

Homework in the Greater Toronto Area : An Exploration of Employment Trends, 1996-2001

Dominik Papinski, Antonio Páez,
Darren M. Scott, Robert D. Wilton
Centre for Spatial Analysis, School of Geography and Earth Sciences,
McMaster University

Abstract

Telework and homework in general has been suggested as a significant contributor to changes in daily activity-travel patterns. Trends within the Canadian context have yet to be explored in large metropolitan areas. Travel diaries offer an excellent opportunity to explore trip behaviour and travel trends within our society. The Transportation Tomorrow Survey is a travel survey conducted every five years for the Greater Toronto Area. Approximately 137,000 people completed interviews and were used to explore the primary objective of this paper, which is to examine differences and similarities between homeworkers and non-homeworkers within the context of land use and transportation. Location quotients are used to reveal 'hot spots' of communities with high numbers of homeworkers. Results indicate shifts in travel times and places of home. Results also indicate differences in employment and other socio-economic characteristics. As urban sprawl encroaches on typically agricultural land, homeworkers move into these areas and present a slightly different impact on daily travel patterns. City planners and other social scientists may find it useful to explore this growing trend and plan for more efficient use of the existing transportation system for suburban travel needs.

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1. Introduction

Time is the largest private cost associated with travel, and telecommunication provides mobility that in turn can save on travel time (Helling and Mokhtarian, 2001). Teleworking may not be a long term solution, however, its impacts on the types of trips being conducted and the time they take place affects the transportation system. Working from home allows employees to perform trips during non-peak commuting hours. Teleworkers also perform a greater variety of trips that are non-work based (Wernick, and Khattak, 2005). Therefore, studying non-work based trips will be key to understanding the real travel patterns created by this segment of the population. The impacts revealed in this paper show travel times differ between households with and without homeworkers. Urban form will change as a growing distributed workforce no longer needs to have a centralized workplace (Ivonne, 2005).

A significant component of homework is facilitated by telework. This segment of the workforce has grown proportionally with the number of household computers with internet access and other mobile technologies. These mobile workers have the flexibility to work from home or the traditional workplace. With the relative decline in the cost of telecommunications, new technologies can provide an incentive for businesses to include teleworkers as part of their workforce mix. Companies no longer require all employees to work at a central location and it saves them money in the long run. Telecommunications may further decentralize residential areas in metropolitan areas (Ivonne, 2005). Flexible hours and workforce size allow companies to dynamically adjust to market conditions.

As of 2003, 64% of all household members in Canada had access to the Internet from home, up from 42% in 1999. Over 80% of household members <35 years of age had access to the Internet from home. Across all age groups, income levels and educational levels, Internet access has risen sharply over the past five years (Statistics Canada, CANSIM). Voice over IP¹ and email technologies have

¹ Voice over IP (VOIP) or Internet telephony is hardware and software that enables household members to use the Internet as the transmission medium for telephone calls

enhanced the possibility of teleworking allowing people to communicate all over the world with great ease and low cost. The number of cell phones and phone lines have risen every year at a staggering rate. One out of five Canadians has two or more phone numbers growing approximately 15% per year (Statistics Canada, Residential Telephone Service Survey).

Teleworking has been studied in great detail in the United States, Europe and Australia. However, it has only recently been tackled within the Canadian context. Teleworking or homework in general can be defined as working from home using communication and information technology to stay in contact with one's employer.

Two sources of data allows for the study of homework trends. The first being the Transportation Tomorrow Survey (TTS) which affords an opportunity to study travel patterns within the Greater Toronto Area (GTA), the most urbanized region in Canada. The second is the 2001 census dataset. The GTA is made up of several municipalities and with an estimated 2,417,500 households (TTS, 2001). Approximately 136,470 households completed interviews for the 2001 TTS. This data set provides insight into underlying activity-travel behaviours, population demographics and employment status.

The 2001 Census data set at the dissemination area level served as a complimentary data set to the TTS. Detailed employment statistics, housing construction dates and other socioeconomic variables provided insight on homemaker and non-homemaker groups. Key similarities and differences between the two groups are highlighted in this paper.

