Active ageing in developing countries? –Trip Generation and Tour Complexity of Older People in Metro Manila

Pierre Pettersson, Department of Civil Engineering, KTH Royal Institute of Technology Stockholm, Sweden, Email: pierreptraba@gmail.com

Jan-Dirk Schmöcker, Department of Urban Management, Kyoto University, Kyoto, Japan, E-mail: schmoecker@trans.kuciv.kyoto-u.ac.jp

Abstract

There is by now quite a substantial body of literature discussing the impact of an ageing population in developed countries on travel needs and required changes to transport policy. As many newly developed and developing countries are following demographic trends of "first world" countries, but offset by some decades, the problem is, however, not limited to the industrialised nations. The focus of this paper is on Metro Manila and analyses travel patterns by those aged 60 or over. Trip frequency and tour complexity are analysed with ordered probit regression, separating the effects of socio-demographic characteristics as well as land-use patterns. The results are compared to observations made for cities in developed countries, in particular London as an example for a city in a first world country. We show that there is a more pronounced decrease in total trips made with increasing age in Manila. However, analysing for specific trip purposes we find, similarly to trends in developed countries, that the number of recreational trips is fairly constant in all age groups. Recreational activities also seem to take more time per day than average for younger old, possibly indicating the advent of similar active ageing trends as in industrialised nations. The paper concludes by discussing some implications given future economic trends and advocates that better datasets from developing and newly developed countries are required for urban planning in developing countries.

Keywords: Older people, travel patterns, active ageing, developing countries

1 Introduction

Populations in most countries around the world are ageing in terms of number and proportion of older people. This phenomenon is not only one of the developed world; in many of the rapidly growing developing countries and countries categorized as "newly industrialized" the proportion of elderly is growing at a never seen speed. Currently the proportion of elderly in developing countries and newly industrialized countries (NIC) is still low compared with developed ones but this will change in a few decades. United Nations data show that China, a newly industrialised country, is projected to have a higher proportion of people aged over 60 than the United States of America by the year 2050 (UN, 2008). The World Health Organisation further suggests that "Worldwide the proportion of people 60 and over is growing faster than any other age group” and that “by the year 2050 there will be 2 billion people aged 60 or over, with 80 percent of them living in developing countries” (WHO, 2002).

As an example for a country where such a development can be observed, this study focuses on Metro Manila in the Philippines. The Philippines is a country until recently defined as a developing country that is now often classified among the NIC; not least because of its high annual growth in GDP. The annual growth in recent years exceeded 7% per annum and in 2007 the country’s president promised that the country will be a “first-world economy” by 2020 (see e.g. Forbes, 2007; OPS, 2007). Though this 2020 target is doubted by many, there are clearly significant economic developments in the Philippines. This is coupled with improvements in the health system. Both developments will raise life expectancy and contribute to increase the number and proportion of elderly population (Figure 1, data from external sources). It is projected that the proportion of people aged 60 or above in the Philippines will grow from 6% in 2005 to almost 18% by 2050. Life expectancy is projected to increase by about 9 years to over 80 for women and over 75 for men within the same time period (UN, 2008).

According to 1995 and 2000 Philippine Census data the share of older people in Metro Manila increased from 4.1% to 4.73% (NSO, 2003). This is well compatible with statistics from other metropolitan cities in developing countries in the region; for example the share in Jakarta, Indonesia in 2005 was 4.57% (Statistics Indonesia, 2010). Other further developed cities in South-East Asia have a slightly higher percentage of population aged 60 or above. For example Kuala Lumpur 5% in 1991 and 6% in 2000 or Bangkok nearly 8% in 2000 (UNESCAP, 2000). This share is still far below those in cities in Western Europe. For example London with 16.4% in 2001 (Census, 2001) or Stockholm with nearly 20% in 2000 (USK, 2009).

As the Philippines develop, other socio-economic factors are changing accordingly, for example, family income, registered vehicles, and issued driving licenses are already growing rapidly (Figure 2). It is reasonable to assume that above described economic developments also will be accompanied by other changes in socio-demographic trends similar to those in developed countries, such as lower birth rates and more single person households. Trends such as these might contribute to increasing isolation of older people and have given concern about life quality of older people in developing countries. International organisations such as WHO or the UN have hence repeatedly reported on possible economic as well as societal impacts of ageing populations. To counter isolation effects in particular WHO is hence promoting “Active Ageing”. Though a term used in many different connotations it is defined by the WHO as “the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age” (WHO, 2002).

Active ageing, life quality and travel behaviour are shown to be closely linked in the literature. Banister and Bowling (2003) decompose the concept of quality of life in order to better understand what it means for older people in Britain. Their “quality of life survey” reveals that transportation and the potential to travel are key aspects. Metz (2000) also discusses the strong connection between transport options and quality of life. He argues that rather the term mobility is more useful in this context as it relates to actual as well as potential travel.

With this background in mind, the objective of this paper is to understand commonalities and differences in mobility of older population in Manila and large cities in developed countries. In particular we analyse the impact of demographic variables that are likely to keep changing in the future, such as income, car ownership, household size and structure. As a measure of mobility our study focuses on trip frequency and tour patterns. We compare the Manila results with those obtained from major cities in developed countries, especially London. Our choice of London, instead of choosing another metropolis from East Asia, is mainly data driven. In the conclusions we then discuss possible impacts on active ageing and life quality.

2. Literature review

There is by now quite an extensive body of literature describing the travel behaviour of older people. There have been contributions aiming to describe all aspects of travel (e.g. Scott et al., 2009) or with a focus on a specific aspect such as trip distance (e.g. Mercardo and Páez, 2009), total time of travel (e.g. Spinney et al., 2009), mode choice (e.g. Su et al., 2009) or trip chaining behaviour (e.g. Schmöcker et al., 2010), to only mention some of the contributions published within the last year.

The vast majority of the literature in this field has been studying major cities in Western developed countries, mainly because of limitations regarding data from developing countries. There are some difference in the findings from different regions, but several trends are now well established: Among the 60-75 year old, recreational trips might increase in number as well as distance but in general total trip numbers reduce with age (Alsnih and Hensher, 2003; Hildebrand, 2003). Though difficult to measure Metz (2000) argues that lower number of journeys and a reduced travel time budget are indicative of mobility impairments, but also suggests that this does not provide the whole picture.

Alsnih and Hensher (2003) in particular further point out that older people are a very diverse age group. They argue that a distinction between "younger old" and "older old" with a threshold around 75 might be useful to describe when the onset of more severe physical impairments will reduce travel and often lead to mobility impairments. A distinction between younger and older-old has also been found to be useful in several other studies; (Okola, 2002; Su et al., 2009 or Schmöcker et al., 2005). However, to conclude that reduced trip making among older old necessarily means lower life quality might not necessarily be true. Spinney et al. (2009) provide evidence that the benefits of transport exposure depend significantly on age, gender and other factors such as living arrangements.

