

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

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1. INTRODUCTION

Inner city trends in car use diverge from suburban and rural trends, see for example (Bastian and Börjesson, 2015). This seems to also be the case in other European countries. Moreover, Sweden, and Stockholm in particular, is a world leader in gender equality as well as adoption of new communication technology, which are two factors driving changes in travel behaviour. Therefore, it is of general interest to study the trend in travel behaviour, and possible drivers, in the City of Stockholm. Changes in travel behaviour emerging from gender equality and new technology might be following in other cities and countries.

We analyse data from three independent travel surveys based on a representative sample of Stockholm County residents, with over 20,000 individuals responding to each survey. The three survey years are: 1986, 2004 and 2015¹. Respondents report their personal travel on one randomly assigned survey day within the study period as well as their socio-demographics and their access to different travel modes. Respondents are weighted to be representative with respect to age, gender and home location.

Analysis is restricted to individuals aged 16-74, the common age span of the three survey samples. The surveys are sufficiently comparable: The questionnaire design is very similar across the three periods, and survey responses were mostly collected via paper mail-back². The samples match the corresponding census statistics of employment and driver's license shares. Hence, residents with driver's licences and employed residents have the same response rate as others. Further, the share of respondents not making any trips on their survey day is nearly constant in each survey, at 20%. And the number of public transit trips per respondent lines up well with automated boarding count statistics.

We find that the differences in travel behaviour between urban, suburban and rural populations are widening over time. In the dense urban core people seem to adopt a more gender equal, income equal and socially beneficial daily travel

¹ The three survey periods are: March 1986 - March 1987; September 2004 - October 2004 and September 2015 - October 2015. For comparability across the three survey years, the summer and winter holiday periods are excluded from the 1986 data analysis. The response rate declines from 80% in 1986 to 48% in 2004 to 35% in 2015.

² A quarter of the 2015 respondents answered the survey online, while the other ¾ decided to mail back their paper survey.

behaviour. We find that car use declines and bicycling increases where economic, housing and activity densities are growing and road space is limited, even without substantial public transit expansion. Thus, congestion can be interpreted as an effect of an attractive growing city. It needs to be managed by policies that allow for the flow of more people in a small space, therefore allocating more space and priority to pedestrians, cyclists and public transit users.

2. RESULTS

Trip location and mode choice

Figure 1 shows that over time an increasing share of the total trips within Stockholm County is entering or exiting the inner city. This agglomeration trend is driven by Stockholm's knowledge economy as well as Stockholm municipality's land-use policy. The spatial concentration of activities and the increased population of the County lead to increased competition for road space in the inner city, despite a reduction in the number of cars entering the inner city with the introduction of a congestion charge in 2007.

Travel speeds in Stockholm County have declined slightly between 2004 and 2015 for cars, busses³ and bicycles but not for rail based public transit. Similarly, in inner London traffic speeds have not increased since the introduction of the congestion charge in 2003, despite a 20% reduction of inner London road traffic between 1999 and 2012. The London Transport Authority attributes this to a reduction in effective road network capacity "with space having been reallocated from general motor traffic to other purposes such as bus and cycle lanes, safety initiatives or improvements to the public realm" (Transport for London, 2015a, p. 24).

Figure 2 shows how mode shares of trips have changed over time, depending on the location of the trip. Bicycles continue to gain trip shares and distance shares from cars for trips within and entering/exiting the inner city. Since 2004 public transit gained trip shares and distance shares from cars for trips outside or passing through the inner city. Similar mode shifts have been observed for inner and outer London respectively (Transport for London, 2015b).

Figure 3 shows the average length of trips within Stockholm County by mode. The average length of trips within Stockholm County increased significantly for all modes from 1986 to 2004. Such trends have been seen in many counties over a long period. However, car and bicycle trip lengths have declined in the regional centre between 2004 and 2015. The increased agglomeration thus enables shorter trips, and increased road congestion is an incentive to reduce trip lengths.

³ Bus travel times for the same routes increased by 6% during peak hours from 1998 to 2006 (Stockholm Transport Administration, 2009)

Figure 4 shows that bicycling increases among the middle aged and decreases among the young. Bicycles are increasingly used for commuting, particularly to reach jobs in the inner city. Of the total bicycle distance travelled in Stockholm County nearly 63% was for commuting purposes in 2015. Bicycles accounted for 11% of commuting trips and 5% of commuting distances in Stockholm County in 2015.

