



Home-based telecommuting and intra-household interactions in work and non-work travel: A seemingly unrelated censored regression approach



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ABSTRACT

Although telecommuting has become a popular option as a new mode of working, no theoretical or empirical consensus has been reached on its potential for substituting or generating travel. This study aims to evaluate the impact of a household head's telecommuting on household travel while controlling for the interdependence within a household and across travel purposes, by applying seemingly unrelated censored regression models to data from the 2006 Household Travel Survey in the Seoul Metropolitan Area. In terms of vehicle kilometers traveled, the analysis shows that telecommuters' non-commute and non-work trips as well as his/her household members' non-work trips are greater than those of non-telecommuters and their household members', whereas telecommuting partially reduces commuting trips. However, an analysis stratified by household type reveals that the difference for household members is significant only in households with less than one vehicle per employed member: in such households (with insufficient vehicles available), the vehicle otherwise used for mandatory travel, such as for the household head's commute, can be used for non-commute purposes or by other household members if the household head does not use it for commuting. This implies that, when vehicle travel budgets of a given household are limited, this compensatory travel mechanism can make optimum use of limited resources (i.e., vehicles), but offsets the travel-substituting effect of telecommuting. Accordingly, to more precisely estimate the impact of telecommuting-promotion policies and apply them as part of travel demand management strategies, their counteracting effects among household members should be considered.

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1. Introduction

Discussions regarding the potential effects of telecommuting on travel demand began with futurists' optimistic views on information and communications technology (ICT) (Nilles et al., 1976; Mokhtarian, 1991). Their projections seemed to imply that city life would be completely changed, representing a radical departure from the past (Graham, 1997). They suggested

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that people could work in 'electronic cottages' (Toffler, 1980) and commute on the 'information highway' (Gates et al., 1995; Mitchell, 1995) instead of being stuck in cars, breathing exhaust on congested highways.

Due to such expectations, telecommuting has been promoted in the public policy arena as a desirable solution for urban travel-related problems such as traffic congestion, excessive energy consumption, and air pollution (Salomon, 1986; Nilles, 1988; Greene et al., 1994; Mokhtarian et al., 1995; Dissanayake and Morikawa, 2008). In the late 1980s, the U.S. government endorsed telecommuting as a strategy for reducing travel, based on the federal Clean Air Act (Handy and Mokhtarian, 1995). This strategy, introduced with a well-known pilot project in California, has now been widely adopted in almost every state. The federal government also passed H.R. 1722, the Telework Enhancement Act of 2010, in order to establish a legal support system for enhancing telecommuting (Lari, 2012).

Telecommuting is not an exclusive feature of the U.S. but rather an international phenomenon reflecting employees' desire to achieve a better work-life balance and live in more sustainable environments away from the ills of overcrowded cities. It has been promoted not only in European countries such as the Netherlands (Hamer et al., 1991) and the United Kingdom (Hopkinson and James, 2003) but also in Australia (Alizadeh, 2013), Japan (Mokhtarian and Sato, 1994), and South Korea (Kim et al., 2012). South Korea, in particular, is a highly suitable country for promoting telecommuting: policy motivations may be stronger in South Korea because of its highly developed ICT and dense urban context, which increases commuters' daily commute costs, stress levels, and exposure to air pollution. Accordingly, the South Korean government instituted the Smart Work Vitalization Strategy, aiming to convert 45% of office workers to telecommuters by 2020 (Korea Ministry of Public Administration and Security, 2010).

These policies may result in diverse social, economic, and environmental outcomes. Because telecommuting is a favored strategy for meeting travel-related policy goals, such as reducing congestion, fossil fuel consumption, air pollution and greenhouse gas emissions, planners and policymakers focus mainly on whether or not telecommuting can, as some optimists predict, reduce travel. Answering this question is key to evaluating its effectiveness and necessity not only as a travel demand management (TDM) strategy but also as an environmental management policy. Despite intensive pursuit of these policies, empirical evidence on the issue remains inconclusive.

Earlier empirical studies suggested that telecommuting may substitute for the commutes and even non-work trips of telecommuters as well as household members (HMs), although some of those effects are counteracted by newly generated trips (Pendyala et al., 1991; Koenig et al., 1996; Mokhtarian et al., 2004). However, in terms of methodology, these studies mainly adopted a quasi-experimental approach using panel data from a few pilot projects with small sample sizes and limited study areas, thus limiting the generalizability of their findings (Mokhtarian, 1998; Helling and Mokhtarian, 2001; Zhu, 2012). Accordingly, subsequent studies such as Zhu (2012) used large-scale travel survey data and argued that telecommuting and travel are complementary rather than substitutionary, in contrast to the findings of earlier research. However, these studies have limitations of their own, notably that a selection and/or simultaneity bias may not have been addressed. Specifically, if telecommuters already (i.e., before adopting telecommuting) travel considerably more than non-telecommuters, for unobserved reasons (such as having particular types of occupations, or attitudes such as risk-taking), then their higher travel may have prompted their telecommuting adoption rather than telecommuting generating more travel.

In addition, however, all studies conducted to date have two main limitations. First, they do not sufficiently consider HMs' travel behavior. As a result, little is known about intra-household interactions between telecommuters and other HMs and their work and non-work travel. Second, in terms of methodology, their empirical models do not consider the statistical interdependence between travel types, and they have also failed to take into account the censored distribution of travel-related dependent variables.

Against this backdrop, this study aims to examine the impact of a household head's telecommuting (HHHT) not only on his/her own commute/work and non-work trips but also on other HMs' work and non-work trips in terms of person kilometers traveled (PKT) and vehicle kilometers traveled (VKT), while considering interdependence within a household and across travel purposes. To do this, we apply a seemingly unrelated censored regression (SUCR) approach using data from the 2006 Household Travel Survey (HTS) in the Seoul Metropolitan Area (SMA). Through the analysis, this study provides new empirical evidence and a novel perspective to the current body of literature on whether telecommuting and travel complement or substitute for one another. In particular, the analysis offers additional evidence regarding the impacts of telecommuting (i.e., complementarity or substitution) on all kinds of trips in a household: those both of telecommuters and of non-telecommuters.

2. Literature review

It has been a relatively uncontroversial opinion in telecommuting research that telecommuting replaces commute travel, whether partially or substantially. However, conflicting opinions (and evidence) remain regarding the impact of telecommuting on the telecommuter's non-commute travel and other HMs' travel.

Some studies argued that telecommuting, once adopted, has a substitutionary effect on these trips through spatial, sequential, and temporal changes in travel behaviors. First, they suggested (with supporting evidence) that telecommuters' activity realms may shrink and become more centered around the home instead of the workplace. Telecommuters may thus discover new destinations for daily activities closer to home, thereby reducing non-work travel (Mokhtarian, 1991; Pendyala

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