With the cessation of work around 65 in many developed countries active ageing appears to be connected primarily to shopping and leisure trips. In many countries such trips are in the majority carried out by private car (Noble and Mitchell, 2001; Tacken, 1998, Rosenbloom, 2003). Independent of this, the increasing car dependency has led to an ongoing discussion on its impacts for road safety, congestion as well as sustainability (Stamatiadis and Deacon, 1995; Rosenbloom, 2001; Scott et al., 2009). Clearly with increasing automobility in developing countries this must also be a concern for the Philippines. Connected to an increasing car dependency in many countries, in general it is found that in most Western cities public transport usage decreases with age. Worryingly, the trend is towards a further reduction when U.S. time series data are analysed (Collia et al., 2003), though Scott et al. (2009) do not confirm this trend with Canadian data. Even though alternative transport modes, such as dial-a-ride type door-to-door services, play an important role for those with severe mobility impairments, in most first world countries such services do not constitute a major modal share neither in rural areas nor in major cities (Stern, 1993, Schmöcker et al., 2008).

Those not living alone use less public transport and special transport services (Golob and Hensher, 2007; Hess, 2009). The effect of household size per se on trip frequencies and active ageing is less clear. On one side living together might encourage trip substitution, which not necessarily might be seen positive. On the other side having a partner or family members might help those with mobility impairments to additional trips they would (and/or could) not do by themselves. Stern (1993) reports that overall those living with a partner appear to make more trips. Controlling for car ownership, the studies by Roorda et al. (2010) and Schmöcker et al. (2005) give weak evidence for an opposite conclusion, though the samples in both studies include not only older people but a wider group of potentially transport disadvantaged. What is clear from the literature though is that older people in households with car access make more trips (Páez et al., 2008; Roorda et al., 2010) and in particular driving cessation often has significant consequences on the quality of life (e.g. Harrison and Ragland, 2003).

Socio-demographic characteristics also have an effect on tour patterns and tour complexity. Combining different trips into one tour is often seen as a way to reduce total travel. However, especially if trip chaining does not reduce total trip numbers, it is also an index for the possibility to combine essential trips with additional side trips. Therefore one might argue that an increase in tour complexity also is an index for enhanced life quality and the feasibility of active ageing. Golob and Hensher (2007) analyse Sydney data and show that trip chaining tendencies decrease after the age of 65. Schmöcker et al. (2010) confirm such trends with London data when considering home-to-home tours, but point out that only for the older old a significant effect can be seen, in particular for those with walking disabilities. They further report income, race and gender effects on tour complexity and add that among older people mobile phone possession appears to encourage trip chaining.

Another particular interest in the literature on older people's trip generation and tour complexity has been the effect of urban form and neighbourhood design. Michael et al. (2006) conduct a focus group analysis to investigate how neighbourhood design encourages active ageing among elderly in Portland, Oregon. They loosely define active ageing as moving or participating in activities outside home. Results emphasise the need for safer, walking friendly roads, a condition that might not be given very often in developing countries. Cao et al. (2008) study trip frequencies by mode of older people in Northern Californian neighbourhoods. They find that distance to grocery stores has a large effect on number of trips made by foot and argue that neighbourhood design is important to maintain accessibility.

One measure of urban form is population density. Noland and Thomas (2007) with U.S. data and the aforementioned study by Schmöcker et al. (2010) with London data both investigate the effect of population density on tour complexity. London results suggest that neighbourhoods with a medium high population density encourage trip chaining, possibly due to a good mix of shopping facilities in these areas (compared to the very densely populated downtown areas and the outskirts of the city). Mercardo and Páez (2009), using Canadian data, give some further evidence for this assumption as they find that a high commercial and residential land-use mix reduces trip distances. However, they did not find a significant effect of population density per se on trip distance. Páez et al. (2007) demonstrate further that spatial variation in itself can be significant for trip generation. In their study with data from Hamilton, Canada, they find that, for example those living further in Eastern direction from the City centre generate more work trips. Roorda et al. (2010) study trip generation of vulnerable population groups in three Canadian cities with spatially expanded ordered probit models and confirm that along different axes of the cities trip numbers can significantly differ.

The literature summarised so far has been exclusively based on data from developed countries. Undoubtedly there have been studies conducted in developing countries, too. But these appear to seldom have been published in international journals. An exception is Zhang et al. (2007) who study older people's travel patterns in Beijing by analysing a large travel survey data. They report that even among those aged between 61-65 the modal share of walking exceeds 50% with a further increase to over 70% for those aged over 80. This is in stark contrast to many Western cities where often the private car remains the dominant mode up until old age. In other aspects, findings are well compatible with European, North American or Australian research. For example, despite the importance of leisure trips, the majority of trips in Beijing are shopping trips, which confirms observations in Western cities such as London (Su et al., 2009). How far observations from Beijing or other large cities are comparable with findings from Manila is the topic of this paper. To the best of our knowledge, there do not appear to be any published papers focusing on trip generation and tour complexity of older people in South East Asia. In the following, we aim to reduce this gap by analysing a large travel survey from Manila and add comparisons to London where suitable.

3. Data

In recent years the Japan International Cooperation Agency (JICA) conducted several studies in major cities of developing countries in order to help these to develop sustainable transport strategy plans. In many cases policy recommendations were based on an extensive travel survey of households and individuals. The main data used for this study is part of the Person Trip Survey (PTS), which was conducted as part of the Metro Manila Urban Travel Integration Study (MMUTIS). The study area is the larger metropolitan area of Manila (generally abbreviated as Metro Manila). The zones of the study areas and their population density can be seen in Figure 3. The PTS database covers a sample of 274,000 individuals, which is equivalent to 1.9% of Metro Manila population. Information about household and individual characteristics are included as well as a one-day travel diary of each respondent. The interviews were conducted in 1996, leaving us with a slightly outdated, though for our analysis still interesting database. The survey was conducted with the aim to interview around 2.5% of the households in each of the central zones in Manila and 0.8% of the households in the larger zones at the city outskirts. A few zones are oversampled but in general this goal was also achieved.

For our analysis we only use data of respondents aged 60 or over. Though in many studies based on data from developed countries only those aged 65 or over are considered as "older", we believe that a cut-off value of 60 is more appropriate in Manila given the generally lower life expectancy. 5% of the sample are aged 60+ which is a slight oversampling though corresponds fairly well to Census statistics discussed before (4.73% in 2000).

Significant effort had to be made to clean our database of incomplete observations, in particular of respondents who do not report all trips (for example identified by the second trip starting at a very different location than the destination of the first trip). We selected only those respondents who either make no trip or at least one *full* tour with at least one stop and without any missing trips of tours starting from home and finishing at home. The remaining data is summarized in Table 1. The table shows that the sample size of people aged 85 or over is quite low. As our objective is to study older people we chose not to merge this group with people aged 80 to 84 in the following descriptive analysis. Instead we point out that some observations for this group are not statistically significant.

For our comparison of travel characteristics in Manila with those in London, we use an additional data source for the London data. The data used in this case is from the 2001 London Area Travel Survey (LATS), made available by Transport for London (TfL) and utilized among others in Schmöcker et al. (2010). The data includes a total of 67252 individuals and 176453 trips. After reducing the data to people aged 60 or over 11919 individuals remain making 27672 trips.

For the comparative analysis described in the following section, it is important to keep in mind the differences in the transportation systems in the two cities. In particular the mode choice options differ significantly as public transport in Manila consists of LRT and buses as well as jeepneys, tricycles and mini-buses. Further, using two different data sets means there are some (though fairly minor) differences in definitions of trip types. Table 2 clarifies the terminology used throughout the remainder of this paper.

