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The effect of gasoline prices on ridesharing

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ABSTRACT

Mitigating the effects of traffic congestion has typically been approached from either an engineering perspective or an economic perspective. One mechanism with the potential to alleviate traffic congestion which requires further empirical research is ridesharing. Using national microdata on ridesharing from different regions of the United States and a novel multilevel methodology, the study explores how these two different approaches might best be balanced to promote ridesharing in the future. Results suggest that macroeconomic conditions in the form of historically high gasoline prices are conducive to ridesharing, but that most of the variation in ridesharing nationwide is attributable to differences in the economic, demographic, and social characteristics of commuters. Results also suggest that working women will be unduly disadvantaged by employer-based policies to promote ridesharing given the greater propensity to drive alone among (family and nonfamily) female householders. Further empirical research is necessary to more fully explore the intended and unintended consequences of other economically-oriented policy tools to promote ridesharing relative to other mode choices.

1. Introduction

Traffic congestion is ubiquitous in the United States and it is costly both monetarily and time wise. Nationwide, congestion cost private-vehicle commuters $818 (in 2011 dollars) and 38 h of delay in 2011 (Schrank et al., 2012). These numbers are down from their peaks in 2005 because of the ensuing economic recession, but they are nonetheless much higher than they have been since about 1980. Projections suggest that congestion will cost private-vehicle commuters $1010 (in 2011 dollars) and 45 h of delay in 2020. If these projections come to fruition congestion will continue to have repercussions for the economy as well as the environment given the greenhouse gas (GHG) emissions that are attributable to traffic delays.

The costs of congestion are well-known; however, what to do about it is not. Policy prescriptions to mitigate congestion range from engineering-oriented approaches to those that are more economically-oriented (Glaeser, 2012). Engineering-oriented approaches, on the one hand, focus on physical or technical solutions to congestion such as adding more freeway and arterial capacity or driverless vehicles. Economically-oriented approaches, on the other hand, focus on incentivizing behavior which will alleviate congestion through regulation, taxation, or subsidies. Congestion pricing is one of many examples of an economically-oriented approach to mitigate congestion (DeCorla-Souza, 2008). On balance, economically-oriented approaches to mitigate congestion hold more promise given empirical evidence suggests additions to the supply of freeways and arterials actually induce greater demand (Goodwin, 1996; Noland and Lem, 2002) and, therefore, exacerbate congestion.

One economically-oriented approach with the potential to mitigate congestion is ridesharing. However, many in the academic literature on ridesharing comment on the failure of economically-oriented approaches to fulfill their promise to increase ridesharing (Tavernise and Gebeloff, 2011). For example, Chan and Shaheen (2012) observe that "…there are numerous behavioral barriers to increased ridesharing use" (p. 96). In addition, the effects of the different ridesharing schemes on traffic congestion, GHG emissions, and public transit ridership are contradictory in the literature. The study is an attempt to address another void in the literature. Specifically, the study answers a call by Ferguson (1997) to use national data on individual ridesharing to sort out some of the contradictory results on the effects of engineering-oriented versus economically-oriented approaches on the likelihood of ridesharing. Engineering-oriented effects include the supply of state/sate equivalent area-level High-Occupancy Vehicle (HOV) facilities and economically-oriented effects include gasoline prices and state/state equivalent area-level gasoline taxes; the latter being a tax policy to affect the price of gasoline and, perhaps, the likelihood of ridesharing.

The organization of the study is as follows. The next section reviews the literature on ridesharing. It also discusses the

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contribution the study intends to make to that literature. The ridesharing in the United States section reviews the empirical literature on the topic from the United States perspective. The methodology and data section presents the multilevel methodology as well as the individual-level and state/state equivalent area-level data. The results and summary sections, respectively, present and interpret the results from the multilevel models in the study. The conclusions section presents the key contributions to the ridesharing literature and the policy implications for promoting ridesharing. Informed by the results, the conclusions section also suggests future research that offers the most promise.