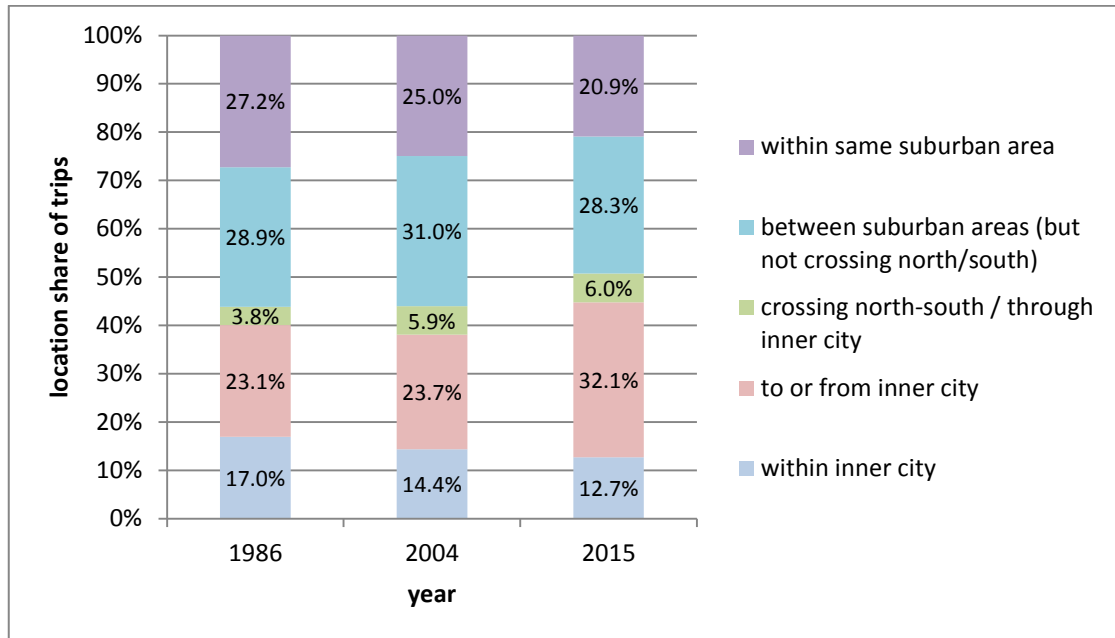


Figure 1: location share of trips within Stockholm County by year

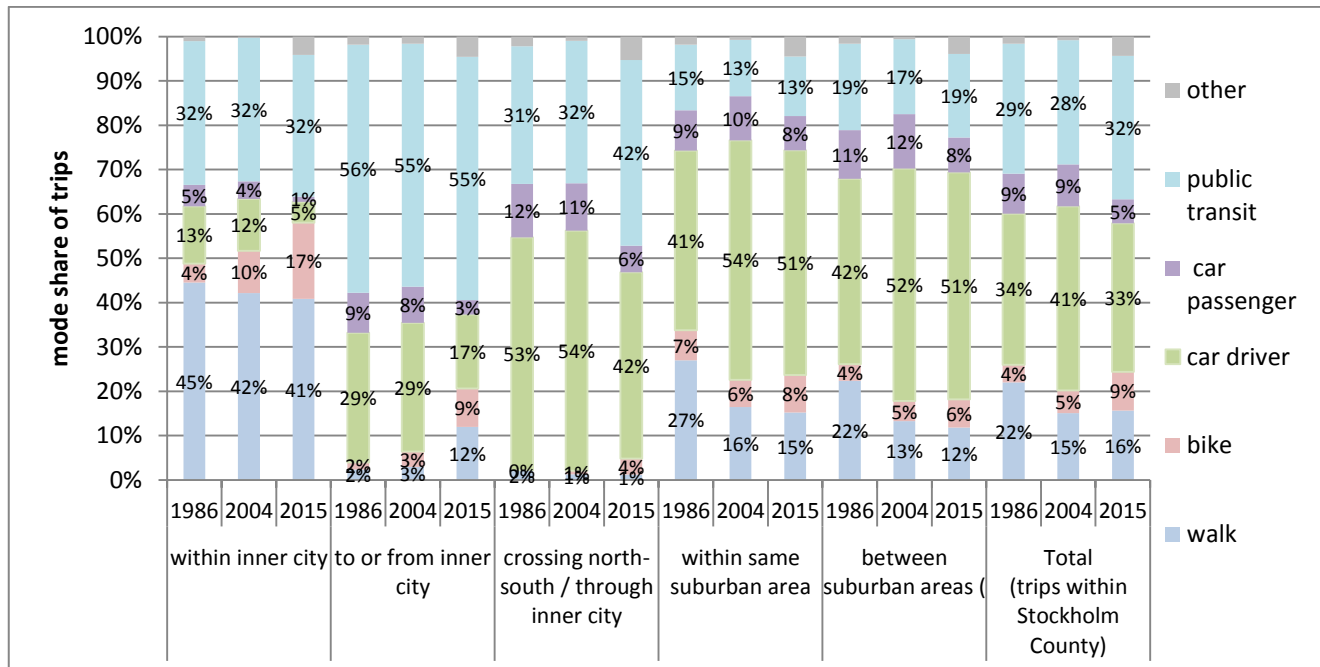


Figure 2: mode share of trips within Stockholm County, by trip location and year

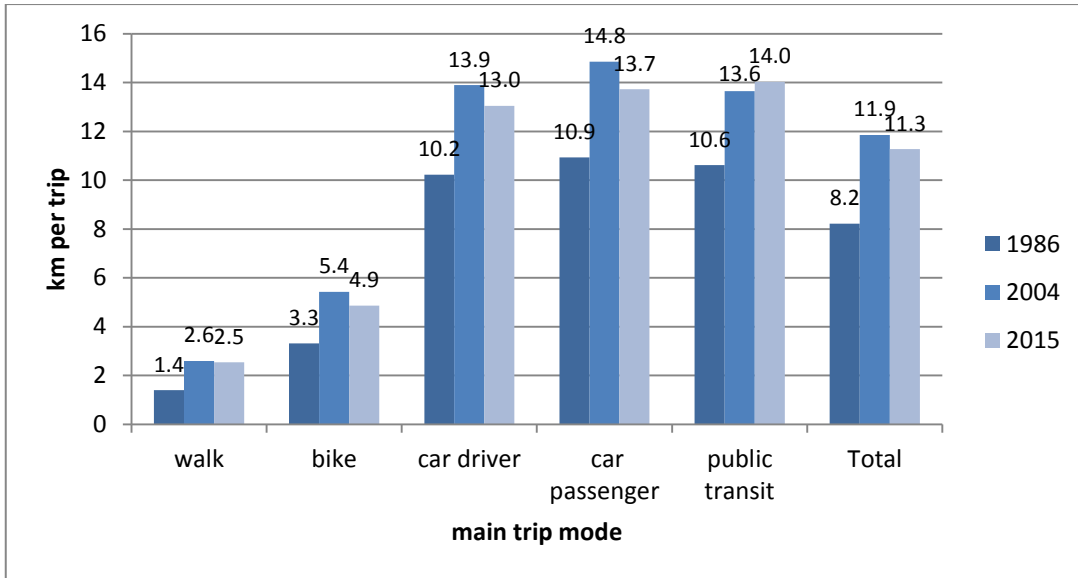


Figure 3: Mean distance per trip within Stockholm County, by main mode and year

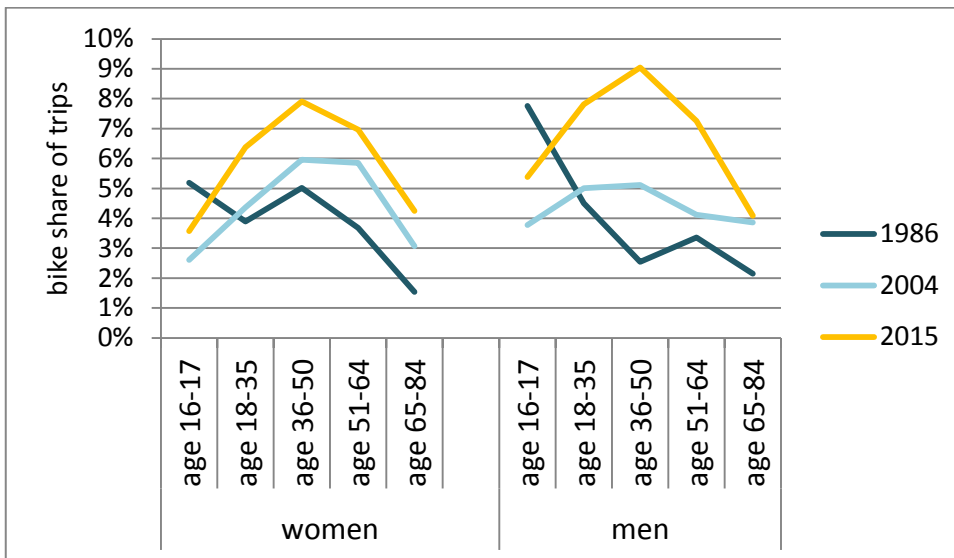


Figure 4: bicycle share of trips within Stockholm County, by age, gender and year

Trip Frequencies

Figure 5 shows trip frequencies (the number of trips per person per day) in Stockholm County by gender and trip purpose. The significant decline in commute trip frequency from 1986 to 2004 can be explained to more than half by fewer activity breaks during the work day, thus more workers only commuting to work once per day. Trip frequencies decline for all purposes, but especially for shopping, leisure and service and especially among younger adults. Between 2004 and 2015 the decline in shopping trip frequencies was strongest for non-food products.