4. Descriptive analysis of travel behaviour

4.1 Trip numbers and trip distance

As expected in general the average trip frequency decreases as people get older. This occurs in both cities at a similar rate, but Londoners make more trips in general as shown in Figure 4. Figure 5 plots average trip length by age groups for all trips and for recreational trips in Manila. Interestingly there is an increase in the length of trips for those aged in their late 70s and early 80s in Manila, with a rapid decrease for those aged 85+. Even though our sample size for those aged 85+ is small, t-tests show that the difference between the 80-84 and the 85+ groups is significant ($p < 0.013$ %). The trip distance trend partly follows those reported in Schmöcker et al. (2005) for London. In particular the increase in average trip distance for recreational trips, as opposed to trips with other trip purposes, can also be observed in Manila for those aged in their 70s. This suggests that older people use their lower time constraints to travel further if they have the opportunity to do so. In contrast to London observations trip distance of recreational trips does not reduce among those aged 80 or over.

Figure 6 confirms that Londoners make more shopping and more recreational trips than older residents in Manila. In London shopping trips increase after retirement while recreational trips stay fairly constant. A different trend can be seen in Manila where shopping trips decrease with higher age and the majority of trips are for recreational purposes after the age of 70. Working trips decrease with age in both cities but more rapid in London. Looking at the proportion of trips by purpose highlights this result. Figure 7 shows that the proportion of working trips stays fairly constant in Manila but that working trips in London decrease to almost zero very rapidly with age. This result is consistent with a study by Martin and Preston (1994) which shows that older people in developing countries have a much smaller difference among age groups when it comes to continuing working.

The sharp decrease in recreational trips in Manila among older-old further qualifies our observations regarding trip distance. Recreational trips are less common in Manila, therefore, the continuously increasing trip distance of recreational trips observed in Figure 5 might be due to only a subset of older people with low physical and financial constraints making these trips with high age. Unfortunately, our data does not include information about physical impairments to support this presumption.

Utilizing information on arrival time at the destination and start time of the next trip, we can further analyze the average time people spend at destinations. Older Manilans spend longer time per trip at the destination compared to their London counterparts (Figure 8). There might be various reasons for this; we suggest that these are, among others, a less efficient transportation system. Spending more time at each destination might be a way to increase participation in social life, offsetting the reduced possibility to travel. One might hypothesize that in the future, with better transport and higher disposable income, total trips will increase and duration at each destination might decrease. A further reason might be that during the last decades in Manila large complexes have developed, combining shopping and recreational facilities as well as churches. Such “one stop for all purposes” destinations reduce the need for multiple trips. This might partly explain the lower total number of trips as well as longer time spent at each destination.

Though our focus is on trip generation and tour patterns we include Figure 9 on mode choice to derive some of our overall conclusions about travel patterns and active ageing in Manila. Firstly, one can observe a similar percentage of trips made by walking as well as similar age effects in Manila compared to London. Secondly, one can observe contrary trends regarding public transport and private car usage. Among those aged 60-64 public transport has the same modal share in Manila as car usage in London. With increasing age the decrease in public transport usage in Manila is almost identical to the decrease of car usage in London. Similarly, in the same way as public transport usage is increasing in London, car usage is increasing with age in Manila. Note that car usage in our case does not differentiate driving or being driven (due to data restrictions in the Manila dataset).

We suspect that the effect shown in Figure 9 is partly because the public transport system in London is more developed and accessible for elderly preferences, while the system in Manila is less accessible for those with impairments. Conversations with Manilans further suggest that crowding and dirt are reasons preventing more public transport usage. Note that public transport in Manila includes several paratransit modes such as jeepneys. Entering these can become troublesome for Manilans with health problems. We suspect that the increase in car usage among older Manilans is likely because they are being driven by a family member. Further analysis (not shown for brevity) give some further evidence to our observations: When analyzing the percentage of car trips by age and household size, we observe that for younger-old Manilans the percentage of trips made by car is not significantly influenced by household size, whereas among older old, only those living in larger households make a significant number of their trips by car.

5. Ordered Regression Analysis

5.1. Model description

Multivariate probit models were conducted to disentangle how the different factors discussed in the previous sections affect the number of trips made and tour complexity. Our focus is on socio-demographic characteristics, we further control for population density following significant factors in the literature.

For our analysis we choose ordered probit models, as our dependent variables for both trip and tour complexity analysis is a count. Alternative model specifications are feasible such as Poisson models as used in Stern (1993). Roorda et al. (2010) also use ordered probit models and argue that these are preferable as this approach is better linked to behavioural theory following Train (2003). Specifically, the unexplained variation in number of trips (or stops per tour) made can be explained by the random component of the utility function. The error term in an ordered probit model follows a normal distribution, which is a reasonable assumption for choices such as whether an additional trip (or stop) should be made. The fact that trip numbers cannot be negative is covered in an ordered probit model by describing the utility as a latent variable.

Let y_i* denote the (latent) utility associated with making a number of trips for individual *i*. Further $\boldsymbol{x}_i$ is a ($k \times 1$) vector of independent (observed) non-random explanatory variables; $\boldsymbol{\beta}$ is a ($k \times 1$) vector of unknown (coefficients) parameters; ε_i is the random error term, which is assumed to be normally distributed with zero mean and unit variance.

$$y_i^* = \boldsymbol{x}_i\boldsymbol{\beta} + \varepsilon_i \quad (1)$$

In our ordered probit model y_i denotes then the observed number of trips (stops per tour) made by individual i. To convert $\mathbf{y}^*$ into $\mathbf{y}$ the cut points $\boldsymbol{\mu}$ are introduced as in (2).

$$y_i = \begin{cases} 0 & \text{if } -\infty \le y_i^* \le \mu_0 \\ 1 & \text{if } \mu_0 \le y_i^* \le \mu_1 \\ 2 & \text{if } \mu_1 \le y_i^* \le \mu_2 \\ & \dots \\ n & \text{if } \mu_{n-1} \le y_i^* \le \infty \end{cases} \quad (2)$$

In our model estimation, the n-1 cut points for n categories of trips (stops per tour) made are estimated along with the set of parameters $\boldsymbol{\beta}$. The parameters of the model are estimated by the method of maximum likelihood following Long (1997). Equation (3) then denotes the predicted probability of individual i making m trips for estimated coefficients $\hat{\boldsymbol{\beta}}$ and $\hat{\boldsymbol{\mu}}$. No constant appears in (3) as the effect is absorbed into the cut points.

$$\hat{\Pr}(y = m \mid \mathbf{X}_i) = F(\hat{\mu}_m - \mathbf{X}_i\hat{\boldsymbol{\beta}}) - F(\hat{\mu}_{m-1} - \mathbf{X}_i\hat{\boldsymbol{\beta}}) \quad (3)$$

Further following Long (1997), with σ_{y^*} denoting the standard deviation of $\mathbf{y}^*$ the vector $\boldsymbol{\beta}^{Sy}$ denotes our y-standardised parameter estimates which are given by

$$\beta_k^{Sy} = \frac{\beta_k}{\sigma_{y^*}} \quad (4)$$

This means that for a unit change in our observed independent variables x_k, $\boldsymbol{y}^*$ is expected to change by β_k^{Sy} standard deviations, holding all other variables constant. This ensures that even if our model is altered by additional independent variables the standardized variables are comparable. This is useful as we report two different model specifications in our following analysis on trips per day made.

