Taxation with pollution and interjurisdictional commuting

Sophie Legras, INRAE, CESAER

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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)

⇒ Focus on fiscality among the determinants of interjurisdictional commuting
• Fiscal competition and capital mobility

• 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
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Outline

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

• 2 asymmetric jurisdictions

![Diagram showing two jurisdictions with CBD1 and CBD2]

- 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: \( w_i = \alpha_i \)
• 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 ($\tau_i$) taxes:
    \[
    F_{ij}(x) = T_i + \tau_j w_j
    \] (FS1)
  • A commuting ($t_i$) tax:
    • $d_i(x)$ distance travelled by household located at $x$ in jurisdiction $i$
    \[
    F_{ij}(x) = T_i + t_i d_i(x) + t_j d_j(x)
    \] (FS2)
• Jurisdictions’ budget constraint :

• $G_i$ : fixed level of local public good in jurisdiction $i$

\[ G_i = \bar{N}T_i + N_i\tau_i w_i \]  \hspace{1cm} (FS1)

\[ G_i = \bar{N}T_i + \int_{x \in X} t_i d_i(x) \, dx \]  \hspace{1cm} (FS2)
• 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 $i$

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

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

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

$$G_1 + G_2 = 2\bar{N}T + \tau(N_1w_1 + N_2w_2)$$  \hspace{1cm} (FS1)

$$G_1 + G_2 = 2\bar{N}T + t(\frac{1}{8} + \hat{x}^2)$$  \hspace{1cm} (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 choosing $T_i$ and $\tau_i$ 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 $\tau_i$ or $t_i$ under her budget constraint:

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

- Jurisdiction 2
  \[
  U_2 = \int_{0}^{\hat{x}} u_{21}(x, G_2, E_2) \, dx + \int_{\hat{x}}^{1/2} u_{22}(x, G_2, E_2) \, dx \\
  \quad \text{s.t.} \quad G_2 = \bar{N} T_2 + \tau_2 N_2(\hat{x}) w_2
  \]
Tax competition: wage tax

- \( \tau_1 > 0 \): wages are taxed in \( J_1 \)

- 3 types of impacts of \( \tau_1 \) 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 \( \tau_1 \): pollution import counterbalances the benefits of the tax burden export
Tax competition: wage tax

- \( \tau_2 \leq 0 \): wages may be taxed or subsidized in \( J_2 \)

- 4 types of impacts of \( \tau_2 \) 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 \( \tau_2 \) 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
  ⇒ 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
  ⇒ 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
  ⇒ however, pollution decreases the total welfare gap, and its impact on jurisdictional welfare gaps depends on $\Delta w$
  ⇒ when $\Delta w$ 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 $\tau_1$ 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 $\tau_2$ 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
  - commuting fiscal pressure depends on precise residential location ($x$, rather than $J_1$ or $J_2$)
  - 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
  - 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