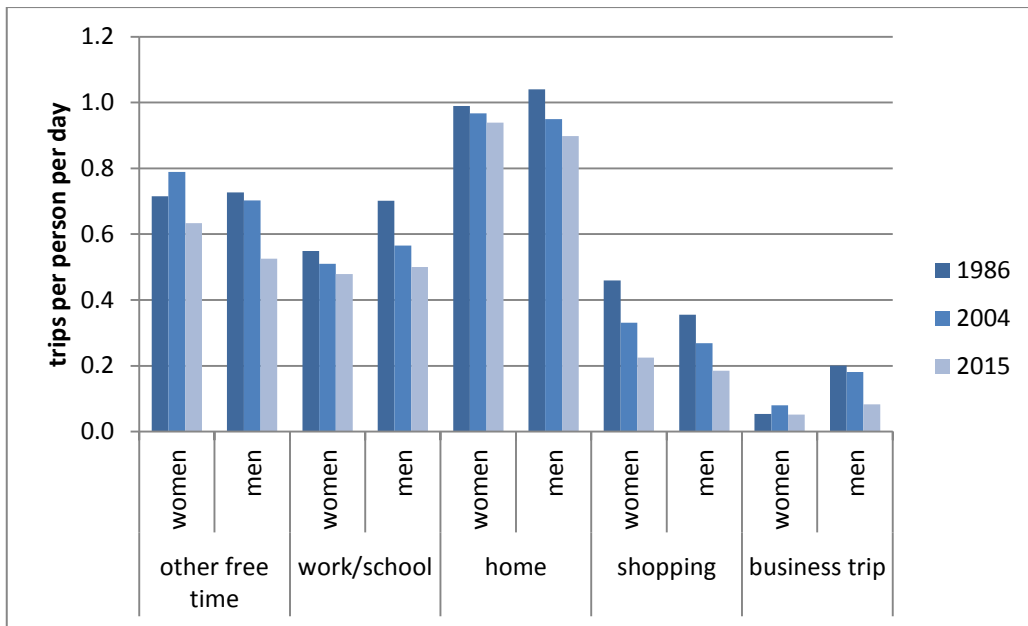


Figure 5: trips per person per day, by gender, trip purpose and year, among ages 16-74 in Stockholm County

Car use

As shown in the trip location sub-section, car shares of trips and distances in Stockholm County have increased between 1986 and 2004 but then decreased again between 2004 and 2015, back to roughly similar average levels than in 1986. Yet, spatially car travel looks very different in 2015 than in 1986. Fewer cars are entering or exiting the inner city in 2015 than in 1986, despite a 40% population growth in Stockholm County. Instead, car use has shifted to the suburban areas. Trips that remain in the suburban regions south or north of the inner city have a higher car share in 2015 than in 1986.

Figure 6 shows the car share of trips by residential location, household income and gender for the years 2004 and 2015. During this time car shares of trips and absolute trip counts have significantly decreased among all income groups, particularly among men and among women above the lowest income quartile.

