Transportation Research Part A 54 (2013) 127–140

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

The causal effect of commute time on labor supply: Evidence from a natural experiment involving substitute teachers

Seth Gershenson *

Public Administration & Policy, School of Public Affairs, American University, 4400 Massachusetts Avenue, NW, Washington, DC 20016-8070, United States

ARTICLE INFO

Article history:
Received 4 September 2012
Received in revised form 21 February 2013
Accepted 18 July 2013

Keywords:
Commuting
Commuting costs
Commuting preferences
Labor supply
Gender

ABSTRACT

The effect of commute time on labor supply is estimated in a unique labor market in which workers are subject to daily exogenous variation in commute time and are free to make daily labor supply decisions: substitute teaching. Data on both accepted and rejected job offers received by substitute teachers are used to estimate a sequential binary-choice model of job-offer acceptance decisions. The elasticity of the offer–acceptance probability with respect to commute time is found to be about −0.4. The aversion to commuting is about 36% larger on extremely cold mornings, but precipitation has essentially zero impact on commuting preferences. The effect of fuel price is of the expected sign, but imprecisely estimated. Women are particularly averse to commuting on cold mornings and are more sensitive to variation in fuel prices than men, but no statistically significant difference in the overall aversion to commuting is found between men and women.

1. Introduction

The cost of commuting is a fundamental parameter in urban-economic spatial models of firm and household location (Muth, 1969) and is central to cost-benefit analyses of transportation–infrastructure investments, as such projects spur economic development by decreasing commute times from suburban and rural areas to jobs in neighboring cities (Calthrop et al., 2010). The effect of commuting on labor supply enters firms' hiring decisions as well by shaping the optimal "spatial search radius" over which to recruit (Russo et al., 1996). Finally, both explicit and implicit commuting costs are fixed costs of working that may influence labor-force participation (Cogan, 1981). Black et al. (2010), for example, find significantly less labor-force participation among married women in cities with longer average commutes. However, identifying commuting's effect on labor supply is complicated by a fundamental endogeneity problem: commute times are jointly determined by individuals' job and residence choices (e.g., Kim, 2008; Pinjari et al., 2009).[1]

The causal effect of commute time on daily labor supply is estimated in a unique labor market in which workers are subject to daily exogenous variation in commute time and are free to make daily labor-supply decisions.[2] To motivate this approach, consider how the causal effect of commuting on daily labor supply would be identified experimentally. Holding each individual's residential location and transportation mode fixed, on a daily basis, individuals would be asked to choose between accepting a job at a randomly-determined location and not working. If all jobs are identical aside from location, it is straightforward to use the observed decisions to estimate the marginal effect of commute time on daily labor supply.

* Tel.: +1 (202) 885 2687; fax: +1 (202) 885 2347.
E-mail address: gershens@american.edu

[1] Two-worker households further increase the problem's complexity (Plaut, 2006).

[2] This approach is similar in spirit to the literature on intertemporal labor supply that examines cab-driver and stadium-vendor labor markets (Camerer et al., 1997; Oettinger, 1999).

0965-8564/$ - see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.tra.2013.07.010

One particular substitute-teacher labor market, previously analyzed in the context of education policy and substitute preferences for school and student type by Gershenson (2012), is similar to this hypothetical ideal experiment: each day, a consortium of Michigan school districts makes hundreds of take-it-or-leave-it job offers to substitutes via a conditionally-random automated calling system.[3] The exogenous variation in offered commute times generated by the call system's randomness solves the usual endogeneity problem of commutes being correlated with individuals' unobserved tastes. Unlike in the ideal experiment, however, all jobs and schools (locations) are not identical. These confounding factors are "partialed out" by controlling for job-offer characteristics and school fixed effects in the empirical analysis.

The empirics use data on accepted and rejected job offers to estimate binary-choice models of substitutes' offer–acceptance decisions that are motivated by a job-search model of expected-utility maximization. The baseline econometric model is similar to that in Gershenson (2012) and rigorously investigates the effect of commute time on labor-supply decisions, gender-specific commuting preferences, and daily shifters of commuting costs. The estimated elasticity of the offer–acceptance probability with respect to commute time is about −0.4.

