Taxation with pollution and interjurisdictional commuting

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Introduction

Context : air pollution and commuting

- Air pollution and health impacts
  - Impact on respiratory, cardio-vascular and possibly neurodegenerative diseases on short/long term
- Road transport : important emitter of NOx, PM10, PM2.5
  - resp. 53, 17 and 19 % of emissions in Ile-de-France in 2018
  - in 2008, 86% of the distance covered for daily mobility by car

Introduction

Context : fiscality and commuting

- 64% of workers commuted out of their municipality of residence in 2013 in France (75% in Ile-de-France) (RP 2013)
- Local fiscality represents around 17 % of tax receipts in the EU28 and in the US
  - residential taxes
  - business taxes (CFE in France)
  - traffic-related : congestion charges (London, I66), vehicle mile traveled tax (NZ, Oregon, Utah)

$\Rightarrow$ Focus on fiscality among the determinants of interjuridictional commuting

Introduction

Literature

- Fiscal competition and capital mobility
  - small region advantage : Bucovetsky (1991), Wilson (1991)
- Fiscal competition and labour mobility
  - industrial productivity gap : Peralta (2007)
  - job decentralization : Gaigné et al. (2016)
  - income tax heterogeneity in US multi-State metropolitan areas : Agrawal and Hoyt (2018)
  - congestion : Ly (2019)

Introduction

Our contribution

- A tax competition model between 2 jurisdictions, asymmetric w.r.t. to productivity ; with residential location given but cross-commuting allowed
  - based on Peralta (JPET 2007)
- with introduction of environmental costs of commuting
  - The incentive for the high productive jurisdiction to attract workers in order to export its tax burden is modified by the induced pollution import
- and comparison wage vs commuting tax
  - individual fiscal burden imposed by the commuting tax is location-dependent
  - higher welfare levels with commuting tax

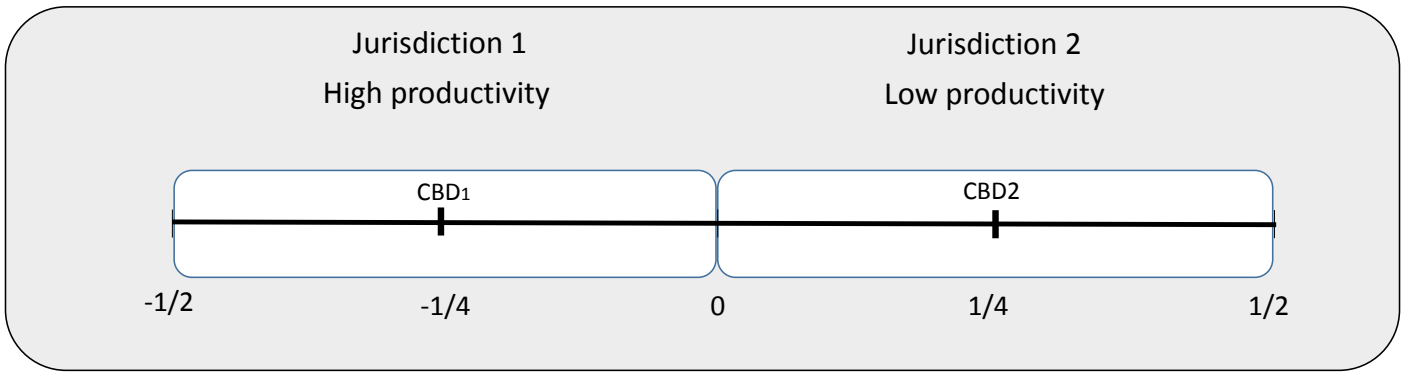
Introduction

Outline

- The model
- The first best
- Fiscal competition
  - with wage tax
  - with commuting tax
- Concluding remarks

Model

- 2 asymmetric jurisdictions



- Residential location given : $\bar{N}_1 = \bar{N}_2 = \frac{1}{2}$
- Job location chosen : $N_1 + N_2 = 1$
  - N_i workers per jurisdiction
  - output : $Y_i = \alpha_i N_i$ $(\alpha_1 > \alpha_2)$
  - wage : $w_i = \alpha_i$

Model

- Utility function with i place of residence and j place of work :

$$u_{ij}(x, G_i, E_i) = w_j + W - c(|x - CBD_j|) - F_{ij}(x) + v(G_i) - E_i$$

  - W : exogenous revenue
  - c : unitary commuting cost
  - $F_{ij}(x)$: fiscal expenditures
  - G_i : local public good in jurisdiction i
  - E_i : ambient pollution

Model

- 2 fiscal schemes analysed :
  - Following Peralta (2007), head (T_i) and wage (τ_i) taxes :

$$F_{ij}(x) = T_i + \tau_j w_j \qquad \text{(FS1)}$$

  - A commuting (t_i) tax :
    - $d_i(x)$ distance travelled by household located at x in jurisdiction i

$$F_{ij}(x) = T_i + t_i d_i(x) + t_j d_j(x) \qquad \text{(FS2)}$$

Model

- Jurisdictions' budget constraint :
  - G_i : fixed level of local public good in jurisdiction i

$$G_i = \bar{N} T_i + N_i \tau_i w_i \qquad \text{(FS1)}$$

$$G_i = \bar{N} T_i + \int_{x \in X} t_i d_i(x) dx \qquad \text{(FS2)}$$

Model

- Ambient pollution affecting an agent located in jurisdiction i :

$$E_i = e_i D_i(\hat{x})$$

  - e_i : unit damage due to ambient pollution
  - $\hat{x}$: location of marginal commuter indifferent between working in CBD_i or CBD_j
  - $D_i(\hat{x})$: total distances travelled in jurisdiction i

$$D_2(\hat{x}) = \int_0^{\hat{x}} x dx + \int_{\hat{x}}^{\frac{1}{2}} |EC_i - x| dx = \frac{1}{16} + \hat{x}^2 - \frac{\hat{x}}{4}$$

$$D_1(\hat{x}) = \int_{-\frac{1}{2}}^{0} |EC_j - x| dx + \int_0^{\hat{x}} \frac{1}{4} dx = \frac{1}{16} + \frac{\hat{x}}{4}$$