2. Data and Methods

The Transportation Tomorrow Survey is a cooperative effort by 21 local and provincial agencies to collect human activity-travel data. Such surveys were conducted in 1986, 1991, 1996 and 2001. Information garnered from these surveys has been used by transportation planning agencies in an effort to understand local transportation needs through modelling trips (Miller, 2001).

Figure 1 shows the GTA, which is anchored by the cities of Oshawa in the east and Hamilton in the West.

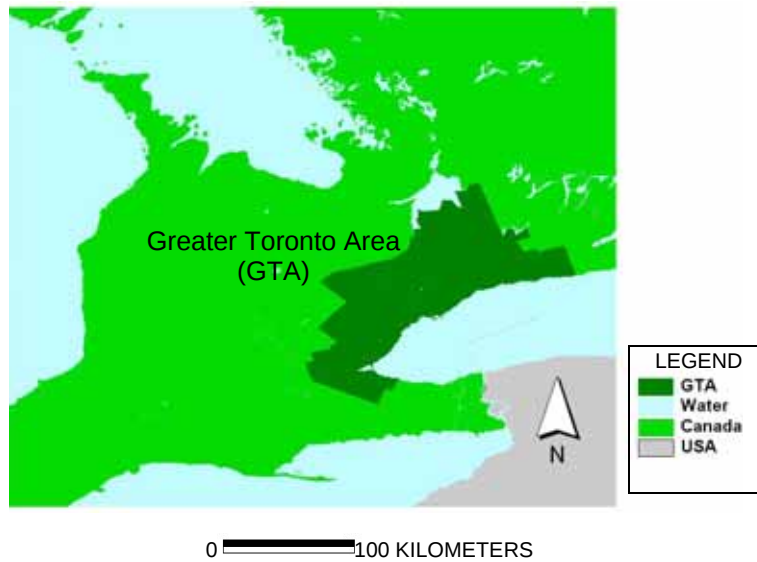


Figure 1. Greater Toronto Area

The 2001 Transportation Tomorrow Survey collected data on 136,470 households, which included approximately 368,500 individual respondents. Six percent of males and females sampled identified themselves as part-time or full-time teleworkers (homeworkers). This is significantly lower than 48% listing themselves as non-teleworkers. The sample size is still significant to understand the impacts on travel. Note that households can be composed of either 0, 1, 2, 3, 4 or 5 homeworkers. Households can also have different compositions of homeworkers and non-homeworkers. The proportion of both adds up to 100%.

The TTS asked respondents if they worked from home on the day of the survey. Respondents had the option of choosing 'not applicable' which was most likely answered by non-homeworkers because they do not typically work from home. In this case it can be assumed that non-homeworkers answered either 'no' or 'not applicable'.

The methods employed in this study specifically identify spatial and aspatial differences between homework and non-homeworker populations. Table 1 illustrates employment status by gender in the TTS sample. Homeworker populations have grown by 9% from 1996 to 2001.

Table 1. Employment Status for workers in the GTA

	Year	Full Time	Part Time	Work at Home
Male	2001	1,239,484	158,232	79,116
	1996	1,108,462	144,582	72,291
Female	2001	934,626	302,379	54,978
	1996	805,344	276,837	50,334

Source: *Transportation Tomorrow Survey*, 1996 & 2001

Location quotients (LQ) are one of the most commonly used tools in economic geography and locational analysis. In this paper, it simply represents an index value indicating an over or under representation of homeworkers in a given census tract.

Location Quotient Equation:

$$LQ_i = (x_i / x) / (X_i / X)$$

where,

LQ_i = location quotient for homeworker group i (in census tract)

x_i = number of i homeworkers in census tract in year T

x = total number of homeworkers in year T

X_i = total number of i homeworkers in census tract in year T

X = total number of all homeworkers in year T

Three inferences can be made using location quotients. First, a value less than one suggests that homeworkers are under-represented within the census tract compared to the region as a whole. If the value is equal to one, the census area has the same proportion of homeworkers as the underlying base population. Lastly, if the value is greater than one, the census area has a higher proportion of homeworkers relative to the area-wide average.

