

Reflections on Congestion Externalities readings

Readings referenced in this reflection:

- Arnott, R., de Palma, A., & Lindsey, R. (1993). A Structural Model of Peak-Period Congestion: A Traffic Bottleneck with Elastic Demand. *The American Economic Review*, 83(1), 20.
- Arnott, R., & Small, K. (1994). The economics of traffic congestion. *American Scientist*, 82(5), 446–455.
- MacKie-Mason, J. K., & Varian, H. R. (1994). Some economics of the Internet. Presented at the Tenth Michigan Public Utility Conference, Western Michigan University.
- Vickrey, W. (1963). Pricing and resource allocation in transportation and public utilities. *American Economic Review*, 53(2), 452–465.
- Vickrey, W. S. (1969). Congestion Theory and Transport Investment. *The American Economic Review*, 59(2), 11.

Bonus reading:

- Varian, H. R. (2016). How to Build an Economic Model in Your Spare Time. *The American Economist*, 61(1), 10.
 - I found this on Hal Varian's page - not related to congestion externalities at all, but very interesting and enlightening.

While I am not particularly interested in the economics of transportation, it's pretty easy to see connections to the fields I am more interested in. Also, as a long-time resident of the SF Bay Area, many of the issues discussed in these readings could readily be applied to problems with the SF Bay transportation network.

Vickrey's 1963 Pricing and Resource Allocation piece provides a very readable and clear conceptual description of the problem of congestion and the potential for tolls, rather than expansion of capacity, for finding more efficient solutions to congested transportation networks:

If, under conditions similar to the above, the levying of congestion charges is either an actuality or an alternative under consideration, benefits from the expansion of capacity are likely to be both smaller and less capricious in their behavior than if no pricing is contemplated.

While most of the math is made clear in the 1969 followup, I did find one more quote in this paper to be particularly interesting: "The delusion still persists that the primary role of pricing should always be that of financing the service rather than that of promoting economy in its use." This resonates because if I recall correctly, the tolls over the various SF Bay bridges were originally (ostensibly) put into place to fund the bridges' construction (and perhaps maintenance). And yet, the tolls still exist nearly 80 years later, and only increase! The messaging of CalTrans may need some work to educate the public that those tolls are no longer for paying for past construction, but to drive efficiencies in Bay Area traffic.

Vickrey's 1969 paper follows up with the mathematical derivations of his congestion model. Conceptually, seeing the math laid out here and in class, it seems quite intuitive that while expanding a congested road may be an obvious solution, that expansion is entirely wasted for the non-congested times of day, and thus shifting incentives to balance the traffic more efficiently on the existing infrastructure through judicious application of tolls should be a first consideration. The paper presents the benefits of variable tolls as not only creating no excess burden, but no burden at all! However, at the time of this publication, variable tolls must have been challenging.

Sticking with the traffic context, technology today creates huge opportunities for reducing congestion through Vickrey-style tolls. It is now feasible to create tolls that readily vary minute-by-minute or mile-by-mile

according to road condition - electronic signs to communicate tolls to drivers, as well as EZ Pass transmitters to collect those tolls per small portions of a route, give immense flexibility to manage congestion (I've seen these between Boston and New York, though not in the Bay Area yet). However, it might be even more effective if such tolls could be observed before deciding on a route or even a transportation method to get to work in the first place.

Which brings us to Arnott et al (1993) and Arnott et al (1994). These papers describe the