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How Congestion Pricing Influences Equity

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TRAFFIC CONGESTION IS A MAJOR PROBLEM IN the United States. A recent study estimated the cost of United States highway congestion at $300 billion in 2016, or 1.6 percent of GDP.[1] Congestion is an instance of the tragedy of the commons: the tendency for people to overuse free public services.

When there is no charge, it is difficult to determine the value drivers place on highway access during rush-hour traffic. This makes it harder to determine the value of building additional lanes to expand capacity. A variable toll, higher in peak drive times, would reduce congestion and provide policymakers with the information they need to make informed decisions about the value of additional highway capacity.[2]

I examine the equity concerns associated with variable tolling of highways in the United States.[3] I argue that variable tolls reduce congestion, improving the overall welfare of a community. However, individual welfare gains vary depending on many factors, such as the relative location of residential communities to jobs and the availability of public transit. The evidence indicates that variable tolls are no more regressive than the fuel and sales taxes currently used to fund highways. Policymakers can make tolling highways more equitable by using toll revenues to improve nontolled roads and public transit or by offsetting tolls by reducing regressive gasoline and sales taxes.

EQUITY ISSUES

The use of variable tolls to reduce traffic congestion results in a more efficient use of highways. Total community welfare is enhanced when the loss of those priced out of toll roads is less than the gain from more efficient highways. However, there are two equity issues: First, although total welfare is higher, the impact on individuals can vary considerably. Second, the toll may be regressive—low-income

drivers may spend a larger percentage of their income on tolls than high-income drivers.

Individual Effects

Basic economic welfare analysis finds congestion tolls efficient, since they satisfy the user-pay principle (i.e., that consumers pay the full cost of their consumption). In the case of tolls, those who use the highway directly pay for it. However, the individual welfare effects depend on whether a driver continues to use the highway after the toll is imposed and how the toll revenues are used.

For any individual driver who continues to use the highway, if the value of a faster, more reliable trip plus highway improvements or offsetting tax cuts exceeds the value of the toll paid, the driver is better off. The size of this net benefit depends on the value of the driver's time.

Individuals who stop using a highway after a toll is imposed lose the value of driving on the highway, as they must use a slower or longer route, carpool, or use public transportation. However, there may be a net welfare gain for these individuals if the revenues are used to lower taxes they pay, such as the sales tax, or to improve their commute through investment in public transit and alternative roads. When the benefits derived from the toll revenues outweigh the lost value of not using the first-choice highway, these drivers are better off.[4]

Economist Kenneth Small simulated the welfare effects of a $0.15-per-mile toll in Southern California, one of the most congested highway systems in the world. He assumed the toll revenues would be divided equally three ways: drivers would receive commuting allowances, other taxes would be lowered to offset the toll, and the remaining revenues would be used to finance public transportation improvements. Based on these assumptions, Small's simulation yielded broad welfare gains. Both high- and low-income drivers stood to gain, but low-income drivers gained less than high-income drivers.[5]

Rather than imposing tolls on all highway lanes, underused high occupancy vehicle (HOV) lanes could be converted into high occupancy toll (HOT) lanes. This would allow solo drivers to pay a toll to use the lane. In order to maintain a steady traffic flow, tolls on HOT lanes must vary, rising in peak drive times.[6] In 2004, researchers estimated that converting HOV lanes to HOT lanes in the Washington, DC, area would benefit households at all levels of income.[7] Because they have higher time value, though, high-income households benefited more. The estimated increase in welfare resulted even without considering the additional benefits that would be generated from the use of the toll revenues. Evidence from the conversion of an HOV lane to a HOT lane on the I-15 interstate highway in San Diego, California, indicated that the lanes were used mostly by high-income drivers. In both cases, congestion in the nontolled lanes declined, which benefited low-income drivers.[8]

HOV lanes are often underused. By tolling solo drivers using the lane, limited highway capacity is used more efficiently. High-income drivers benefit most from faster more reliable trips using the HOT lane. Low-income drivers who chose not to use the HOT lanes also benefit because the nontolled lanes are less congested. Providing drivers with a choice and a less congested highway system can benefit all drivers.