The TTS has identified the absolute number of homeworkers in a given household separately from non-homeworkers. This implies that

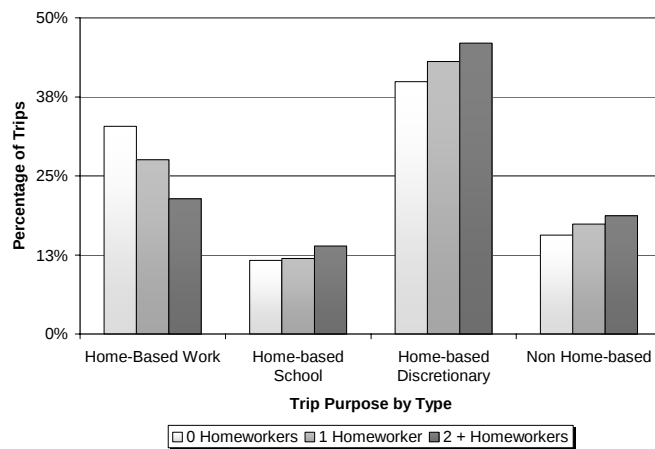
there can be three compositions of households by group. The first includes households with employees working outside their home. The second household composition is of only homeworkers. The third household composition is a mixture of both homeworkers and non-homeworkers. The following section will discuss the results of the analysis.

3. Results and Discussion

Several variables were analyzed in this study: trip distance and duration, frequency of trips by time of day, and naturally, the absolute number of homeworkers in a household. Data can be explored at the person, household or zonal level. Variables used to complement the TTS data were taken from the 2001 census. They include occupation, place of work, period of construction of housing, household and personal income and employment rate. These variables provided significant insight on differences between homeworkeer averages and the average population in the GTA. So what kind of trends were inherent in both data sets?

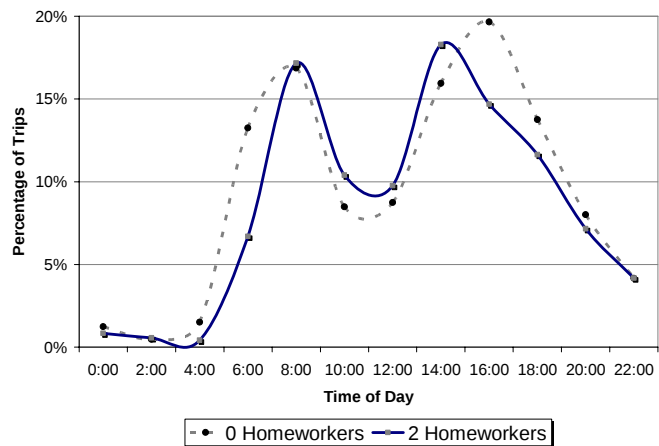
Figures 2 and 3 display the trends in regards to trip purpose and trips by time of day. Both are aggregated for the week and clearly depict differences between household without homeworkers and households that have at least 1 homeworkeer.

The analysis indicates non-homeworkers make more work-based trips during the course of a day. Conversely, households with one or more homeworkers participate in more non-work, discretionary and school-based trips. All compositions of household types share relatively the same number of trips per day and travel distances. Figure 3 also reiterates the fact that the two groups have different daily travel patterns across time of day. Homeworkeer populations typically take trips outside the peak travel hours as they spread their trips throughout the day.



