Race to the Top in Traffic Calming

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Research questions

• Study horizontal competition between two suburbs facing transit traffic using non-pricing measures.
• How do local and federal optimum depend on the type of traffic calming?
• When does local decision making lead to an efficient amount of traffic calming and when is there a race to the top?
• Is it better to concentrate all transit traffic in one suburb or to distribute transit traffic symmetrically over several suburbs?
Analytical model

- Transport network with two parallel roads
- Two suburbs $i \in \{A, B\}$ face local and transit traffic
- Allocation of transit follows Wardrop’s principle
- Traffic gives rise to a local external cost
  \[ E_i = (1 - az_i)(X_i + Y) \]
- Two types of government consider traffic calming measures $z_i$ to the externality
Traffic calming measures

Two types of government with different preferences composed of traveler cost, investment cost and external cost

• Local governments

\[ W_i = - \left( c + \frac{d}{2} z_i^2 \right) Y - \frac{b}{2} z_i^2 - e(1 - az_i)(X_i + Y) \]

• Federal government

\[ W_F = \sum_i \left[ - \left( c + \frac{d}{2} z_i^2 \right)(X_i + Y) - \frac{b}{2} z_i^2 - e(1 - az_i)(X_i + Y) \right] \]

Traffic calming measures characterized by three key parameters:

• \( a \) captures effectiveness of externality reduction measures \( z \)
• \( b \) captures investment cost for public budget with \( z \)
• \( d \) captures how investment \( z \) affects generalized travel cost
Noise walls and pedestrian overpasses

• Noise walls reduce external cost without affecting the generalized cost of traffic (d=0, b>0)

• Local response functions independent of the other suburb

\[ z_{local}^i = z_{federal}^i = \frac{ea(X_i + Y)}{b} \]

**Proposition 1:** The local government will invest in the optimal level of externality reduction when the measures do not affect the generalized transport cost.
Speed bumps

- Speed bumps increase user cost of travel ($d > 0, b > 0$)
- Nash equilibrium leads to a race to the top where local governments try to shift transit traffic to its neighbors

$z_i^{local} = \frac{ae(X_i + Y) - e \frac{dX_i}{dz_i}}{Yd + b - ea \frac{dX_i}{dz_i}} > \frac{ea(X_i + Y)}{(X_i + Y)d + b} = z_i^{federal}$

**Proposition 2**: The local governments install more speed bumps than the federal government.
Asymmetric solution

• Assume federal government can direct transit traffic directly

Proposition 3: The federal government prefers to direct all transit traffic to a single suburb as long as there is an investment cost for the government due to economies of scale in externality reduction investments.
The welfare gain of concentrating all transit traffic in a single suburb
Effects on local welfare from an asymmetric solution

Proposition 4: For a given level of traffic calming, a suburb receiving the transit traffic is always worse off.

\[ X_A = 2X\beta \]
\[ X_B = 2X(1 - \beta) \]
Noise walls versus speed bumps

**Proposition 5:** The local governments prefer speed bump type of measures to noise walls when the federal government is indifferent between the measures.
Conclusions and caveats

• Paper studies competition of two suburbs facing transit traffic

• Decentralized decision making leads to a race to the top in traffic calming for measures that increase the cost for transit traffic

• Federal government prefer an asymmetric solution that concentrates all transit traffic in one suburb

• Can only be realized if the authority over the local roads is transferred to the central authority
Merci beaucoup pour votre attention!
Race to the top with no stable solution