Congestion Toll Regressivity

A tax or toll can be regressive or progressive. If a toll is regressive, low-income individuals pay a larger percentage of their income on the toll than do high-income individuals. Regressivity is an undesirable feature from an equity perspective. In contrast, a toll is said to be progressive if high-income individuals pay a larger share of their income on the tax than do low-income individuals.

The best way to judge congestion tolls' regressivity is to compare them to fuel and sales taxes, which are used to fund highway construction and maintenance. The difficulty in calculating the regressivity of a tax depends on the way income is measured. When current income is used, fuel taxes are regressive. Alternatively, when lifetime income or average income over a five- or ten-year period is used in the calculation, the fuel tax is still regressive, but less

so.[9] The same issue applies to the sales tax, another common source of revenue for funding highways and mass transit, and researchers find this tax to be regressive as well.[10]

Evidence on the regressivity of congestion tolls is limited. The United Kingdom has allowed communities to use tolls in order to reduce congestion since 2000. Economists Georgina Santos and Laurent Rojey simulated the effects of congestion pricing for three UK cities: Cambridge, Bedford, and Northampton.[11] Differences in commuting patterns and the availability of public transportation resulted in different equity outcomes. Under the assumption that toll revenues are used to finance infrastructure and public transportation, congestion tolls appeared to be regressive in Cambridge, neutral in Northhampton, and progressive in Bedford. Santos and Rojey concluded that, generally, high-income individuals continue to drive on tolled roads and low-income individuals reduce driving on tolled roads.

Analysts Jonas Eliasson and Lars-Göran Mattsson examined the equity effects of congestion tolling in Stockholm, Sweden, in 2005. In this case, toll revenues were used to improve public transportation. They found congestion pricing to be progressive.[12] Anders Karlström and Joel P. Franklin also examined the Stockholm congestion pricing experience but found no clear relationship between income and the burden associated with paying the toll.[13]

The question is whether tolls are more regressive than the fuel and sales taxes that are used to fund highway construction and maintenance in the United States. These taxes are regressive. Given that some studies find tolls to be progressive or neutral, it is unlikely that the regressivity of tolls is greater than that of fuel or sales taxes.[14] The added benefit of using variable tolls to fund highways is that they are an efficient way to reduce congestion.

POLICIES THAT REDUCE EQUITY CONCERNS

Urban highways in the United States are congested. Expanding highway capacity increases vehicle flow temporarily, but congestion returns.[15] An alternative approach is to move away from fuel and sales taxes as the primary highway funding mechanism and use a variable tolling system instead.[16] By improving the efficiency of the highway system, overall welfare would be increased.

There are several policy options to deal with the remaining equity concerns associated with congestion tolling. First, policymakers should use toll revenues to make improvements to alternate travel routes or expand public transportation.[17] This approach was used in Singapore, London, and Stockholm, resulting in greater public acceptance of congestion tolls.[18] A second option is to expand the use of highway tolls and reduce regressive sales and fuel taxes at the same time. This would maintain or even reduce the overall tax burden on low-income drivers. Tax credits could be provided to low-income drivers who pay tolls.

Other policy options can make tolling highways more equitable and easier to use. Low-income individuals, who may not have bank accounts and therefore cannot easily pay tolls electronically, could be given the option to pay cash into toll accounts at retail locations. Another option would be to provide discounts to low-income drivers on the purchase price of transponders used to pay tolls electronically.[19]

In conclusion, variable congestion tolls are a useful way to address the problem of highway congestion in the United States. While this policy enhances the efficiency of highway use, its equity effect can sometimes be regressive. However, an array of policies could help reduce the burden of the tolls on low-income families. Commuters in the United States are therefore likely to benefit from congestion tolling.