Source: Transportation Tomorrow Survey, 2001

Figure 2. Trip Purpose by Household Type (2001)

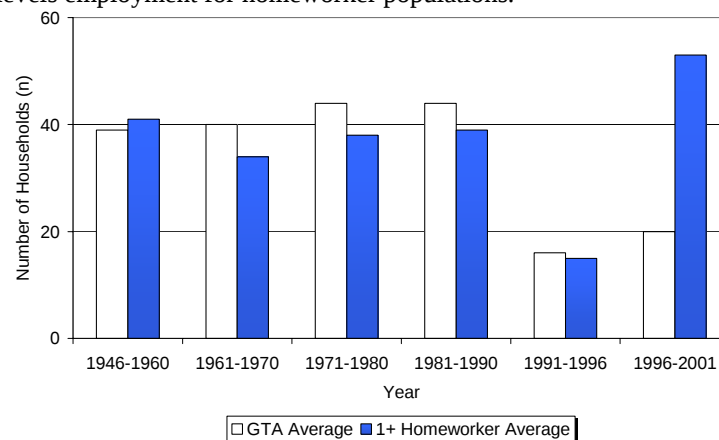


Source: Transportation Tomorrow Survey, 2001

Figure 3 Percentage of Trips by Household (weekly total)

Figure 4 displays period of housing construction by census tract. Using dwelling age can determine housing needs or detect growth areas within a city. Typically, suburban communities have more recent housing. Using this technique, one can determine whether homeworker populations live in downtown city cores or in the peripheral regions of the city. Figure 4, shows high levels of 1 or more homeworker households living in dwellings built during the period of 1996-2001. Period of construction is represented by the number of households in a given census tract over time.

Areas identified as having high numbers of homeworkers were linked with the 2001 census data. Figure 5, shows the breakdown of significant employment types by group. Management, retail, information systems, finance and agriculture had significantly higher levels employment for homeworker populations.

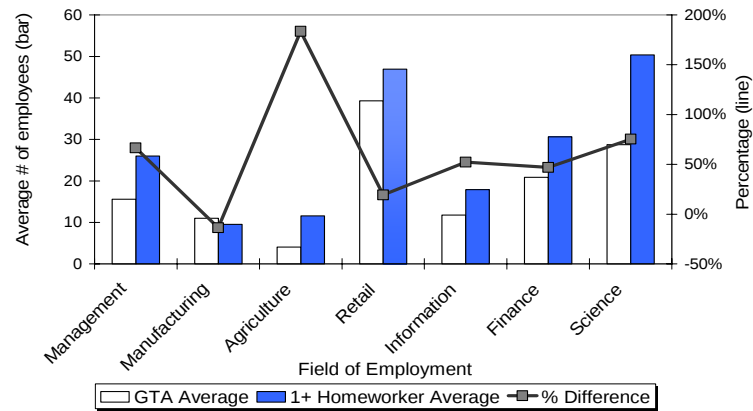


Source: Statistics Canada & 2001

Figure 4. Average Period of Housing Construction by Household

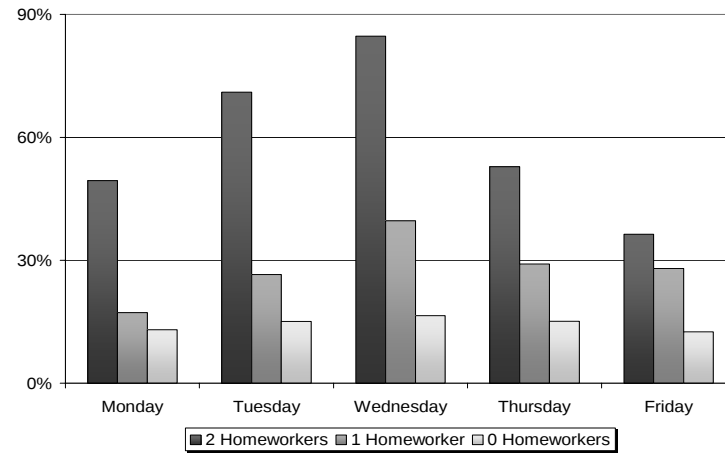
As expected, manufacturing had lower levels of employment. The line represents the difference expressed as a percentage. Higher levels indicate a significant difference between the average population (which includes homeworkers and non-homeworker populations) and the households with 1 or more homeworkers in a household. Notably the agricultural field stands out as more than twice the number of

employed are performing agricultural jobs. This may be the result of farmers working and living on their own farm.



