The economics of roads

Adler, M.W.

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Summary

Road transport is important to the modern economy. An increase in trade and personal mobility has intensified road use in the last decades and thereby exacerbated congestion and the associated losses in travel time, public health and environment. This thesis contributes to the on-going discussion on how to measure road congestion and examines the cost and benefits of some of the main policy remedies.

We propose a novel approach to estimate the marginal external congestion cost of motor vehicle travel and associated welfare losses, while allowing for hypercongestion, i.e. when the road supply curve is backward bending. We apply this approach to the city of Rome, using quasi-experimental variation in public transit supply to address endogeneity issues. We find that the marginal external cost of travel is substantial. Although hypercongestion is rare in our data, it accounts for about 30 percent of congestion-related welfare losses. We demonstrate that the marginal congestion-relief benefit of public transit supply is sizeable and approximately constant over the full range of public transit supply levels. These results suggest that substantial welfare gains can be obtained not only by introducing road pricing, but also by adopting quantity-based measures (e.g. adaptive traffic lights) to avoid hypercongestion. We also show that road congestion has a strong effect on travel time delays of bus travelers.

One of the unanswered questions in the field of urban economics is to which extent subsidies to public transit are justified. We examine one of the main benefits of public transit, a reduction in car congestion externalities, the so-called congestion relief benefit, using quasi-natural experimental data on citywide public transit strikes for Rotterdam, a city with mild congestion levels. On weekdays, a strike induces travel times to increase only marginally on the highway ring road but substantially on inner city roads. During rush hour, the strike effect is much more pronounced. The congestion relief benefit of public transit is substantial, equivalent to about 80% of the public transit subsidy. We demonstrate that during weekends, travel time does not change noticeable due to strikes. Further, we show that public transit strikes induce similar increases in number of cyclists as number of car travelers suggesting that bicycling-promoting policies to reduce car congestion externalities might be attractive.

We estimate the marginal external losses from vehicle traffic for inner city roads and a highway in Rotterdam based on the external effect of traffic density on travel time. We account for endogeneity issues from reverse causality and measurement error through a two-stage instrumental variable approach using bicycle use and hour-of-the-weekday as instruments. Our approach captures the backward-bending function of the relationship between travel time and flow. We use this road supply cost curve for economic evaluation of marginal external cost. Larger travel demand during peak hours has much higher external

cost due to hyper-congestion. With tolls between €0.40 and €0.50 per kilometer during these hours, hyper-congestion could be prevented.

Non-recurrent congestion is frequently caused by accidents and other incidents. We estimate the causal effect of incident duration on drivers' time losses through changes in non-recurrent road congestion on Dutch highways. We demonstrate that incident duration has a strong positive, but concave, effect on non-recurrent congestion. The duration elasticity of non-recurrent congestion is about 0.35 implying that a one minute duration reduction generates a €57 gain per incident. We also show that at locations with high levels of recurrent congestion, non-recurrent congestion levels are considerably higher. At very congested locations, the benefit of reducing the incident duration by one minute is about €1200 per incident. Public policies that prioritize duration reductions at congested locations are therefore more beneficial.