5.2 Trip frequency results

After testing correlations among the independent variables and fitting several models, two models are presented in Table 3. Model B interacts income and vehicle ownership and groups population density in five categories, whereas Model A treats population density as a continuous variable. We find that in general the model fit is very low. Even though most of our variables are significant, the McFadden pseudo R2 is 0.089 in Model A and only slightly improved to 0.091 in Model B. These values are, however, very similar to model fits reported in other studies with ordered probit models such as Schmöcker et al. (2005) or Roorda et al. (2010). In addition we provide the Veill-Zimmermann R2, which suggests a slightly better model fit.

As expected we can see that age is significant, where younger old make more trips. Similarly expected is that females tend to make more trips than males and that access to a private car as well as holding a driving license also increases the number of trips made. As in London or in the study on three Canadian cities by Roorda (2010) the effect of driving license is more important than that of having access to a car within the household. Personal income is further highly significant with the expected signs of more trips made by those in the highest income group[1]. This confirms London or Montréal results where income has a fairly linear positive effect on trips. We find, however, some surprising non-linear effects of income in our Model A. Those with an income between P6–10k per month tend to make more trips than those with higher income except for those with very high income. Model B confirms that the effect of car ownership is constant across the income groups. Household structure only has a significant effect comparing the largest and smallest household size groups. Older people living in small households without children tend to make more trips. It might be that trips of those in large households decrease because they take care of (presumably) grandchildren or because other household members make necessary trips such as shopping for them. This is also hypothesized in Paez et al (2007) where they note that there might be some substitution in trip making in households with multiple persons (the one exception being single parents). Also in London the general trend that those living in smaller households tend to make more trips can be observed. The impact of having children or grandchildren is, however, reported to rather increase trips in London, whereas this cannot be found in our Manila data. A possible explanation for this might be that family life in the Philippines is often more home-based.

Model A further suggests that the population density in the area, where the person lives, influences the number of trips made. Model B shows that especially those living in areas with very low population density tend to make less trips. The effect on trips between different categories of higher population densities is still significant though not that pronounced. Figure 3 illustrates the population densities of zones. Further regression models conducted for specific trip types suggest that especially shopping trips are affected by living in areas with low population density. Therefore, our results possibly suggest that especially for elderly living in the outskirts of Metro Manila it is difficult to access recreational and shopping facilities.

5.3 Tour complexity results

In addition to the trip database a tour database has been constructed so that the ordered probit models for trip frequency could be duplicated for tour complexity (Table 4). Our proxy for tour complexity is stops per tour similar to the London analysis by Schmöcker et al. (2010). Though Schmöcker et al. report the usefulness to distinguish different tour types by their anchor points, for simplicity, we only conduct here an analysis for tours with home as tour start and end point. The model fit is low, with a pseudo R2 of 0.066, but again the fit is well compatible to those reported for analysis with London data. Firstly, it should be noted that the overall tour complexity of tours is significantly lower in Manila compared to London. The average number of stops per tour in Manila is 1.13 whereas the London data showed an average of 1.4. Given the results of our descriptive analysis, we suggest that this might again support our assumption that older Manilans tend to do more tours to malls that satisfy a large number of recreational and shopping demands at a single location.

We find that income has the expected positive effect on tour complexity. The effect of household structure is not very clear as we find only significant effects for those in medium sized households. Age does not seem to have any significant effect on tour complexity, in contrast to London observations. A possible explanation might be the reduced tendency to use public transit with increasing age as shown in Figure 8. In other words, a negative effect of age on tour complexity might be offset by possibilities

[1] We conducted the same regression with household income instead of private personal income which similarly shows that a higher income leads to more trips, but because the *household income* data appear more unreliable (e.g. often no income was stated even though an individual of the household states a monthly income) we have chosen to conduct the analysis based on private personal income.

to conduct additional stops within increasingly frequent tours made with car as the main mode of transport.

Further, compared to London data or US results by McGuckin and Murakami (1999), we find an opposite trend for gender, as males tend to make more complex tours. As men presumably less frequently travel to the large shopping malls, which are likely to result in simple home-mall-home tours, this appears to be a plausible result. Men tend to keep working until older age and our model further confirms that tours that include a work trip tend to be the most complex. In fact, tours with primary purpose shopping are the least complex ones.

The population density of the household zone has further significant impact on the complexity of tours. We find that people living in the densest areas of Manila not only make the most trips but also the most complex tours. Generally, higher population density appears to encourage trip chaining though the effect is not monotonous. In particular, those living in areas with density 15-25k persons/km^2 make less complex tours than one might expect. Compared to this, Schmöcker et al. report for London a reverse positive effect for those living in very low-density areas, which cannot be observed in Manila. The reasons for this are unknown, one might speculate that older people in the outskirts of London have more chances to visit central London and then combine several errands into one tour, whereas the less efficient transport network in Manila does not encourage older people to do so.

Finally, we include total tour numbers per day to illustrate the negative relationship between tour complexity and tour numbers. We include this variable even though there might be some endogenous effects, as the causality between tour numbers and tour complexity is not clear. Model specifications that omit total numbers per tour do, however, not change our observations discussed in this section.

6 Discussion and conclusions

The demographic trends shown in our introduction will clearly influence travel behaviour and hence have policy implications: We find that as people get older they will make shorter and less complex tours in general but more and longer recreational trips. As income increases, more trips will be made by car. Further, car usage appears to increase in Manila already among younger-old. Taking these two trends together, the total number of car trips made by older Manilans are hence likely to significantly increase in the near future.

Another demographic that is changing currently is the household structure. In our Manila sample, we find only 1% of older population living alone, in London it is 36% who live by themselves. Though, such a high percentage might not be attained in Manila due to possibly stronger family bonds, it is likely to be increasing. For example the average household size in the Philippines has already reduced from 5.6 in 1980 to 5.0 persons per household in 2000 (NSO, 2009). Based on our analysis, we presume that many of the car trips made by older old Manilans are made as passenger. Whether in the future some of these trips will be suppressed or substituted by public transport will in part depend on investments made into the transport network. As shown younger-old are using public transport much more than in London.

Older old Manilans use public transport far less though compared to Londoners in the same age group. To keep the share of public transport users high in an ageing society will require investments in its accessibility. Based on UITP 2000 data, Ooi (2008) reports that public transport investments in Manila with 8.4 US$ per capita are lower than those in other megacities in South-East Asia such as Jakarta (9.2

US$) or Kuala Lumpur (75.3 US$)[2]. Especially when recreational and shopping trips are increasing in the future due to higher income, there is a danger that the share of these trips being made by car will further increase. Currently in London 37% of shopping trips are made by car while only 6% of these trips in Manila are made by car. Similar to London recreational trips tend to become longer with age for the younger-old. Increasing car availability might hence lead to more shopping trips and more as well as longer recreational trips made by private car. Further, low traffic efficiency might be one reason for the generally low tour complexity. According to 2000 UITP data, average network speed in Manila is 18km/h compared to for example 28.7km/h in London. If some of the urgent traffic congestion problems can be solved the car might hence become even more attractive for older people (but an increase in automobility of older Manilans might of course be counterproductive to improvement efforts.)

Based on our descriptive and regression analysis we suggest that the multi-purpose malls in Manila have a significant impact on trip numbers and tour complexity. It seems reasonable to conclude that these malls have an important function in the life of older Manilans. Several studies such as Cai (2008) suggest though that neighbourhood design with attractive local shopping options is important for active ageing. Therefore, it should be topic of further research in how far these malls can really cater for active ageing needs, especially of older old.

