Do rich households live farther away from their workplaces?

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Abstract
One of the classic predictions of urban economic theory is that high-income and low-income households choose different residential locations and therefore, conditional on workplace location, have different commuting patterns. According to theory, the effect of household income on commuting distance may be positive or negative. Empirical tests of this effect are not standard, due to reverse causation and lack of good control variables. To address reverse causation, estimates of household income on commuting distance are derived using changes in distance through residential moves keeping workplace location constant. Our preliminary results, based on administrative data, show that, for Denmark, the (long-run) income elasticity of distance is non-positive.1

Arguably, the centrepiece of urban economics is its elegant application of equilibrium analysis to land rent theory (Persky, 1990). Urban economic theory predicts that individuals

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1 In a previous version of this paper, we apply our methodology using household survey data for Germany. Due to limited size of the dataset, a lack of information about residence location, and a lower quality of the data about income, it is difficult to interpret these results. In addition, endogeneity issues are more difficult to address with these data.
with high incomes have different commuting patterns than those with low incomes. However, there has been a good deal of contention over the exact nature of this relationship. This paper aims to examine the long-run causal effect of income on the workers’ commute.

The basic urban economic literature argues, based on a monocentric city model (so, workplace is given), that households with higher incomes will have longer commuting distances (Alonso, 1964; Muth, 1969). Essential assumptions in this model are that employment is constrained in one location, monetary commuting costs depend on distance, and workers may freely choose the optimal residence location. Furthermore, it is assumed that house prices are endogenous and workers are homogeneous in all aspects except for income (Straszheim, 1987). Finally, the standard urban model is a static model which assumes away the presence of residential moving costs (one exception is Zenou, 2009), so it essentially deals with the long-run effect of income on residential location decisions. The resulting effect of income on the commuting distance is then the result of two underlying mechanisms: (i) a higher income leads to an increase in demand for housing and therefore for more residential space, and (ii) house prices (per unit of residential space) fall with distance from the employment centre. Consequently, in equilibrium, high-income households have a longer commute (e.g. Brueckner, 2000).

Although elegant, it appears that this intuitive result does not hold when some of the more restrictive assumptions are relaxed. For example, the unambiguous positive effect of income on commuting distance does not hold when commuting costs not only depend on monetary costs but also on commuting time. In time-extended urban economic models, which assume that the workers’ commuting costs include time costs that positively depend on income, the effect of income on commuting distance is ambiguous (e.g. Beckman, 1974; Hochman and Ofek, 1977; Henderson, 1977; Fujita, 1989, p. 31). The only empirical study of this effect that we are aware of finds that the income elasticities of residential space and (generalised) commuting costs are about equal (Wheaton, 1977). This implies that the overall effect of household income on commuting distance is close to zero and the observed spatial variation in household income should be explained by other factors than commuting, such as residential amenities (e.g. Brueckner et al., 1999).

Extending the standard model in other directions, for example allowing for more than one employment centre, generally complicates matters as the spatial distribution of wages,
and therefore household income, is endogenously determined in equilibrium (e.g. Fujita and Ogawa, 1982; White, 1988; Lucas and Rossi-Hansberg, 2002). In essence, however, the general idea that workers trade-off housing prices and commuting costs, and that the level of income determines housing demand and therefore the length of the commute remains in these models.

Despite the large theoretical debate on these issues, and the extensive discussion of this topic in urban economics textbooks (e.g. O'Sullivan, 2009), there are no accurate empirical estimates of the causal effect of income on the commute. Previous studies rely on cross-section estimates (e.g. White, 1977; Rouwendal and Rietveld, 1994), which makes a causal interpretation problematic. As far as we are aware, there are currently three studies which use panel data and estimate models with worker fixed effects (Benito and Oswald, 1999; Van Ommeren et al., 1999; Simonsohn, 2006). Although the use of fixed effects may reduce some of the endogeneity issues, these studies still have severe limitations. First, although panel studies deal with time-invariant unobserved worker characteristics, they do not deal with reverse causation, which may play a role as labour market theories indicate that the length of the commute might affect wages. For example, firms located at locations far from residences might compensate their workers with higher wages. Second, by including worker fixed effects and by using annual data, these studies identify short-run effects of household income, as most households do not move residence. When focusing on the effect of income, economic theory usually assumes away residential moving costs and therefore applies to effects in the long run. In the short run, due to the presence of residential moving costs, even when experiencing a large change in household income, few workers will immediately change commuting distance by moving residence. We focus on the long-run effect, so conditional on a residential move. We emphasise that the bulk of the current literature is not informative about the long-run causal effect of income on commuting.

In this paper, we will deal with the above issues by estimating reduced-form models. Hence, we cannot relate our findings directly to more fundamental properties of a structural urban economic model, such as Wheaton (1977). However, our study is the first one which deals with three fundamental difficulties -- unobserved heterogeneity of workers, the presence of residential moving costs and a reverse causational relationship of income and distance -- which have not been properly addressed in the literature. Using Danish register-
based panel data, our approach essentially analyses the effect of changes in household income on changes in commuting distance for workers who stay at the same workplace and who must move residence at least once during the period of observation (on average, about 4 years). In this way, we deal with time-invariant unobserved worker characteristics, reduce reverse causation, and identify long-term effects. We emphasise that our paper must not be interpreted as a test of the monocentric model, but as a test of its prediction that high-income households have different commuting patterns than those with low incomes.

For Denmark, we find a non-positive long-run income elasticity of distance. Our preliminary results imply that rich households tend to move closer to the workplace, in line with suggestions for European cities (Brueckner et al., 1999).

References