2. Literature on ridesharing

Ridesharing is a not-for-profit mode of travel for drivers and for passengers whose origins and destinations are similar (Chan and Shaheen, 2012). It includes carpooling and vanpooling, but it excludes jitneys and taxis. Chan and Shaheen (2012) classify ridesharing into three schemes: (1) acquaintance-based; (2) organization-based; and (3) *ad hoc*. Acquaintance-based ridesharing is made up of family and friends and is also known as fampooling. Organization-based ridesharing requires formal or informal membership by participants. *Ad hoc* ridesharing is also known as casual ridesharing or slugging and is self-organized by participants who are not related or members of any organization.

Ridesharing first became topical during World War II with the formation of car-sharing clubs to help conserve oil and rubber in support of the war effort (Fig. 1). It became relevant again in the aftermath of the Organization of Arab Petroleum Exporting Countries (OAPEC) oil embargo from October of 1973 to March of 1974 to help decrease gasoline consumption in the United States. Since then, ridesharing has decreased in popularity mostly due to the increase in the numbers of private vehicles per household (Ferguson, 1997) and the decrease in real gasoline prices (Chan and Shaheen, 2012). However, approximately 10.2% of workers sixteen years and over rideshared to work between 2007 and 2011 in the United States (US Bureau of the Census, 2013). To underscore the importance of ridesharing, half of that percentage, approximately 5.0%, of workers sixteen years and over used public transportation as a means of transportation to work over the same time period.

Fig. 1. World War II campaign to promote ridesharing. *Source*: US National Archives and Records Administration.

The traffic congestion-reducing benefits of ridesharing for the United States are obvious given that it decreases the number of vehicles making the commute. This decreases demand for workplace parking; which is indirectly subsidized by commuters (Pratsch, 1986). Ridesharing also reduces GHG emissions. Fabricatore (2001) found that the approximately 1450 vanpools in Puget Sound in the State of Washington in 1999 were responsible for annual reductions in Vehicle Miles Traveled (VMT) (−2700000) and in GHG emissions (−63475). The benefits of ridesharing for individuals and households are also important to note. Participants enjoy monetary cost savings related to the cost of owning and operating a vehicle. They also enjoy travel time savings because they can use HOV facilities on the trip to work which would otherwise be inaccessible if they drove alone. Finally, ridesharing often provides participants with access to preferential parking and other financial inducements (Concas et al., 2005).

2.1. Future trends

Indeed, there are several trends which might bode well for the future of ridesharing in the United States. First, historically high real gasoline prices make ridesharing more likely given their effect on household expenditures for transportation. Second, the popularity of slugging, or casual ridesharing, in metropolitan areas like: Washington, DC (LeBlanc, 1999); San Francisco, CA; and Houston, TX (Burris et al., 2012). Third, and finally, the potential of ride-matching software, social networking, and real-time ridesharing services to facilitate informal ridesharing, already common among people who all do not have vehicles available at home, also bodes well for the future of ridesharing.

2.1.1. Rising real gasoline prices

Ferguson (1997) suggests that the decline in ridesharing since the 1980s may be attributable to lower gasoline prices. Indeed, he found that reductions in marginal gasoline prices account for 34% of the overall decrease in ridesharing between 1970 and 1990 and rank second only to auto availability in that regard. Further, DeLoach and Tiemann (2012) estimate the carpooling elasticity with respect to gasoline prices between 2003 and 2009 was +0.50; lower, but comparable to the long-run carpooling elasticity estimate of +0.71 by Ferguson (1997). Therefore, the empirical evidence in the ridesharing literature seems to suggest that higher gasoline prices encourage ridesharing. Fig. 2 shows that real gasoline prices are lower in 2013 ($3.56) and in 2014 ($3.36), down from the historical high in 2012 ($3.74). However, because real gasoline prices are comparable to the past historical high in 1981 ($3.59), the present economic conditions seem conducive to ridesharing.

2.1.2. Casual ridesharing

One of the psychological barriers to ridesharing is the need on the part of commuters for privacy (Bonsall et al., 1984; Basmajian, 2010). Indeed, there is empirical evidence that suggests that commuting is desirable for some (Ory et al., 2004). Another psychological barrier is an aversion to social situations. However, this barrier is not problematic in casual ridesharing, also known