Older people in Manila appear to keep working to a much greater extent than their counterparts in London even in old age. This trend can be seen among older Manilas for all income groups. In fact, we find that especially those with high income among older-old conduct more work trips. This suggests that it is not so much a necessity but a voluntary activity, possibly to keep being an active member of society. Together with our observations regarding possibility to fulfil a multitude of demands at a single destination, we, hence, suggest that trip numbers are indeed only partly a measure for active ageing. Similarly, Banister and Bowling (2003) write that to describe the benefits of mobility "standard transport representations in form of trips made, travel distance and transport mode only represents a part of the picture".

Our study clearly has a number of limitations. Firstly, our data are rather old. Unfortunately newer data from the region are not available. JICA conducted a number of studies that involved collecting personal travel surveys, some of them after the year 2000 (see Hyodo et al. (2005) for an overview). Many of these datasets appear though not large enough or are not detailed enough to conduct an analysis similar to the one conducted here. Especially since several Southeast Asian cities are rapidly developing similar to Manila and given the ageing trends described in the introduction, this calls for the collection of newer and better data sets. Secondly, a number of key variables to understand older people travel behaviour are missing in this data set. In particular mobility impairments of the respondents are unknown. As argued especially older old Manilans might face mobility problems, a result that might be emphasised if data on mobility impairments were available. A third area of future research would be to disentangle culture specific effects. Throughout this paper we argued that economic trends might lead to changes in demographics similar to those in London possibly leading to similar effects on trip and tour patterns. To understand in how individual travel demand is influenced by the different culture is beyond the scope of this paper.

[2] The UITP 2000 might predate some important investments in the Manila public transport network, in particular investments in the LRT network

Acknowledgements

The first author thanks the Sweden-Japan foundation and ‘‘Stiftelsen Marcus och Amelia Wallenbergs Minnesfond” for their financial support. Further, we would like to thank the editors and two anonymous reviewers for their helpful comments on an earlier draft of this paper.

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Tables

Figures

Table 1: Manila data used in this study

	Surveyed people		**Trip makers**		**Tours**		**Trips**	
	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage
60-64	4948	46.33%	3164	53.97%	3370	54.00%	7229	54.35%
65-69	3310	30.99%	1839	31.37%	1959	31.39%	4174	31.38%
70-74	1228	11.50%	514	8.77%	550	8.81%	1150	8.65%
75-79	631	5.91%	217	3.70%	225	3.61%	464	3.49%
80-84	342	3.20%	83	1.42%	91	1.46%	190	1.43%
85 and over	221	2.07%	45	0.77%	46	0.74%	95	0.71%
Total	10680	100%	5862	100%	6241	100%	13302	100%

Table 2: Terminology

Trips and Tour Purpose	
Working trip	
Manila	Trips with purpose *work* or an *employer's business*
London	Trips with purpose *usual workplace*, *delivery/loading* or *other work*
Shopping trip	
Both cities	Trips with purpose *shopping*
Personal business trip	
Manila	Trips with purpose *private business* or a *medical activity*
London	Trips with purpose *use services/private business*
Recreational trip	
Manila	Trips with purpose *social activity*, *eating*, *church* or *others*
London	Trips with purpose *entertainment, sport, social activity,* visiting a *hotel/holiday home* or *others*
Trip Mode	
Car	
Manila	Only a private car and/or a jeep is used for the trip (driver or passenger)
London	A car is used as main mode as driver or car passenger
Public Transport	
Manila	A trip includes at least one of the following modes of transport: Tricycle, Jeepney, Mini-bus, standard bus or water transport. Note: If a trip includes the following modes: Car-Jeepney -Walk it is a classified as a public transport trip.
London	A trip includes at least one of the following modes: National rail, Underground, Light rail or bus.
Walk	
In both cities	The whole trip is made on foot
Household Structure (used in Manila regression analysis)	
Small	1 or 2 persons aged over 4 or over
Medium	3 or 4 persons aged 4 or over
Large	5 or more persons aged 4 or over

Table 3: Ordered Probit Model: Number of Trips

	Marginal percentage	MODEL A Estimate	MODEL A y standardized	MODEL A t-value	MODEL B Estimate	MODEL B y standardized	MODEL B t-value
Cut points							
0 trips / μ_1 (0 trips < μ_1)	44.3%	**-0.849**	**-0.694**	5.94	**-0.622**	**-0.509**	-4.54
2 trips/ μ_2 (μ_1 < 2 trips < μ_2)	48.0%	**0.912**	**0.746**	6.42	**1.142**	**0.934**	8.34
3 trips/ μ_3 (μ_2 < 3 trips < μ_3)	2.7%	**1.154**	**0.944**	8.13	**1.384**	**1.132**	10.10
4 trips/ μ_4 (μ_3 < 2 trips < μ_4)	3.9%	**1.883**	**1.540**	12.99	**2.112**	**1.727**	15.09
5+ trips (μ_4 < 5 trips or more)	1.1%	--	--	--	--	--	--
Age group							
60-64	46.7%	**0.955**	**0.781**	9.27	**0.934**	**0.764**	9.07
65-69	30.8%	**0.824**	**0.674**	7.93	**0.804**	**0.657**	7.73
70-74	11.5%	**0.562**	**0.460**	5.20	**0.540**	**0.442**	5.00
75-79	5.8%	**0.376**	**0.307**	3.30	**0.360**	**0.294**	3.16
80-84	3.1%	0.196	0.160	1.54	0.181	0.148	1.43
85+	2.0%	Reference	Reference	.	Reference	Reference	.
Gender							
Male	46.4%	**-0.211**	**-0.173**	-8.12	**-0.209**	**-0.171**	-8.04
Female	53.6%	Reference	Reference	.	Reference	Reference	.
Income							
No income	53.6%	**-1.060**	**-0.867**	-11.78			
under P3.000	18.1%	**-0.539**	**-0.441**	-5.92			
P3.000 - P5.999	15.2%	**-0.382**	**-0.312**	-4.20			
P6.000 - P9.999	7.5%	**-0.277**	**-0.226**	-2.92			
P10.000 - P14.999	2.9%	**-0.310**	**-0.253**	-2.87			
P15.000 - P19.999	1.1%	**-0.506**	**-0.414**	-3.67			
P20.000 and over	1.7%	Reference	Reference	.			
Vehicle ownership							
No owned vehicle	72.8%	**-0.094**	**-0.077**	-3.36			
One or more owned vehicles	27.2%	Reference	Reference	.			
Income and vehicle ownership							
No income. without vehicle	40.4%				**-0.915**	**-0.748**	-12.53
No income. with vehicle	13.1%				**-0.842**	**-0.688**	-10.79
under P3.000. without vehicle	13.8%				**-0.398**	**-0.325**	-5.17
under P3.000. with vehicle	4.3%				**-0.277**	**-0.226**	-3.18
P3.000 - P5.999. without vehicle	11.4%				**-0.234**	**-0.191**	-3.04
P3.000 - P5.999. with vehicle	3.8%				*-0.171*	*-0.140*	-1.92
P6.000 - P9.999. without vehicle	4.7%				*-0.146*	*-0.119*	-1.70
P6.000 - P9.999. with vehicle	2.7%				-0.039	-0.032	-0.41
P10.000 - P14.999. without vehicle	1.6%				**-0.232**	**-0.190**	-2.07
P10.000 - P14.999. with vehicle	1.3%				-0.021	-0.017	-0.18
P15.000 and over	2.9%				Reference	Reference	.
Driving license							
No license	88.8%	**-0.541**	**-0.442**	-12.88	**-0.540**	**-0.442**	-12.86
Has a license	11.2%	Reference	Reference	.	Reference		
Household structure							
Small. without children	16.3%				**0.215**	**0.176**	3.77
Small. with children	1.0%				0.075	0.061	0.58
Medium. without children	45.9%				0.085	0.070	1.63
Medium. with children	6.2%				0.017	0.014	0.25
Large. without children	24.6%				-0.019	-0.016	-0.35
Large. with children	6.0%			.	Reference	Reference	
Household size							
Number of people aged 4 and above		**-0.45**	**-0.037**	-5.63			
Children							
No children	86.8%	0.29	0.024	0.81			
One or more children	13.2%	Reference	Reference				

