Policy Brief on the Impacts of Telecommuting Based on a Review of the Empirical Literature

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Policy Description

Telecommuting is the practice of working from home by employees who have a regular work place. This arrangement usually depends on electronic communications of some form, such as telephones, e-mail, or video-conferencing. Alternatively, employees may work out of a "telecommuting center", also called a "telecenter", that is located close to home and provides desk space, Internet access, and other basic support services.

Telecommuting was first put forward in the 1960s as a strategy for reducing vehicle travel and congestion, and thus saving energy and improving air quality (NAE, 1969; Nilles, et al.,1976). Although telecommuting programs are generally adopted by employers as a part of an organization's trip reduction program, policies to encourage adoption of such programs are in place at the local, regional, state, and federal levels.

Impacts of Telecommuting

Early forecasts of telecommuting and its impacts on travel, and therefore greenhouse gas (GHG) emissions, have proven overly optimistic (Tal, 2008). The total impacts of telecommuting depend on the number of workers telecommuting, the number of days each telecommutes, and the impact per telecommuting day. Fewer people are telecommuting and they are doing it less frequently than early studies predicted. However, a solid body of evidence shows that the reduction in travel for a telecommuter on a telecommuting day is substantial.

Effect Size

Most studies measure the reduction in vehicle-miles traveled (VMT) for a telecommuter on a telecommuting day, usually as a percent reduction in total VMT (Table 1). Studies have examined impacts for both telecommuters who work at home and those that work at a telecenter. Studies vary in their use of commute VMT, personal VMT, and household VMT as the total VMT from which the percentage reduction is calculated.

The reductions appear to be substantial. In theory, the reduction in commute VMT for home-based telecommuters on a telecommuting day should be 100 percent, but Henderson and Mokhtarian (1996) found a reduction of 90.3 percent, owing to some trips to work on days that workers spent mostly working at home. Reductions in commute VMT for center-based telecommuters are lower, ranging from 62.0 percent to 77.2 percent, because of the travel to the center. The percentage reductions in personal daily VMT, including commute and non-commute VMT, are smaller than the

percentage reductions for commute VMT only for both types of commuters. The reductions for personal daily VMT range from 53.4 percent to 76.5 percent on telecommuting days. Studies are mixed as to whether non-commute VMT decreases or increases on average for telecommuters (Mokhtarian 1998). As a share of household VMT, the reduction attributable to telecommuting is 48.1 percent, according to one study (Kitamura, et al., 1991).

Table 1: Telecommuting and VMT: Results from Studies of Individual Travel

Study	Study Location	Study Year(s)	Results		
			Telecommuting Variable	*VMT Variable*	*VMT Reduction per Telecommuter per Telecommuting Day*
Kitamura, et al. (1991)	California	1988-1989	Telecommuting day – home-based	Personal daily VMT	-76.6%
				Household daily VMT	-48.1%
Henderson and Mokhtarian (1996)	Puget Sound, WA	1990-1991	Telecommuting day – home-based	Commute VMT	-90.3%
				Personal daily VMT	-66.5%
			Telecommuting day – center-based	Commute VMT	-62.0%
				Personal daily VMT	-53.7%
Balepur, et al. (1996)	California	1995	Telecommuting day - center-based	Commute VMT	-77.2%
				Personal daily VMT	-64.8%

As noted, the total effect for the region also depends on how many people are telecommuting and how often they telecommute. This is where the effect size shrinks considerably. Studies show that telecommuters average from 1.2 to 2.5 days telecommuting per week. Balepur, et al.(1996) factored in the frequency of telecommuting and estimated a reduction in personal daily VMT of 17 percent for an average weekday (including both telecommuting and non-telecommuting days). Given an estimate of 1.5 percent of the workforce in a region in California telecommuting on any particular day, Mohktarian (1998) approximated a net reduction for telecommuting of 1.1 percent of household vehicle travel in the region as a whole. Shares of workers telecommuting and their frequency of telecommuting might be higher today, given advances in computer and telecommunications technologies since these studies, but

each region should rely on the most recent data available (e.g. from the latest regional travel survey or American Community Survey) in estimating regional telecommuting effects.

Evidence Quality

All three studies in Table 1 provide solid evidence of the effect of telecommuting, because they examine changes in VMT from before to after workers begin telecommuting, measure VMT for comparison groups of non-telecommuters, and collect data on all travel, not just the commute. Using these results to predict changes in VMT for new telecommuting policies raises concern owing to small sample sizes, the likelihood that the study participants are not representative of the larger pool of potential telecommuters, and the timing of the studies, occurring in the 1990s prior to wide-spread use of the Internet and smart phones. With respect to geography, the studies are strong: two of the studies were conducted in California and the other was on the West Coast. The studies do not account for other employer policies, such as parking fees or transit subsidies, that might increase or decrease the effect of telecommuting (Kuzmyak, et al. 2010). Newer studies, however, do not use before-and-after measurements, control groups, or travel diary surveys and are thus not recommended for use in estimating effect sizes (e.g. Nelson, et al. 2007). Although technological improvements in the intervening years are likely to have influenced the share of workers telecommuting and their frequency of telecommuting, we do not expect them to have influenced the effect per telecommuting day.

