Accessibility,work location, and migration in a regional model of transport and land use

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Context & Motivation

The chief benefits of new transport infrastructure often lie in increased accessibility for personal and goods movements. As transport infrastructure is improved, households and employers take into account increased accessibility when they decide whether, and to where, to change locations. The improvements are, in other words, capitalized into a variety of subsequent decisions, and these collectively affect how urban regions grow over time.

Standard transport models, on the other hand, are intended for partial analyses of changes in transport infrastructure and for changes in transport prices. This works as long as these changes do not induce important changes in adjacent markets such as the housing market and the labour market. Similarly, it is also possible that aggregate trends observed in the transport system, such as indications that car use has peaked in recent years, can be explained less by changed preferences, and more as an effect of urbanization.

Hence, in urban regions there exist patterns of substitution and complementarity among different types of mobility. Changes in transport cost may lead to different strategies, depending on how they affect the housing and labour markets, such that an increase in transport cost is compensated by lower housing prices, or that someone with the means can trade higher housing costs for shorter and cheaper trips. Pricesin the transport system may also affect the need for households to relocate or the possibility to find a new job in a given location. The combination of housing costs and transport costs will affect the utilization of transport infrastructure and the rate of change as a response to generalized costs in the transport system.

An example, say there is a tax deduction available for costs that you incur for the work commute. Changes to the rules for this tax deduction will obviously affect travel behavior, but in a longer perspective, it will also have an effect on where people and businesses locate. For analyses of future energy use it is crucial to capture the trade-offs involved.

We address these dynamics by first estimating models of household travel demand, location choice, migration, and job change. By linking job relocation dynamics with transport choices, we enable insights to be gained regarding the time horizon over which new opportunities will be utilized.

In the current (Swedish) modelling practice, responses to such changes take effect instantaneously. Using a policy analysis model that predicts propensity to change jobs will provide us with the means to represent this as a dynamic process.This applies both to the rate of job change and the rate of starting to work. Similarly, transport costs may affect household migration frequency, since costs are associated with travel to work. These effects are taken into account when discussing such policies as fuel taxes tominimize greenhouse gas emissions.

Methodology

Our approach is to develop an urban model system, known as *Regent*,thatrefinesseveral previous attempts to represent the land use and transport systems of the Mälaren Valley region of Sweden, where Stockholm is the dominating metropolitan area. The region is approximately 34,000 square kilometres in size and holds a population of approximately 3,2 million.

The models for travel behaviour are fully integrated in the Regent system. These are derived from an existing trip-based transport model including trip generation, mode choice and destination choice,

alljointly represented in a nested logit structure. However, in this case,population dynamics must play a bigger role, hence we have converted the model operations into an agent based simulation of individual persons, rather than applying it to population segments. This design allows us to retain consistency between component models, in the sense that agents persist over time and their choices are path dependent. As an example, destination choice is only applied to those in the population who choose to change their work arrangements during the year in question. Still, all agents are able to change their travel behaviours for other types of trips, reflecting a notion that these trips are more flexible in nature. Agents can also update their mode choices every year in response to changing traffic conditions.

From the transport model, agents acquire some variables that are subsequently used in the component models that govern long term decisions. Examples include accessibility and distance to work, which influence their decisions to move or change their work situation;by the same token, car ownership decisions are influenced by differences in the computed accessibility metrics between having a car versus not.

The model system is particularly unique in that the migration and workplace change models are estimated using data from the national registry of persons. We have estimated models for the probability of moving separately for those who work (for whom we can compute distances to work) and for those without a job. We have also estimated the probability that working individuals will change jobs or quit. Finally, we have estimated the probability that someone without work will start working. The explanatory variables in these models are predominately socio-economic in nature, such as age, sex, and income. We also include zone specific variables, such as municipality tax rate, and the share of single family dwellings.

Results

Our findings show that for employed people, distance to the current job has a significant positive effect on migration rates but accessibility did not turn out significant. The longer the distance to one's current job, the more likely it is for the individual to migrate. For unemployed people, accessibility has a significant negative effect on migration rates, i.e. if an unemployed person lives in an area where there is in general high accessibility to jobs it is less likely that he/she will migrate.

In the choice for employed people between to continue to work, change jobs, or quit working, we found significantly positive effects on accessibility for both changing job and quitting working. We interpret this to mean that high accessibility reflects the opportunities to job change, and that the risk associated with ceasing to work is lower in labour markets with high accessibility to work in general. We also found that both for changing and for quitting work, the probability increased with travel time by public transport to the current job.

In a model of choice for people not working to start work we found no significant effect of accessibility. This would seem to suggest that infrastructure investmentsare not particularly effective in increasing opportunities for the unemployed to enter the labour market.

Conclusions

Our research confirms the commonly understood role that accessibility plays on the long term dynamics of a region. In particular, we find that, although individual socio-economic characteristics dominate, local accessibility and labour market conditions influence agents\behavioursby changing their home or work situations. This leads to systematic differences among subareas within a region, and that is on top of the differences that are already understood to arise from different socio-economic composition of the population in different zones. Land use interaction models have traditionally included accessibility as a factor influencing location choice. Our estimates of migration and job change frequencies add to this by also giving accessibility and labour market conditions a role in the pace of change.