(Table 3 continued)	Marginal percentage	MODEL A			MODEL B		
		Estimate	y standardized	t-value	Estimate	y standardized	t-value
Population density *(10000per/km2)*		**0.026**	**0.021**	6.50			
1-5000 per/km2	21.1%				**-0.330**	**-0.270**	-8.68
5001-15000 per/km2	23.7%				**-0.116**	**-0.095**	-3.22
15001-25000 per/km2	15.9%				**-0.139**	**-0.114**	-3.48
25001-50000 per/km2	19.8%				**-0.083**	**-0.068**	-2.24
over 50000 per/km2	19.5%				Reference	Reference	.
Model Fit							
Log Likelihood (Intercept only)			-9873.7			-9873.7	
Log Likelihood			-8996.5			-8983.6	
McFadden R2			0.088			0.090	
Veall-Zimmermann R2			0.195			0.197	

Table 4: Ordered Probit Model: Number of stops per tour

	Marginal percentage	Model 1 Estimate	y standardized	t-value
Cut points				
1 stop / μ_1 (1 stop < μ_1)	92.0%	**0.571**	**1.420**	3.00
2 stops / μ_2 (μ_1 < 2 stops < μ_2)	4.9%	**1.066**	**2.652**	5.58
3+ stops (μ_2 < 3+ stops)	3.1%	--	--	--
Age group				
60-64	54.3%	Reference	Reference	
65-69	31.1%	0.007	0.017	0.12
70-74	8.9%	-0.066	-0.164	-0.71
75-79	3.6%	-0.239	-0.595	-1.56
80-84	1.5%	-0.260	-0.647	-1.12
85+	0.7%	-0.541	-1.346	-1.30
Gender				
Male	47.9%	**0.134**	**0.333**	2.48
Female	52.1%	Reference	Reference	
Household structure				
Small. without kids	18.7%	-0.182	-0.453	-1.64
Small. with kids	1.0%	*-0.611*	*-1.520*	-1.77
Medium. without kids	47.4%	**-0.227**	**-0.565**	-2.25
Medium. with kids	5.7%	-0.16	-0.398	-1.14
Large. without kids	21.8%	-0.167	-0.415	-1.56
Large. with kids	5.3%	Reference	Reference	
Income				
No income	39.8%	**-0.721**	**-1.794**	-5.72
under P3.000	21.4%	**-0.643**	**-1.600**	-5.19
P3.000 - P5.999	19.9%	**-0.407**	**-1.012**	-3.36
P6.000 - P9.999	10.6%	**-0.325**	**-0.808**	-2.58
P10.000 - P14.999	4.0%	*-0.289*	*-0.719*	-1.97
P15.000 - P19.999	1.4%	**-0.395**	**-0.983**	-1.98
P20.000 and over	2.8%	Reference	Reference	
Vehicle ownership				
No owned vehicle	69.7%	**-0.243**	**-0.604**	-4.50
One or more owned vehicles	30.3%	Reference	Reference	
Population density				
1-5000 per/km2	17.7%	**-0.264**	**-0.657**	-3.26
5001-15000 per/km2	24.5%	**-0.166**	**-0.413**	-2.31
15001-25000 per/km2	16.3%	**-0.227**	**-0.565**	-2.77
25001-50000 per/km2	20.7%	**-0.101**	**-0.251**	-1.38
over 50000 per/km2	20.8%	Reference	Reference	
Tour purpose				
Others	5.3%	0.214	0.532	1.56
Recreational	20.8%	**0.354**	**0.881**	4.07
Work	34.3%	**0.447**	**1.112**	5.32
Personal business	12.8%	**0.585**	**1.455**	6.43
Shopping	26.8%	Reference	Reference	
Number of tours		**-0.206**	**-0.512**	-2.90
Model fit				
Log Likelihood (Intercept only)			-1961.4	
Log Likelihood			-1832.6	
McFadden R2			0.066	
Veall-Zimmermann R2			0.102	

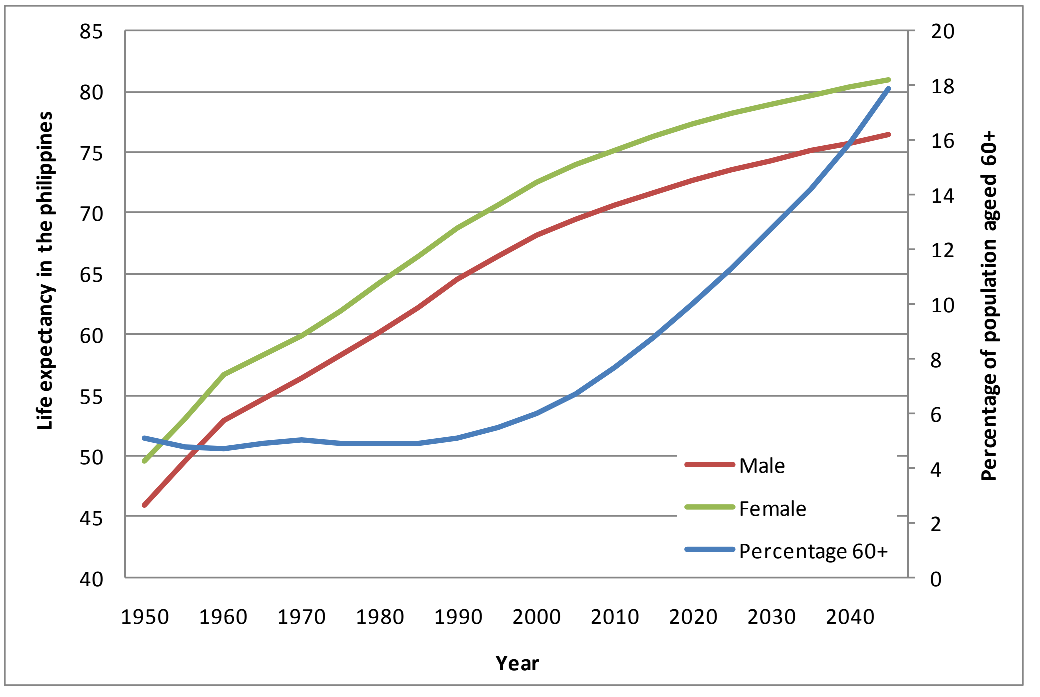

Figure 1: Proportion of elderly and life expectancy in the Philippines. Data taken from: UN (2008)

