

Substitution between working at home and out-of-home: The role of ICT and commuting costs

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Abstract

This paper analyzes the trade-off between working at home and out-of-home, ICT and commuting time. To this end, we develop a microeconomic demand system, which explicitly incorporates both time and income constraints. Commuting time is considered as the price to be paid for working out-of-home and a decrease in earnings as the price for working at home. For the latter, we find that working at home leads to a (marginally significant) reduction of the wage rate of about 19%, but this gap largely disappears when ICT is used for at home work. To examine the relation between out-of-home and at home work empirically, we estimate a translog indirect utility function, from which we are able to estimate substitution and price elasticities between working at home and out-of-home for The Netherlands. The results show that changes in ICT and commuting time display rather weak substitution effects on working out-of-home and at home, respectively. Moreover, individual characteristics – especially age and education – seem to be more important for the choice between working at home and out-of-home than ICT availability or commuting time.

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1. Introduction

Since the mid 1970s, the phenomenon of teleworking has witnessed a great deal of attention in the literature (see for overviews, inter alia, Nilles, 1988; Salomon, 1986, 2000; Mokhtarian, 1990). Telework in itself is especially interesting, because since the industrial revolution individuals increasingly organized themselves in firms and institutions outside the location of the household (Mokyr, 1999). This initial shift in working location caused an increase in specialization and was mainly driven by the high fixed costs of complementary capital. Thereafter, with the general decline of the industrial sector and the rise of the service, government and non-commercial sector, clustering of workers outside the household became more and more beneficial due to the

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benefits of spillovers between workers themselves. However, with both the adoption of information and communication technology (ICT) and the increase in flexibility of the labor force, workers nowadays are less constrained to work continuously together on the same location. Because commuting costs – temporal, monetary, and even emotional – do not have to be incurred and because working life can be better combined with family life, teleworking seems to be an attractive alternative to working out-of-home.

However, although figures of teleworking are scarce and international comparisons difficult to make, the general impression is that the number of teleworkers is still relatively low. Most figures show that within Europe Finland, Sweden and The Netherlands are the countries with relatively the largest numbers of teleworkers.¹ Usually, these teleworking figures show large variations between studies, which are partly caused by the definitions used. In this study, we adopt the definition from the Dutch Ministry of Transport, Public Works and Water Management: A teleworker is an individual who works partly at home (or somewhere else than at work) and who uses for that purpose information and communication technology.² Note that this definition is fundamentally different than that of telecommuting, which we interpret as the actual substitution of the commuting trip (cf. Salomon, 2000). Estimates of teleworking for The Netherlands commonly range from 3.3% (CBS, 2001) to 6% (Steyaert and de Haan, 2001). However, actual percentages of people working at home will not exceed 3–4% of the labor force at any time (see, e.g., De Graaff and Rietveld, 2004). Therefore, combined with the large increase in the diffusion and its corresponding fast decrease in relative prices of ICT applications during the late 1990s, one would expect a large growth in teleworking. Nevertheless, from the datasets we use (SCP, 1996, 2001) we measure a 18% increase in the hours per week worked at home between 1995 and 2000, which is substantial but not dramatic. Thus, despite an increasing flexible labor force and an increasing availability of (cheaper) means to communicate, working at home still remains a marginal issue.

If a substantial part of the labor force starts teleworking, then profound consequences for living, travel and labor behavior are expected to take place in the long run (Toffler, 1980). In the short run, it is assumed that if individuals telework more they commute less, at least during peak hours. However, the empirical information available does yet not convincingly indicate such a relationship (see De Graaff, 2004). If anything, individuals usually tend to aggregate to travel more per day than less (see, e.g., Van Wee et al., 2002), however this may also be attributed to an increase in income, which seems positively related to traveling. To complicate matters further, income also appears to be positively related with ICT use and teleworking (Vilhelmson and Thulin, 2001). Thus, to relate ICT, travel, and the location of work temporal and monetary constraints need to be incorporated explicitly, to control both for income and for substitution effects between activities. Moreover, such a model of activity participation does not only need to look into the decision between working at home and out-of-home, but also between labor supply and non-labor supply (e.g., leisure) in general, if the preference for non-labor supply is correlated with the decision to work at home.

Traditional activity demand analysis (Damm and Lerman, 1981; Kitamura, 1984) often focuses solely on time constraints. In this paper, however, we choose to model activity demand – in our case labor supply and leisure time – in a microeconomically rigorous framework, by applying microeconomic theory in terms of rational (economic) behavior and utility maximization subject to constraints imposed by both monetary and time budget constraints (see for overviews dealing with both types of constraints, inter alia, Juster and Stafford, 1991; Kraan, 1996; Bhat and Koppelman, 1999). For our purpose, a more microeconomically oriented approach offers two salient advantages above other activity demand methodologies. First, income effects play a pivotal role in well rooted microeconomic labor supply models, a feature which is strongly supported by empirical research in both teleworking (Vilhelmson and Thulin, 2001; De Graaff and Rietveld, 2004) and especially in economic labor supply theory (Gronau, 1977; Deaton and Muellbauer, 1980). Second, the model specification is firmly rooted in an economics structural behavioral framework, which is lacking in a more traditional activity based approach (such as Golob and McNally, 1997; Kuppam and Pendyala, 2001; Zhang

¹ For example, according to an European study these figures were respectively, 17%, 15%, and 15% of the labor force for the year 2000. See <http://www.ecatt.com/> for more details. However, those studies usually only show that part of the labor force that occasionally works at home.

² In the empirical part of this paper we use the term at home work, because we do not have information whether workers actually use ICT when working at home. Instead, we look at the influence of ICT repeated availability on the at home labor supply.

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