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The first-best

- Benevolent policy-maker maximizes sum of utilities w.r.t. N_1, N_2, T and τ (or t), under budget constraint :

$$G_1 + G_2 = 2\bar{N}T + \tau(N_1 w_1 + N_2 w_2) \qquad \text{(FS1)}$$

$$G_1 + G_2 = 2\bar{N}T + t(\frac{1}{8} + \hat{x}^2) \qquad \text{(FS2)}$$

- No use of distortive taxation ($\tau^* = 0$ or $t^* = 0$) and a positive head-tax ($T^* = (G_1 + G_2)/2\bar{N}$)

- Cross-commuting from 2 to 1 as long as the wage gap is positive :

$$x^* = \frac{w_1 - w_2}{2c + e} > 0$$

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Fiscal competition

- Two-stage game solved by backward induction :
  - In each jurisdiction, the local PM maximizes aggregate utility by chosing T_i and τ_i or t_i - *fiscal equilibrium*
  - Then, agents choose their workplace given the tax rates - *commuting equilibrium*

    $\Rightarrow$ location of the marginal commuter $\hat{x}$

    s.t. $\Delta u = u_{ij}(\hat{x}, G_i, E_i) - u_{ii}(\hat{x}, G_i, E_i) = 0$

Tax competition : PM maximisation problem

Each jurisdiction's PM maximises aggregate utility wrt τ_i or t_i under her budget constraint :

- Jurisdiction 1

  $U_1 = \int_{-1/2}^{0} u_{11}(x, G_1, E_1)dx$ s.t. $G_1 = \bar{N}T_1 + \tau_1 N_1(\hat{x})w_1$

- Jurisdiction 2

  $U_2 = \int_{0}^{\hat{x}} u_{21}(x, G_2, E_2)dx + \int_{\hat{x}}^{1/2} u_{22}(x, G_2, E_2)dx$

  s.t. $G_2 = \bar{N}T_2 + \tau_2 N_2(\hat{x})w_2$

Tax competition : wage tax

- $\tau_1 > 0$: wages are taxed in J_1
- 3 types of impacts of τ_1 on U_1 :
  - a wage tax effect : < 0
  - a pollution load effect : > 0
  - a head tax effect

$\Rightarrow$ The higher the pollution damage, the higher τ_1 : pollution import counterbalances the benefits of the tax burden export

Tax competition : wage tax

- $\tau_2 \lessgtr 0$: wages may be taxed or subsidized in J_2
- 4 types of impacts of τ_2 on U_2 :
  - wage, pollution and head tax effects, sign undetermined
  - a commuting cost effect : < 0

$\Rightarrow$ $\tau_2 \neq 0$ in contrast with previous literature

$\Rightarrow$ Sign of τ_2 depend son how the positive impacts of taxing (more cross-commuters earning higher wages, less residential fiscal pressure) compare with the negative ones (less workers in J_2 with lower wages)

Tax competition : wage tax

- Cross-commuting is reduced compared to the first-best
  - $\Rightarrow$ since wages are taxed in J_1, it is always less attractive for residents of J_2 to commute there compared to the first-best
  - $\Rightarrow$ even more so when pollution damage is high
- J_1 gains welfare, J_2 loses welfare, and aggregate welfare is reduced compared to the first-best
  - $\Rightarrow$ however, pollution decreases the total welfare gap, and its impact on jurisdictional welfare gaps depends on Δw
  - $\Rightarrow$ when Δw is high, e increases the welfare gaps since the incentive to cross-commute, hence the pollution impact, is high

Tax competition : commuting tax

- $t_1 > 0$: commuting is taxed in J_1
- 3 types of impacts of τ_1 on U_1 :
  - a commuting tax effect : < 0
  - a pollution load effect : > 0
  - a head tax effect : > 0

$\Rightarrow$ The higher the pollution damage, the higher t_1 : pollution import counterbalances the benefits of the tax burden export

Tax competition : commuting tax

- $\tau_2 < 0$: commuting is subsidized in J_2
- 4 types of impacts of τ_2 on U_2 :
  - commuting, pollution and head tax effects, sign undetermined
  - a commuting cost effect
  - aggregate impact < 0

Tax competition : commuting tax

- Cross-commuting is reduced compared to the first-best, but higher than with wage tax
  - $\Rightarrow$ commuting fiscal pressure depends on precise residential location (x, rather than J_1 or J_2)
  - $\Rightarrow$ incentive to x-commute since taxed in J_1 and subsidized in J_2
- J_1 gains welfare, J_2 loses welfare, and aggregate welfare is reduced compared to the first-best
  - $\Rightarrow$ but all welfares are higher than with wage tax

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Concluding remarks

- Fiscal competition in a spatial context when pollution matters
  - tradeoff between fiscal burden export and pollution import (J_1)
  - tradeoff between cross-commuters and resident-workers' welfares (J_2)
- Wage tax vs commuting tax
  - commuting tax increases incentive for cross-commuting
  - aggregate and jurisdictional welfares higher with commuting rather than wage tax

Concluding remarks

- Spatial framework rather coarse
  - economic geography framework and environmental fiscal competition : work in progress with R. Gaté and T. Ly
- Role of citizens' and policy-makers perception of pollution
  - perceptions aligned ?

Thank you for your attention