



# The city as a driver of new mobility patterns, cycling and gender equality: Travel behaviour trends in Stockholm 1985–2015



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## ABSTRACT

This paper analyses changes in individual travel behaviour in Stockholm County over 30 years, using three large cross-sectional travel survey data sets. It shows that travel patterns have diverged over time between city, suburban and rural residents. The trends in travel behaviour that we find are consistent with changes in the labour market, ICT use, land-use and transport policy, gender equality, and population composition trends. The inner city has become increasingly attractive: the share of trips to the inner city is increasing for all purposes, socio-economic groups, and residential locations. The reduction of car traffic in response to the introduction of the congestion charges in 2006 is more than compensated by an increase in bicycle and transit trips to the inner city. Travel times by car are increasing in the city, although the car traffic volumes have decreased. The travel behaviour gender gap has closed completely in the inner city, but not further out in the region or in the rest of the country. Understanding long term trends in travel behaviour in different population segments, and the context under which they occur, helps to understand how the conditions, opportunities and constraints for different population segments are changing, which is key for transport policy and land-use planning. Since the societal trends driving travel behaviour in Stockholm and Sweden are much the same in many cities and countries, the findings are of general relevance.

## 1. Introduction

This paper explores travel behaviour trends over a 30-year period in the county of Stockholm. We use three large cross-sectional travel surveys among Stockholm County residents, conducted in 1986, 2004 and 2015, with essentially the same questionnaire and survey method. We analyse how the trends in trip frequencies by purpose, mode, travel time and trip distance have evolved over time by income, gender and age group, and in central versus peripheral areas of the region. We relate the observed trends in travel behaviour to societal trends (gender equality, ICT, knowledge-based economy) and policy changes (congestion charges), and we compare them to trends in other European capital cities.

We add to the literature by showing how the gaps in travel behaviour between Stockholm's inner city, suburbs, and the rest of Sweden are evolving over time. Previous literature has found that car use trends diverge between metropolitan areas and less densely populated areas in several European countries over the past 10–15 years (Headicar, 2013; Madre et al., 2012; OECD/ITF, 2013). However, these studies were limited to car use and also limited in spatial resolution and time span.

The travel surveys analysed in this paper have the unique combination of a long time span covered (30 years), comparability over time, and large sample sizes (20,000–40,000 Stockholm County residents per survey). The large sample sizes enable a higher spatial resolution than previous studies, allowing for example to account for spatial sorting by socio-economic status.

Stockholm is a relevant case study, because the societal trends driving travel behaviour trends in Stockholm are global and similar in many cities. Stockholm is a front runner in many of these trends, with a highly educated and specialized workforce, high gender equality, early and widespread adoption of new ICT and new services, and the implementation of congestion charges in 2006. Hence, many cities can be expected to follow travel behaviour trends similar to those in Stockholm.

We add to the literature on gender gaps in travel behaviour (Johnston-Anumonwo, 1992; Rosenbloom, 2006; Crane, 2007; Hanson, 2010) by analysing their spatial and temporal variation within the Stockholm metropolitan region. Sweden and Stockholm are since the 1970s forerunners in introducing policies promoting the economic independence of women, the reconciliation of parenthood and working

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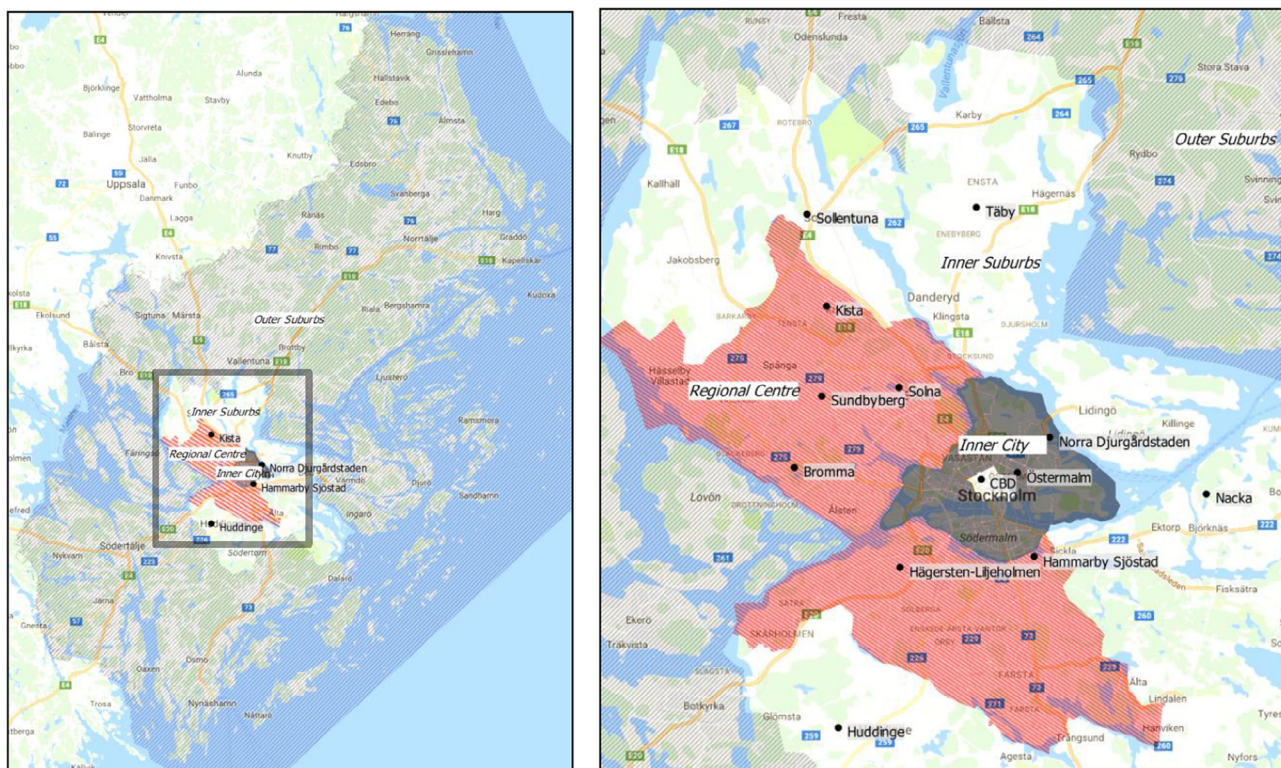


