Static Models in Transport Exercises w/o corrections

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Three exercises

1. How would you construct a static model for a general network?
2. Braess Paradox
3. Self-financing theorem for a dynamic model

1. How would you construct a static model for a general network?

1. Network
2. O-D matrix
3. Behavioral parameters
4. External data for calibration
5. Types of outputs
6. How would you handled two matrices on the CBD (with many zones) and the whole city (with larger zones) ?

2. Braess Paradox: Before investment

River

A

N_1

Bridge 1

Route 2, T^0_2=15

N_2

C

Route 1, T^0_1=15

N_1

D

N_2

Bridge 2

B

Braess Paradox: Before investment (new road)

$N = 1000$

Travel time on Route 1: $T_1 = 15 + N_1/100$.

Travel time on Route 2: $T_2 = 15 + N_2/100$.

Question 1. Compute the equilibrium solution

Question 2: Compute the optimal solution (first best)

Question 3: Which toll decentralizes the first-best optimum?

3. Self-financing

Individual cost (reduced form of a dynamic model):

$$C^e = \delta \frac{N}{s};$$

s : capacity

N : fixed number of users

Construction cost: $K = \xi s$.

Let TR be toll revenue and W be the welfare

Question: Is the road self-financed by an optimal fine toll?

HINT: as proved, social cost C^o is half of equilibrium cost C^e

Self-financing

Individual cost (reduced form of a dynamic model):

$C^e = \delta \frac{N}{s}$, s : capacity, N : fixed number of users.

$TR^o = NC^e/2$ see next lecture for the optimal (fine) toll.

Construction cost: $K = \xi s$. Let TR toll revenue, W: welfare.

Question: is the road self-financed by an optimal tax?