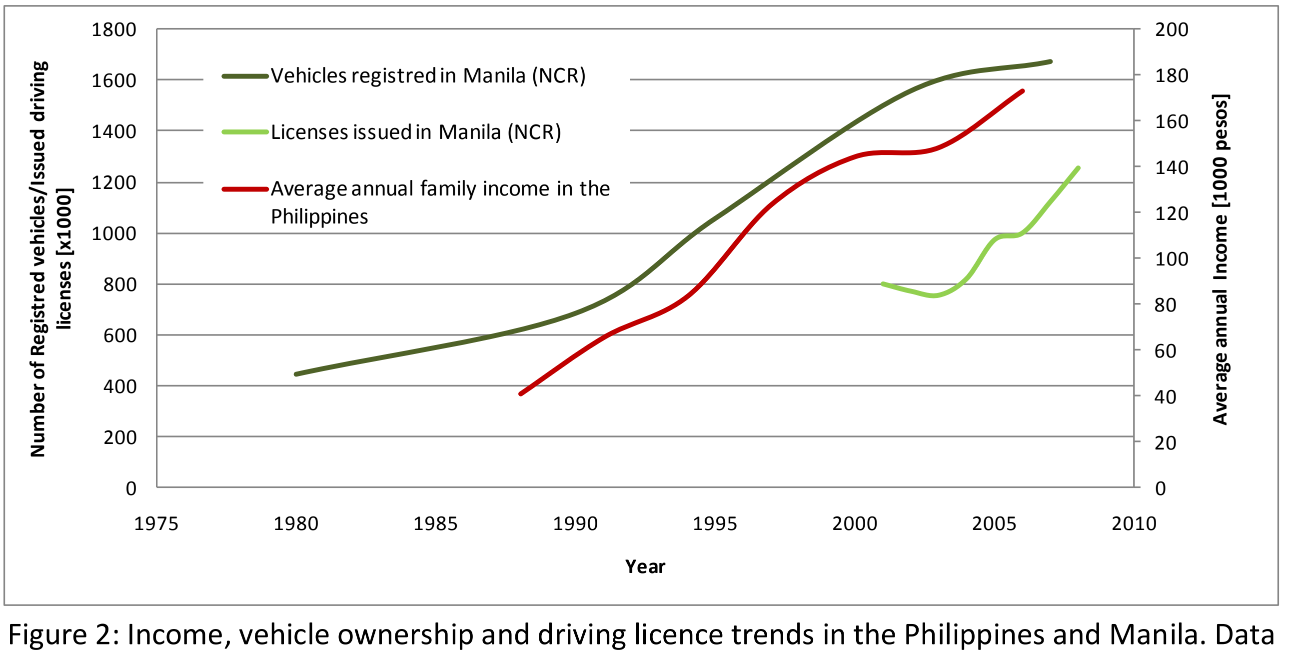

Figure 2: Income, vehicle ownership and driving licence trends in the Philippines and Manila. Data taken from: NSO (2009); LTO (2009) and JICA (1999)