Source: Statistics Canada & 2001

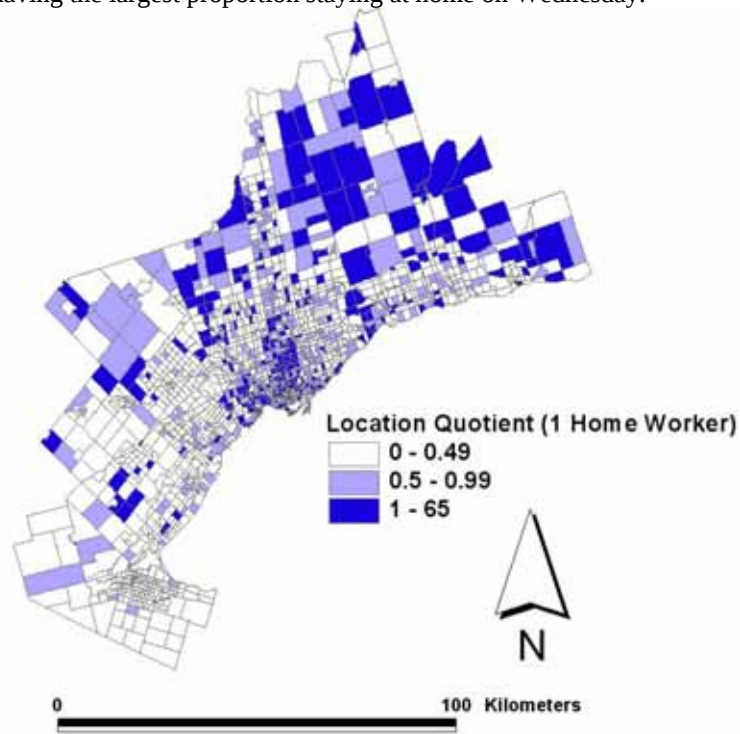
Figure 5. Field of Employment by group



Source: Transportation Tomorrow Survey, 2001

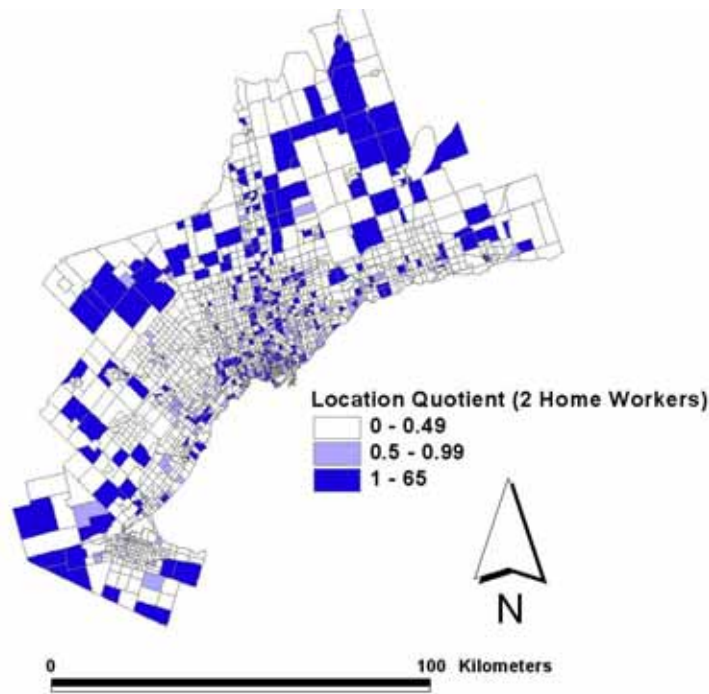
Figure 6. Daily proportion of working from home by household

Homeworkers tend to live in the suburbs and in relatively new housing. This housing is encroaching on agricultural land and in turn it is most likely selecting farmers as an employment type. Transportation in essence is changing in these areas and needs further investigation. Figure 6, illustrates the breakdown of working from home by day of week. Non-homeworker populations have a steady rate of working from home throughout the week. Fifteen percent of respondents noted they remained at home to work. Households with one or more homeworkers showed a greater range of values while having the largest proportion staying at home on Wednesday.



