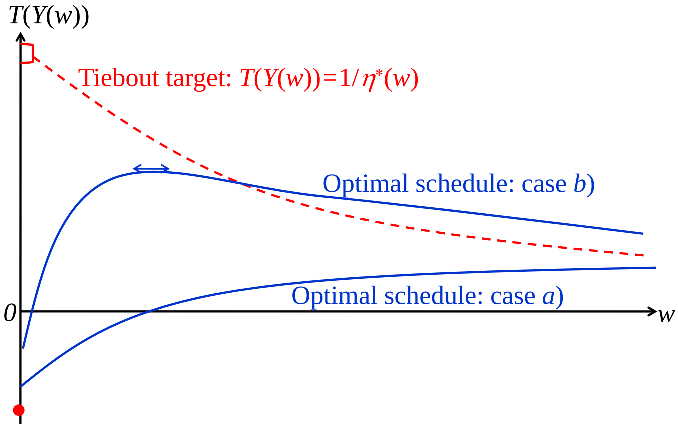


FIGURE : Increasing semi-elasticity of Migration

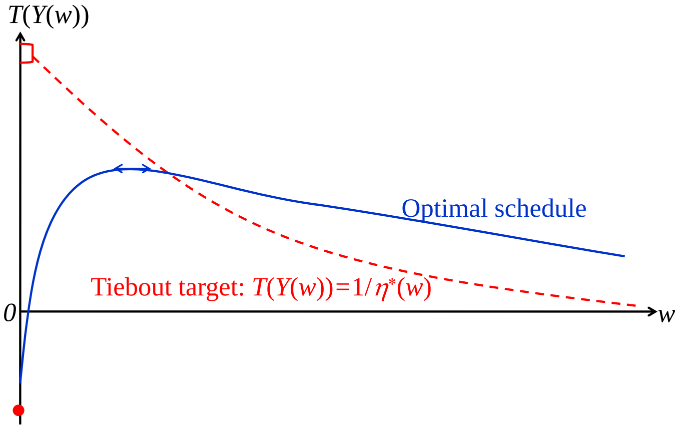


FIGURE : The semi-elasticity of Migration increases to infinity

Asymptotic Marginal Tax rates

- Assume that the skill distribution is Pareto in the upper part with $\frac{w\ \ f^*(w)}{\alpha(w)(1-F^*(w))} = k$. (k=Coefficient of the Pareto distribution of the income distribution)
- Assume that the elasticity of migration is constant, equal to ν.

$\Rightarrow$ Marginal tax rates tends to (Brewer Saez and Shepard (2010), Piketty Saez (2013)) :

$$T'(\infty) = \frac{1}{1+\varepsilon\ k+\nu} > 0$$

- Blumkin Sadka and Shem-Tov (2013), the semi-elasticity being constant, the elasticity of migration tends to ∞, thereby leading to zero asymptotic marginal tax rates.

Parameterization

- Symmetric equilibrium.
- Constant labor supply elasticity $c - \left(\frac{y}{w}\right)^{1+\frac{1}{\varepsilon}}$, with $\varepsilon = 0.25$.
- CPS 2007 distribution of weekly earnings for singles without kids.
- Three scenarios for migration responses. All such that average elasticity of migration within the top 1% is 0.25. But different profile for semi-elasticity.