Fig. 1. Maps of Stockholm County and its regional centre. Background data ©2017 Google.

life, women's labour market participation and women's political representation. The impact of gender divisions on travel behaviour is well documented, and it might even shape the spatial structure of urban regions (Markusen, 1980; England, 1991; Massey, 1995). Women are more likely than men to live, work, and move to dense areas in Sweden and other countries in North-Western Europe (Swedish National Housing Board, 2012; ESPON, 2013), suggesting that the city is relatively more attractive to women than to men.

Understanding long term trends in travel behaviour in different population segments, and the context under which they occur, helps to understand how the life conditions, drivers, opportunities, incentives and constraints evolve for different population segment. It is therefore fundamental for policy innovation and implementation, as well as for decision making regarding transport and land-use planning. A key issue in this respect is to better understand the interaction of the city and the suburbs, in the context of the labour market development, and service and leisure offerings.

For different reasons, previous papers have hypothesized that the attractiveness of the city versus the suburbs, and the travel behaviour of city versus suburban populations, will evolve differently over time. One reason is that ICT use would affect travel behaviour and land-use. Some authors argue that ICT will make suburban residences increasingly attractive relative to city centres (van Wee, 2015). A second reason that raised concerns over Stockholm's inner city becoming less attractive was the introduction of congestion charges (Eliasson, 2008). Yet, Börjesson et al. (2012) find that, following the congestion charge introduction, the decrease in car trips to Stockholm's inner city was more than compensated by an increase in public transit trips. Contrary to suburbanization concerns, Glaeser et al. (2001) argue that inner cities become increasingly attractive, and people spend larger shares of their income on entertainment and eating out (Statistics Sweden, 2017a, 2016). Agglomeration advantages attract more productive workers and firms to inner cities, and knowledge-spill overs in a dense city core increase their productivity even more (Glaeser and Resseger, 2010; Behrens et al., 2010; Glaeser, 2011). This paper therefore explores

whether agglomeration of activities and residents to the city centre or dispersion is the dominating trend in the Stockholm region, and how it influences the travel behaviour.

## 2. Methodology

Many societal trends occur simultaneously and are interconnected. Therefore, it is not possible to quantitatively test hypotheses about each individual mechanism driving trends in travel behaviour in the Stockholm metropolitan area. Instead, we identify the outcomes – changes in travel behaviour, land-use and population sorting over time – and we relate them to the context under which they occur: changes in society, technology, economy and policy. Furthermore, we discuss similarities in outcomes between the Stockholm region and European capital regions that have similar conditions.

We present our results via descriptive statistics, because they directly illustrate effect sizes, and they do not assume any functional form. We have also explored multivariate models of trip frequencies, trip lengths, mode choice and car access, but we concluded that the models do not add sufficiently to the understanding of the changing mobility trends. We put our findings in the context of existing research throughout the paper. Since travel behaviour trends are dependent on land-use, we start the paper with a review of land-use trends in Stockholm County.

## 3. Agglomeration forces and land-use policy

This section puts the land-use development of the Stockholm metropolitan area in the context of the development of other cities, primarily North-western Europe. Travel behaviour depends on land-use and the location of activities. It is thus influenced by agglomeration forces and land-use policy. This section explains the trends in agglomeration and land-use policy in Stockholm County over the past 30 years, and compares them to other cities.

We have divided the county into four type locations: “Inner city”,

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