Source: Transportation Tomorrow Survey, 2001

Figure 7 Location Quotient Values for 1 Home Worker



Source: Transportation Tomorrow Survey, 2001

Figure 8 Location Quotient values for 2 Home Workers

Figure 7 and 8 both show similar spatial distributions of households with 1 or more homeworkers. They appear to be residing primarily in the peripheral regions of the GTA and few located in the downtown core. This supports the census data on dwelling period of construction where these groups of homeworkeer populations similarly resided in the suburbs.

4. Discussion of Exploratory Analysis

This paper has explored the Transportation Tomorrow Survey data, specifically examining the differences and similarities between households with 0, 1, 2 or more homeworkers. The literature on

telework has outlined the advantages and disadvantages to working from home from a social, environmental and transportation policy point of view (Gareis and Kordey, 2005. Handy and Mokhtarian, 1996. Wernick and Khattak, 2005).

The suggested benefits to teleworking include: increased motivation and employee productivity, improved work-life balance based on flex time, increased equality of employment opportunities for the disabled, rural, and older workers, creation of a distributed work force. Other ancillary benefits relating to the field of transportation includes the overall reduction in traffic levels (especially during peak commuting periods) along with reduced vehicle pollution.

Social disadvantages of working from home may include: change in management styles, mixing work and family responsibilities, and concern of social and professional isolation (opportunities for promotion may be less likely due to less availability and interaction with management) Other concerns planners and businesses may face include: decreased inner city investment, large initial capital investment and data security fears. From a transportation and land use point of view teleworking may be a possible contributor to urban sprawl and perhaps the number of discretionary or non-work based trips may increase and in turn cause congestion and pollution.

This paper findings present teleworkers as having a positive impact from a transportation point of view. Since both households with larger number of homeworkers have similar trip frequencies, travel times and distances some positives can be interpreted. Households with 1 or more homeworkers tend to take trips during non-peak hours of the day and spread them out throughout the entire day. This in turn may help to reduce traffic times and in turn congestion levels throughout major transit arteries.

Flexibility in the workplace offers new opportunities for both travel management and from a business perspective. Telecommuting and compressed work weeks allow for travel reduction and a reduction in time spent commuting. For households with 1 or more homeworkers the distribution of work-based trips have declined while at the same time replaced by discretionary trips. The impact of teleworking may not be entirely clear because of the organization of

data within the TTS. However, evidence in shifting travel times and other social reasons make teleworking attractive to urban transportation planners. The city of Toronto's and surroundings areas plan to collect this type of data is one step forward to understanding possible future transportation scenarios. Employees who are offered flexible work hours and the opportunity to work from home feel valued and trusted. Employees who work from home would also prefer to share cubicles and continue to work from home rather than have a dedicated office. Flexible hours may in turn allow workers to choose better commuting times for work and other trip purposes. Travelling during non-peak hours of the day helps reduce travel time, congestion and pollution. (Handy and Mokhtarian, 1996)

Teleworking affords workers the spatial flexibility to be anywhere at anytime, and this includes choosing a place of residence. As shown in this study, homeworker populations tend to live in the suburbs in relatively new housing. If this trend continues, new transportation patterns may emerge moving away from a CBD to a multiple nuclei city structure with supporting transit systems. Mixed land use development may also be spurred based on this growing sector of work. The city and regions may need to adapt their strategies to accommodate these new travel demands. The changes in telework are not only present in Canada and the North American context but will also have to be tackled in the European context (Gareis and Kordey, 2005).

Teleworking may be interpreted as a technological innovation. It can be described as substituting one form of communication to another. Moving from person-to-person exchange of ideas and information to using the Internet and other mobile technologies to exchange information on work related topics (Handy and Mokhtarian, 1996). Teleworking is simply changing the way we communicate and transmit information. A fixed workplace environment is no longer required in jobs related to the service sector. The growth in working from home or in a mobile setting will continue to impact on transportation and land use patterns. Policy makers and urban planners will need to recognize these travel characteristics in order to better design cities for a new generation of travel related patterns.

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