NOTES

1. INRIX, *INRIX Global Traffic Scorecard*, accessed October 10, 2017, http://inrix.com/scorecard/.

2. Robert Krol, "Tolling the Freeway: Congestion Pricing and the Economics of Managing Traffic" (Mercatus Research, Mercatus Center at George Mason University, Arlington, VA, May 2016).

3. Robert S. Kirk, "Tolling of Interstate Highways: Issues in Brief" (report, Congressional Research Service, Washington, DC, 2013). Kirk discusses the federal regulations that determine the use of tolls on

funded highways. Since 1992, tolling has been allowed on all non-interstate highways that receive federal aid. For interstate highways, new highways and extensions can be tolled. The addition of high occupancy toll lanes can also be tolled so long as it does not reduce the number of toll-free lanes.

4. Krol, "Tolling the Freeway."
5. Kenneth A. Small, "Using Revenues from Congestion Pricing," *Transportation* 19, no. 4 (1992): 359–81.
6. Krol, "Tolling the Freeway." Allowing HOV lanes to be converted into HOT was part of a "Value Pricing Pilot Program" that began in 1998.
7. Elena Safirova et al., "Welfare and Distribution Effects of Road Pricing Schemes for Metropolitan Washington, DC," *Research in Transportation Economics* 9 (2004): 179–206.
8. Edward C. Sullivan, "HOT Lanes in Southern California," in *Street Smart: Competition, Entrepreneurship, and the Future of Roads*, ed. Gabriel Roth (Piscataway, NJ: Transaction Publishers and Independent Institute, 2006), 189–224.
9. Krol, "Tolling the Freeway"; James A. Poterba, "Is the Gasoline Tax Regressive?," *Tax Policy and the Economy* 5 (1991): 145–64; Howard Chernick and Andrew Reschovsky, "Who Pays the Gasoline Tax?," *National Tax Journal* 50, no. 2 (1997): 233–59.
10. John P. Formby, Hoseong Kim, and Keith D. Malone, "How Regressive Are State and Local Taxes?," *Journal of Business, Economics, and Finance* 2, no. 1 (2013): 90–106.
11. Georgina Santos and Laurent Rojey, "Distribution Impacts of Road Pricing: The Truth behind the Myth," *Transportation* 31 (2004): 21–42.
12. Jonas Eliasson and Lars-Göran Mattsson, "Equity Effects of Congestion Pricing Quantitative Methodology and a Case Study for Stockholm," *Transportation Research Part A* 40, no. 7 (2006): 602–20.
13. Anders Karlström and Jole P. Franklin, "Behavioral Adjustment and Equity Effects of Congestion Pricing: Analysis of Morning Commutes during the Stockholm Trail," *Transportation Research Part A* 40, no. 7 (2006): 602–20.
14. Transportation Research Board, *Equity of Evolving Transportation Finance Mechanisms*, 2011. The geographic distribution of residences, employment, and shopping locations, along with the demographic makeup of a community, will also influence equity.
15. Gilles Duranton and Matthew Turner, "The Fundamental Law of Road Congestion: Evidence from U.S. Cities," *American Economic Review* 101, no. 6 (2011): 2616–52.
16. The administrative costs would be higher than current financing methods. See Krol, "Tolling the Freeway."
17. Liisa Ecola and Thomas Light, "Equity and Congestion Pricing: A Review of the Evidence (technical report, Rand Corporation, Santa Monica, CA, 2009).
18. Krol, "Tolling the Freeway."
19. US Department of Transportation, Federal Highway Administration, *Income-Based Equity Impacts of Congestion Pricing: A Primer*, 2008.

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Robert Krol is a professor of economics at California State University, Northridge, and a Senior Affiliated Scholar at the Mercatus Center at George Mason University. He received his PhD in economics from Southern Illinois University, Carbondale, in 1982. His recent research has focused on transportation infrastructure issues, the forecasting bias of government agencies, and the impact of economic policy uncertainty on the economy.