Even though substitute teachers' preferences do not obviously generalize to those of the overall U.S. workforce, the current paper highlights the type of data necessary to identify the causal effect of commute time on labor-supply decisions, gender-specific commuting preferences, and the daily determinants of commuting costs (e.g., fuel prices, inclement weather). Furthermore, there are at least two reasons why substitute teachers' commuting preferences are interesting in their own right. First, substitutes are members of a small, but quickly growing and increasingly important, segment of the U.S. labor force: contingent (temporary) labor. From a base of less than 1% of the U.S. workforce in the 1970s, contingent employment has grown at an annual rate greater than 10% over the past 35 years (Peck and Theodore, 2007; Blank, 1998; Segal and Sullivan, 1997). Contingent labor is used by employers in a variety of industries and its growth is expected to continue.[4]

Second, substitute teachers are potentially important inputs in the education production function (Gershenson, 2012) and may provide insights into the commuting preferences of regular teachers. Specifically, commuting preferences may contribute to the difficulties recruiting and retaining regular teachers encountered by schools serving low-income populations, as Boyd et al. (2005) and Reininger (2012) find that regular teachers prefer to live and teach in the relatively wealthy neighborhoods in which they themselves attended school.

2. Literature review

There are both explicit and implicit private costs of commuting (White, 1977). There are two types of explicit commuting costs. The first is monetary: the average automobile costs $0.42 to $0.66 per travel mile, about $0.10 of which is for fuel (AAA, 2009). The second includes potential physical- and mental-health costs (Koslowsky et al., 1995). The primary implicit cost is forgone time: the average one-way commute in the US in 2007 was about 24 min.[5]

Three recent studies directly investigate the effect of commuting on labor supply. Using panel-data methods, Gutiérrez-i-Puigarnau and Van Ommeren (2010) find that long-commute German workers work fewer but longer days per week than those with shorter commutes, but no difference in weekly hours worked. Similarly, applying an instrumental-variables procedure to Spanish time-use data, Gimnez-Nadal and Molina (2011) find that an extra hour of commute time is associated with a 35 min increase in the length of the workday.[6] Both studies maintain strong identification assumptions, however, and are subject to the criticism that workers' abilities to adjust labor supply may be constrained by employers (e.g., Dickens and Lundberg, 1993). Van Ommeren and Gutiérrez-i-Puigarnau (2011) avoid the latter complication somewhat by examining the effect of commute time on German workers' absences. The authors estimate the elasticity of absences (with respect to commute time) to be between 0.07 and 0.09.

Alternatively, early empirical analyses of commuting used discrete-choice models of commuters' transportation-mode choices to estimate the willingness to pay per hour of commute time (WTP) and typically find a WTP of about 50% of the hourly wage (Small and Verhoef, 2007, p. 52). A well-documented problem with this method, however, is the implicit assumption that time spent travelling in one mode (e.g., a car) is equivalent to that in another (e.g., a bus).

Stated-preference survey data, in which respondents rank or choose from a hypothetical set of commute-wage bundles, has been proposed as a solution to the "comparability" problem inherent in the mode-choice literature. Calfee et al. (2001) and Calfee and Winston (1998) evaluate stated-preference data using various econometric methods and find significantly lower WTP closer to 20% of the hourly wage. More recently, De Borger and Fosgerau (2008) investigate the role of reference-dependent preferences and loss aversion in creating a gap between WTP and willingness to accept (WTA) estimates. The authors find that estimates range from 10% (WTP) to 40% (WTA) of the hourly wage, and that the reference-free valuation of an hour of travel time is between 15% and 20% of the hourly wage. However, the validity of estimates based on stated-preference data is questionable, as a "hypothetical bias" is often present in answers to subjective and hypothetical questions (Harrison, 2006; Hensher, 2010).

[3] District-level details are not provided to preserve the districts' anonymity.

[4] Erickcek and Houseman (1997) report that 78% of U.S. firms employ contingent labor and 27% employ on-call workers.

[5] Based on author's calculations using the 2007 American Community Survey (ACS).

[6] Schwanen and Dijst (2002) find a similar positive correlation between commute length and hours worked in the Netherlands and discuss the theory behind the relationship between commute time and daily hours worked.