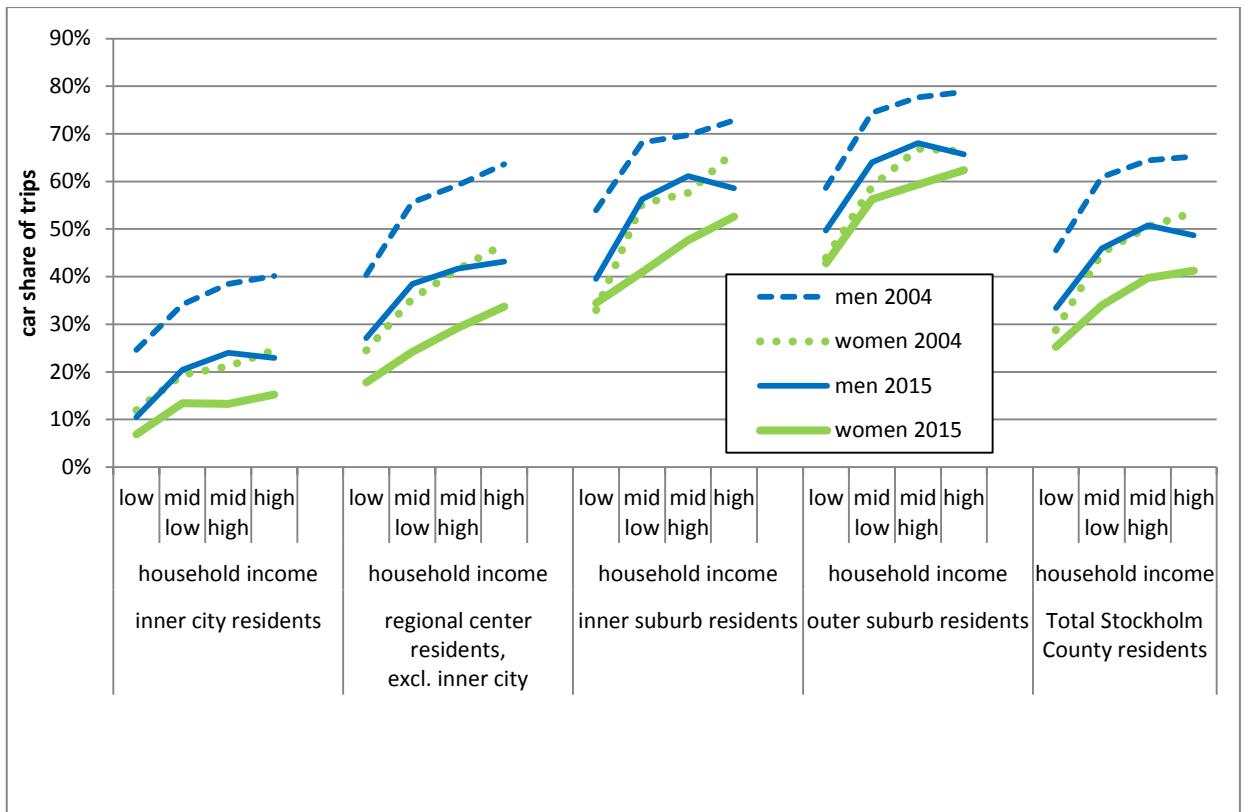


Figure 3: car share (driver or passenger) of trips within Stockholm County, by residence location, household income and gender and year

Commuting distances

Men travel farther than women to reach suburban job locations. In rural areas of Sweden the gender gap in commute distances is not declining. However, figure 7 shows that for employees in the region centre of Stockholm, there are no gender differences in travel distance.

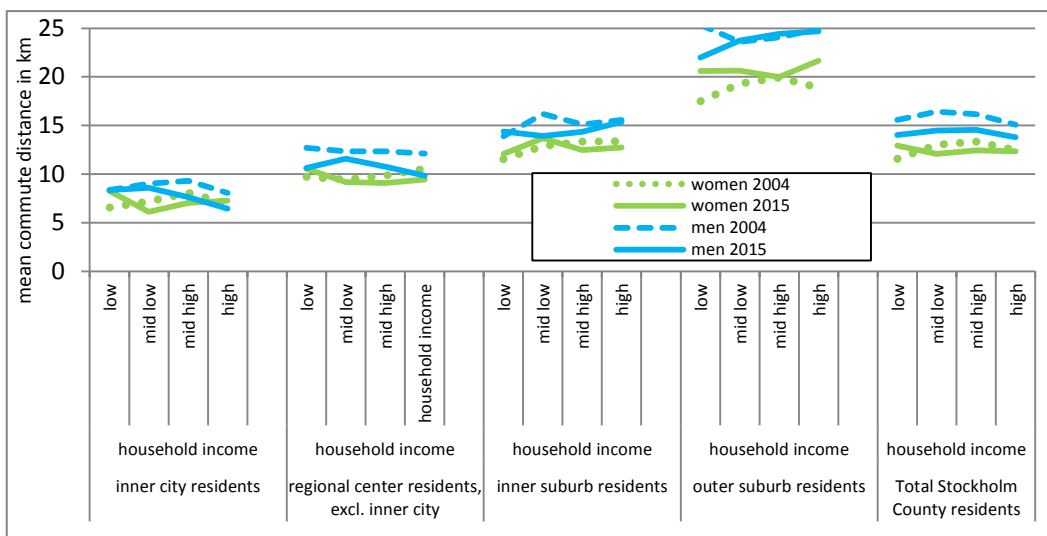


Figure 7: Mean commute distance among employed adults, by residence location, household income, gender and year, for trips within Stockholm County