Road Pricing: An Alternative for Metropolitan Chicago?

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Basics of Highway Traffic Flow

- Imagine a circular track, one mile in circumference and with one lane.
- The track has 80 cars moving at a speed of 25 mph.
- Each car crosses the “finish line” 25 times per hour.
- Traffic volume (V) is 2000 cars per hour.
- Traffic density (D) is 80 cars per mile.
- Average speed (S) is 25 mph.
- V = D * S; or S = V/D; or D = V/S.

Production Function Analogy

- Traffic volume (a flow per hour) is the output.
- The inputs are the fixed highway (capital K) and the variable number of cars (D, each equipped with a driver).
- An hour's worth of 80 cars and drivers produces traffic volume of 2000, with average product of 25 miles per hour.
- Production function is $V = V(D, K)$
- What does $V(D, K)$ look like?

Traffic Volume on the Eisenhower

- Data from IDOT can be used to estimate the production function for hourly traffic volume.
- Data are from the western half of the Ike during rush hour for a week without rain…
- Data source gives “occupancy rate” rather than traffic density, but if each car is 20 ft. in length, 80 cars per mile translates into occupancy of 30.3%. More general formula is

  Occ = D*L/5280; L is car length.

Empirical Estimate

$$V = -18{,}008 - 522.4\,Occ + 11{,}394\,\ln(Occ)$$

(11.3) (15.2) (14.8)

R sq. = .614, N = 150

V is hourly traffic volume on 3 lanes; mean = 5165, range 4048 to 6235

Occ is occupancy rate, mean = 23.6%, range 12.80% to 37.70%

V is a maximum at 5718 (1906 cars per lane per hour), Occ = 21.8%.

Welcome to the Ike

- The empirical estimate implies that traffic volume falls if occupancy is greater than 22%.
- The actual mean occupancy rate was 23.8%, so
- The Ike was operating below maximum traffic volume because of high traffic density over 50% of the time during rush hours.
- We have a big problem.

Road Pricing Options for Metropolitan Chicago: Some Background Facts

- We have a tollway system with high-tech toll collection technology – good news.
- Our traffic congestion problems are severe on the radial expressways and on the circumferential tollway – often in both directions at the same time.
- We have trucks moving freight on the radial expressways (from one rail yard to another?). This looks to be a big problem to this observer.

What Can Be Done?

- Impose time-of-day congestion tolls on the Illinois Tollway system. An improvement in efficiency can be found, but it's complicated.
- Improve the rail links within the metro area to reduce truck traffic.
- Maybe we should experiment with a HOT lane. Would we get more car pooling? Maybe. But where do we have enough lanes to conduct such an experiment without causing a riot?

What Can Be Done, Part 2

- Should there be a London-like cordon line around the downtown area – with a hefty fee for driving into it? Probably not because parking fees are already high, and the big problem is not traffic within the downtown area itself.
- Pour more concrete – build some version of the Crosstown Expressway. Daley I killed it by making the project too grandiose. Is it time to revisit?
- Widen the circumferential tollway? Can this be done?