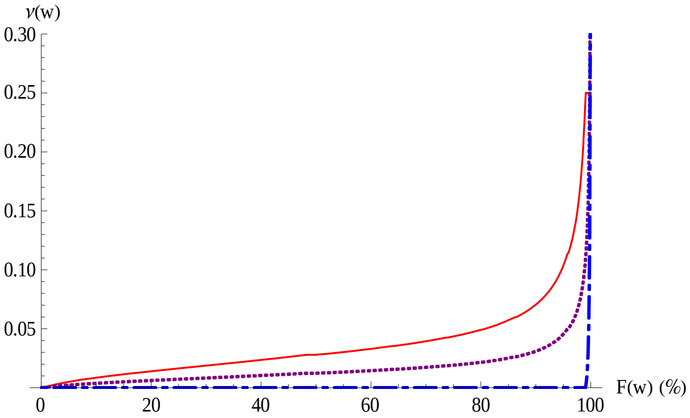


FIGURE : The Three Scenarios : Elasticities

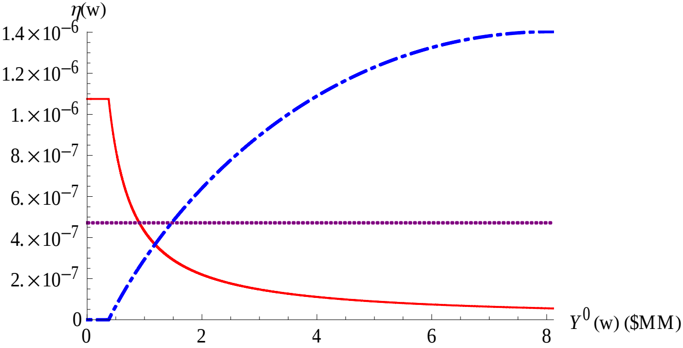


FIGURE : The Three Scenarios : Semi-Elasticity

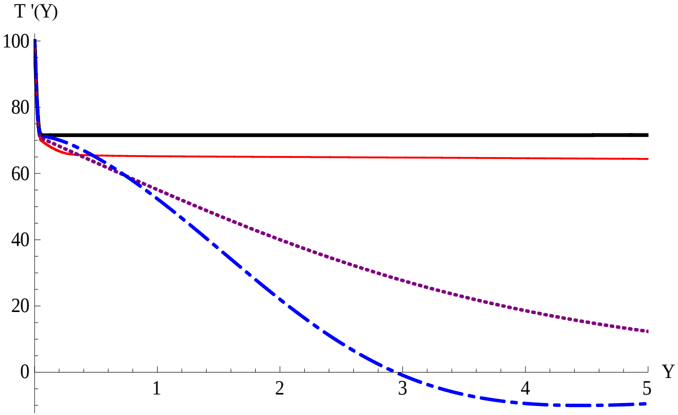


FIGURE : Optimal marginal tax rates

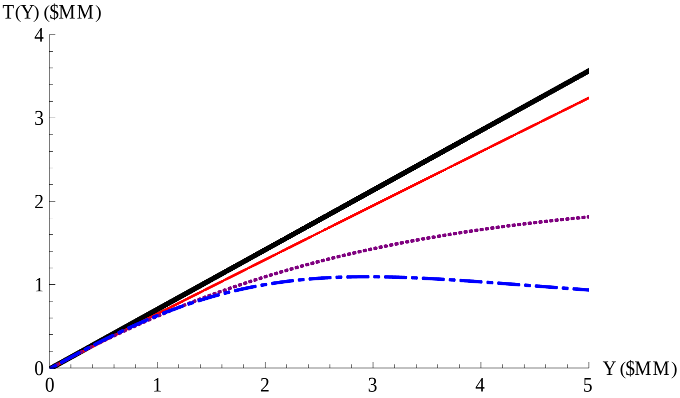


FIGURE : Optimal tax liabilities

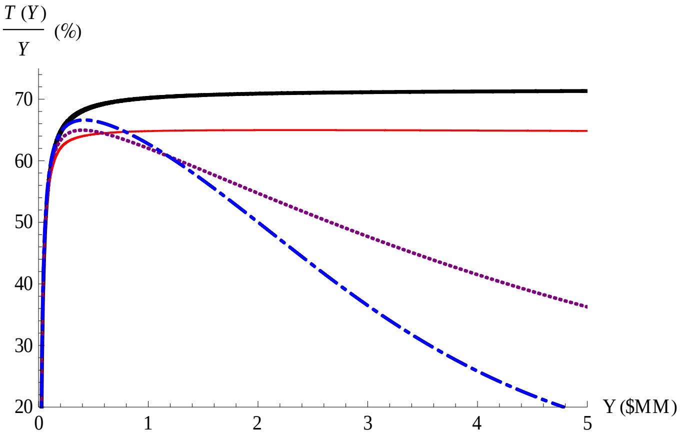


FIGURE : Optimal average tax rates

Concluding Comments

- Derive optimality rule for the income tax, taking migration into account.
- Show that the optimal tax schedule for top income earners not only depends on the intensity of the migration response of this population, but also on the way in which the semi-elasticity of migration varies along the skill distribution.
- The level as well as the slope of the semi-elasticity of migration are crucial to derive the shape of optimal marginal income tax, even for high income earners.