Caveats

The telecommuters in these studies may differ from other workers in important ways. They are “early adopters” of telecommuting, with potentially stronger motivations to work at home than their colleagues. These motivations may be tied to other characteristics that influence their reductions in VMT. For example, in all three of these studies, telecommuters live farther from work than non-telecommuters. In addition, it is possible that the opportunity to telecommute induces workers to move farther away from work, thus off-setting some of the VMT reduction on telecommuting days with longer commutes on non-telecommuting days. Similarly, the time saved not commuting on telecommuting days can be used for travel for other purposes. Some telecommuting may replace transit trips or carpooling, rather than driving alone. While the net effect of telecommuting in the short run still appears to be a significant reduction in VMT, the long-term effects are more uncertain.

Note that these studies were all conducted for employment sites within metropolitan areas. It is likely that the effect size for rural areas is different, depending on commute distances and on non-work travel in those areas. In addition, these studies do not address situations in which telecommuting enables workers to move their residence from metropolitan areas to rural areas. No studies are available that examine the impact of telecommuting on VMT in rural areas.

As noted, the total effect of telecommuting in a region depends on the reduction in VMT per telecommuting day, the number of days of telecommuting per worker, and the number of workers telecommuting in the region. Accurately forecasting these numbers is difficult.

Greenhouse Gas Emissions

No studies provide direct evidence of the impact of telecommuting on GHG emissions, though several studies estimate the effect on energy use. For example, the Federal Highway Administration (2008), using data from the 2001 NHTS, estimates a savings of 1.72 gallons for each telecommuting day, assuming an average roundtrip commute distance of 34.8 miles and an average fuel economy of 20.3 miles per gallon (mpg).

Translating VMT reductions into estimates of GHG emissions reductions depends on the nature of the VMT eliminated (e.g. speeds, acceleration, deceleration, times vehicle is started) and the types of vehicles owned by residents who telecommute. Apart from those particular considerations, one would generally expect GHG reduction to be similar to VMT reduction, if vehicle fleet composition and driving patterns are unchanged. While the pattern of such changes in response to telecommuting has not been documented, it is reasonable to expect that policies that reduce VMT will also lead to reductions in GHG emissions.

Telecommuting may also affect GHG emissions through changes in office and household energy use. Researchers at UC Berkeley have developed a Telework Impact Estimation Tool to estimate the net effects of telecommuting on energy use and air pollutant emissions (http://cgdm.berkeley.edu/telework/).

Co-benefits

Telecommuting offers many potential co-benefits for workers, employers, and the community. For workers, telecommuting helps to reduce personal transportation costs, save time, reduce stress, and increase flexibility. These benefits to the worker create benefits for the employer in the form of increased employee morale and productivity. Telecommuting represents a relatively low-cost benefit that employers can offer to their workers. Employers may be able to save money by reducing work space and energy costs, if a sufficient share of workers telecommute. For the community, telecommuting has the benefit of reducing traffic and vehicle-related air pollution, and enabling greater participation in the workforce, particularly for workers with mobility limitations.

Examples

As noted, telecommuting programs are generally adopted by employers as a part of a trip reduction program. Policies to encourage such programs, however, have been put in place at the local, regional, state, and federal levels as well. In 1999, Congress passed the National Air Quality and Telecommuting Act, which established pilot programs in five metropolitan regions as the basis for developing a market-based,

pollution-credit program to encourage telecommuting. State Departments of Transportation and Metropolitan Planning Organizations (MPOs) can use funding from the federal Congestion Mitigation and Air Quality program to support telecommuting programs. Telecommuting is an important component of the travel demand management programs of many MPOs, and several of these efforts have shown success in reducing air pollution, according to the Federal Highway Administration (http://www.fhwa.dot.gov/environment/cmaqpgs/telework/index.htm). The Houston-Galveston Area Council (H-GAC), for example, uses federal funding to offer grants to employers to begin or expand telecommuting programs as a part of the Commute Solutions program, a partnership of state, regional, and local agencies (http://www.commutesolutionshouston.org/commuters/telework.htm).

Suggested Further Reading

Balepur, K.V. Varma and P.L. Mokhtarian, (1998). Transportation impacts of center-based telecommuting: interim findings from the neighborhood telecenters project. *Transportation* 25: 287–306

Henderson, D.K. and Mokhtarian, P.L., (1996). Impacts of Center-Based Telecommuting on Travel and Emissions: Analysis of the Puget Sound Demonstration Project. *Transportation Research D* 1(1): 29-45.

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Acknowledgments

This document was produced through an interagency agreement with the California Air Resources Board with additional funding provided by the University of California Institute of Transportation Studies MultiCampus Research Program on Sustainable Transportation and the William and Flora Hewlett Foundation.