CORRECTING TRANSPORTATION EXTERNALITIES USING LOCAL FUEL PRICE CONTROLS

Cody Nehiba, University of California-Irvine, Phone: 218-966-7737, Email: cnehiba@uci.edu

Overview

Marginal damages and abatement costs for externalities often vary across firms or regions. When correcting such heterogeneous externalities, economic theory predicts locally targeted regulations will outperform regulations levied on a broader scale (Peltzman and Tideman, 1972). Despite this prediction, most policies implemented to correct externalities in the transportation sector are targeted at the federal and state-levels in the U.S. In particular, fuel taxes are bluntly levied at the federal and state-levels despite varying levels of transportation externalities across geographic areas. If transportation externalities are heterogeneous across regions, imposing finer fuel taxes based on local marginal damages and benefits may provide substantial welfare gains for society.

This paper examines driver response to exogenous local fuel price shocks and the ensuing changes in transportation externalities to determine if more targeted fuel price controls are welfare improving. This task is made empirically challenging due to the endogenous relationship between the demand for vehicular travel and fuel prices as well as the fine geographic level being investigated. This paper circumvents these issues by utilizing an expansive data set on county-level travel demand and fuel prices as well as a novel instrument for local fuel prices. Combining these geographically and temporally detailed data with exogenous shocks to local fuel prices generated by county-level gasoline content regulations allows for the examination of driver response to local fuel prices. These gasoline content regulations are local pollution controls that aim to reduce emissions of volatile organic compounds and ground-level ozone formation that have been shown to also increase fuel prices because they increase refining costs and segment fuel markets (Brown et. Al, 2008; Chakravorty et. Al, 2008; Auffhammer and Kellogg, 2011).

By combining these data with an instrumental variables (IV) strategy that utilizes gasoline content regulations as an instrument for county fuel prices it is possible to identify local elasticity estimates for travel demand. The elasticities found in this paper are at a much finer geographic level than has previously been estimated which provides a richer understanding of demand elasticities across regions. Further, this empirical strategy improves upon past research which has relied on fuel taxes, which may not meet the exogeneity requirement of an IV model, as an instrument for fuel prices.

The travel demand elasticities are then utilized to simulate changes in transportation externalities in individual counties that are induced by both county fuel price shocks and broader state-level price shocks. Comparing the changes in transportation externalities from price shocks at different geographic levels sheds light on the welfare effects of regulating externalities at various levels.

Methods and Data

The identification strategy utilizes over 750 million hourly vehicle counts from the universe of traffic sensors in the U.S. and weekly fuel prices from over 450 locations between 2013 and 2016 to analyse the changes in traffic caused by higher fuel prices from strict gasoline content regulations. The elasticity estimates from this instrumental variables model are then used to simulate changes in transportation externalities in individual counties that are induced by both county fuel price shocks and broader state-level price shocks

Results

The travel demand elasticities generated from estimating the IV model on the entire sample are similar to those found in past research. However, when the model is estimated on individual counties, a wide range of elasticities is found. This suggests there is significant geographic heterogeneity in travel demand elasticities. The results of the

simulation study suggest that, due in part to the heterogeneity in travel demand elasticities, that implementing more locally targeted fuel taxes would be welfare improving relative to the broad state-level taxes currently used.

Conclusions

This paper examines the welfare effects of implementing geographically targeted fuel taxes by estimating driver response to exogenous local fuel price shcoks and the ensuing changes in transportation externalities. This task is accomplished by combining a rich data set on local travel demand and fuel prices with a novel instrument for fuel prices, gasoline content regulations. This methodology allows for the estimation of a national average travel demand elstacity as well as the estimation of individual county elasticities. The average travel demand elasticity estimates are similar in size to those found in previous studies, but the county-level estimates reveal significant heterogeneity across regions. These county-level estimates are then used to simulate changes in transportation externalities that would be induced by locally targeted fuel taxes as well as blunt state fuel taxes. The results of this simulation study reveal that locally targeted fuel taxes would be welfare improving relative to state fuel taxes.

References

Peltzman, S., & Tideman, T. (1972). Local versus National Pollution Control: Note. The American Economic Review, 62(5), 959-963.

Jennifer Brown, Justine Hastings, Erin T. Mansur, Sofia B. Villas-Boas,b Reformulating competition? Gasoline content regulation and wholesale gasoline prices, Journal of Environmental Economics and Management, Volume 55, Issue 1, 2008.

Ujjayant Chakravorty, Céline Nauges, Alban Thomas, Clean Air regulation and heterogeneity in US gasoline prices, Journal of Environmental Economics and Management, Volume 55, Issue 1, 2008.

Auffhammer, Maximilian, and Ryan Kellogg. 2011. "Clearing the Air? The Effects of Gasoline Content Regulation on Air Quality." American Economic Review, 101 (6): 2687-2722.