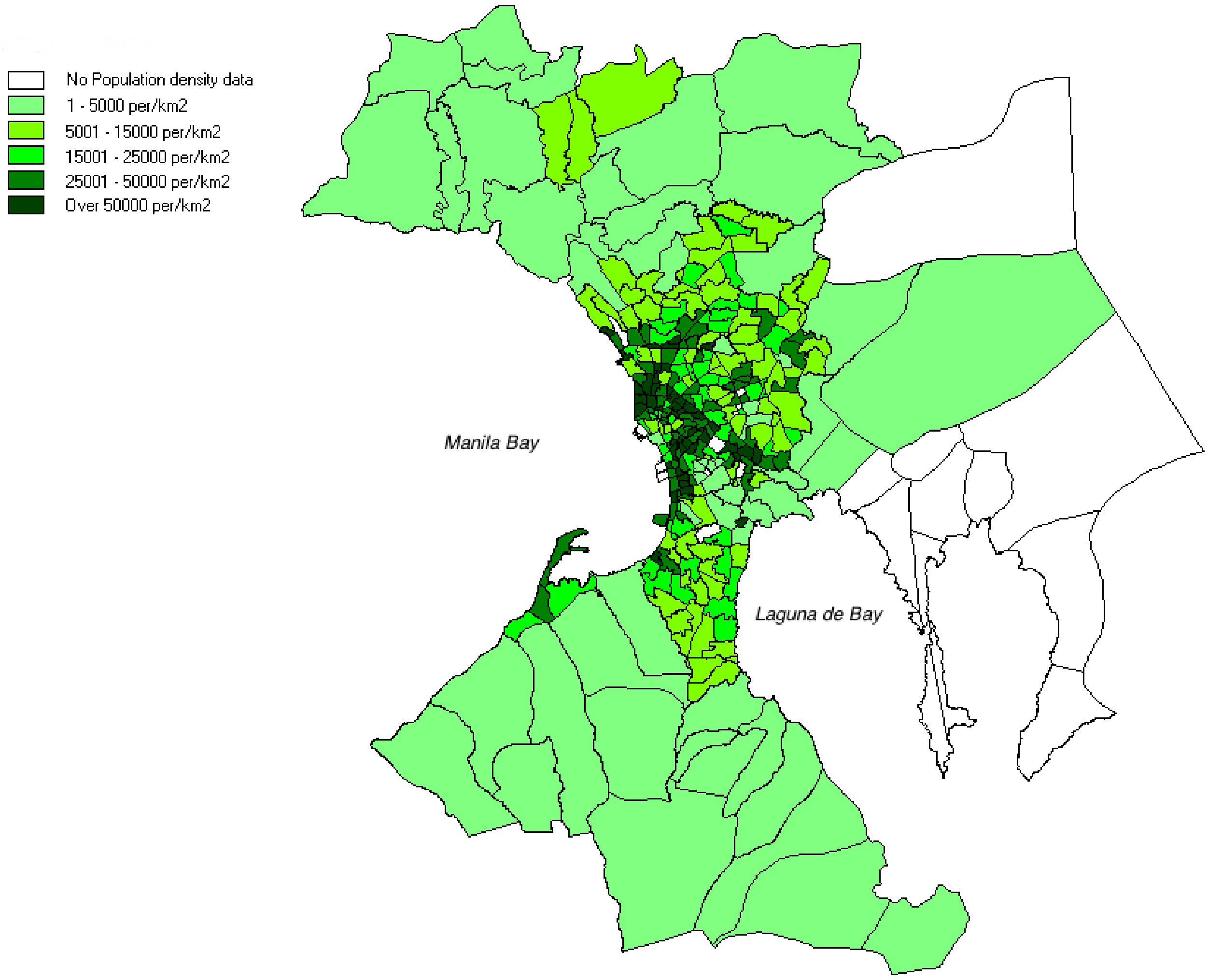

Figure 3: Study area and population density

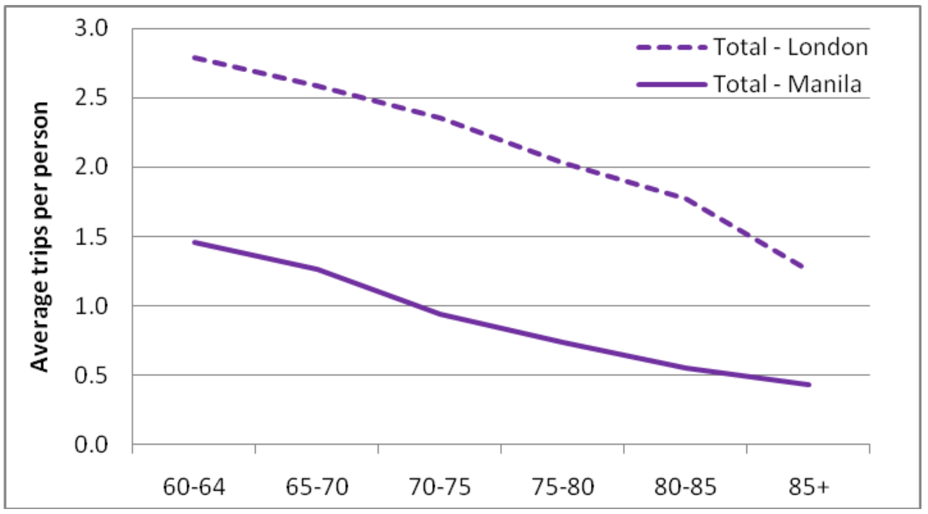

Figure 4: Average trips per person by age

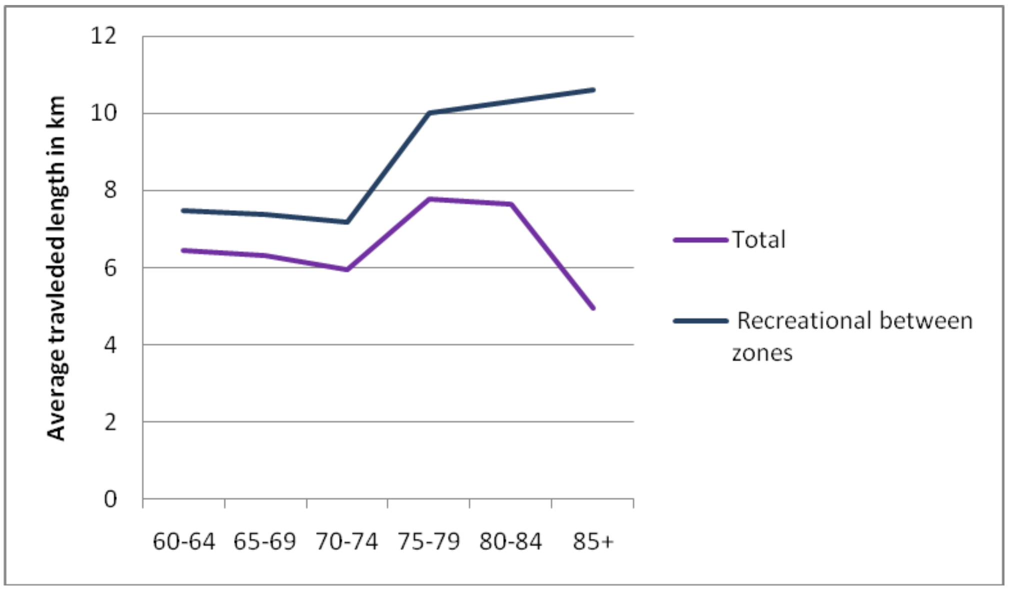

Figure 5: Average trip length in Manila

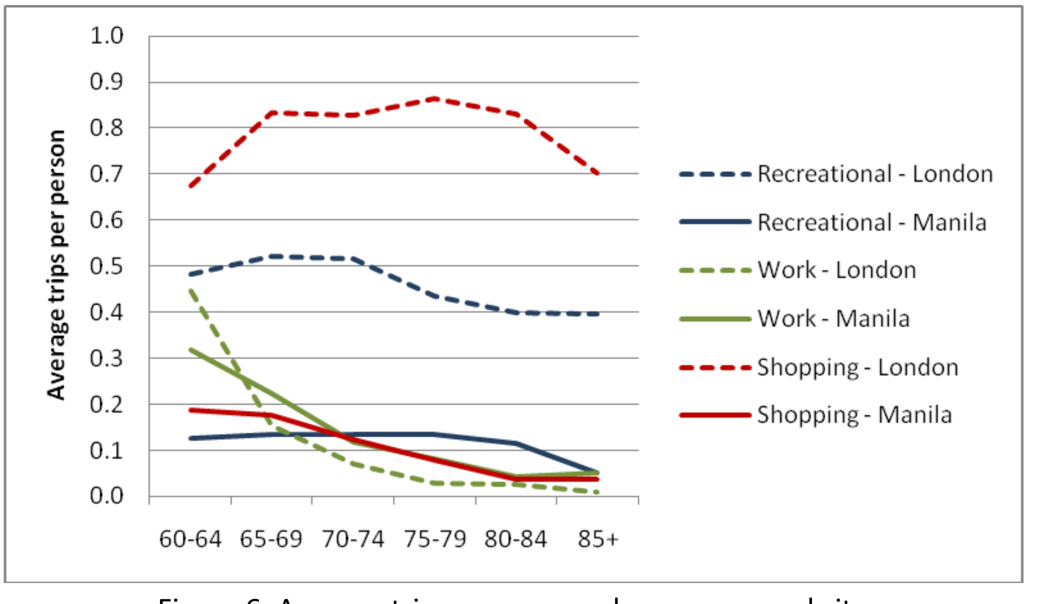

Figure 6: Average trips per person, by purpose and city

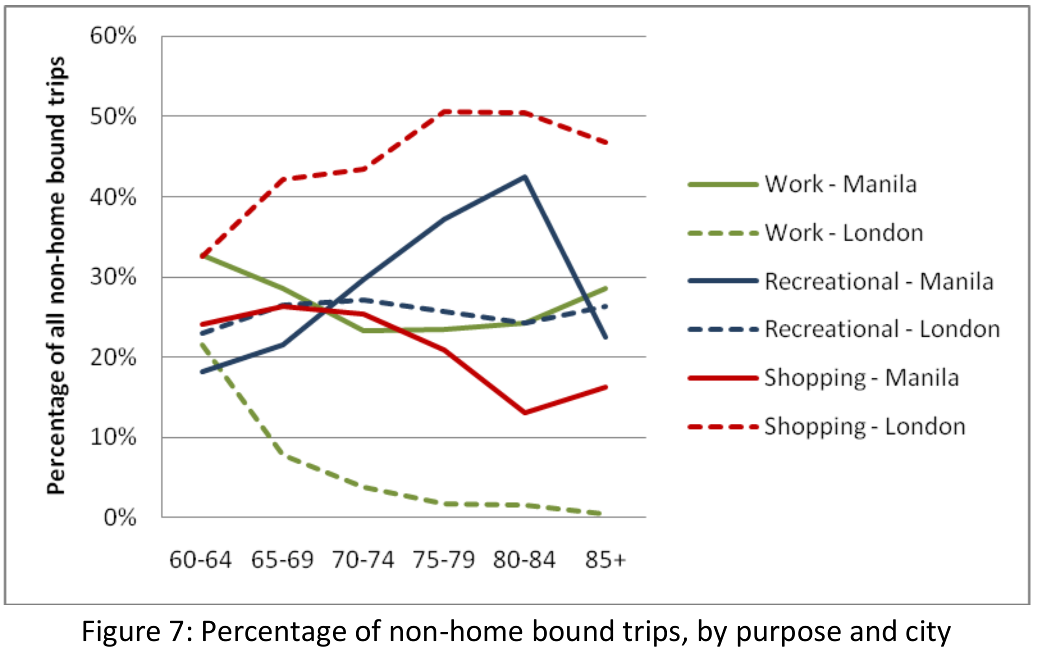

Figure 7: Percentage of non-home bound trips, by purpose and city

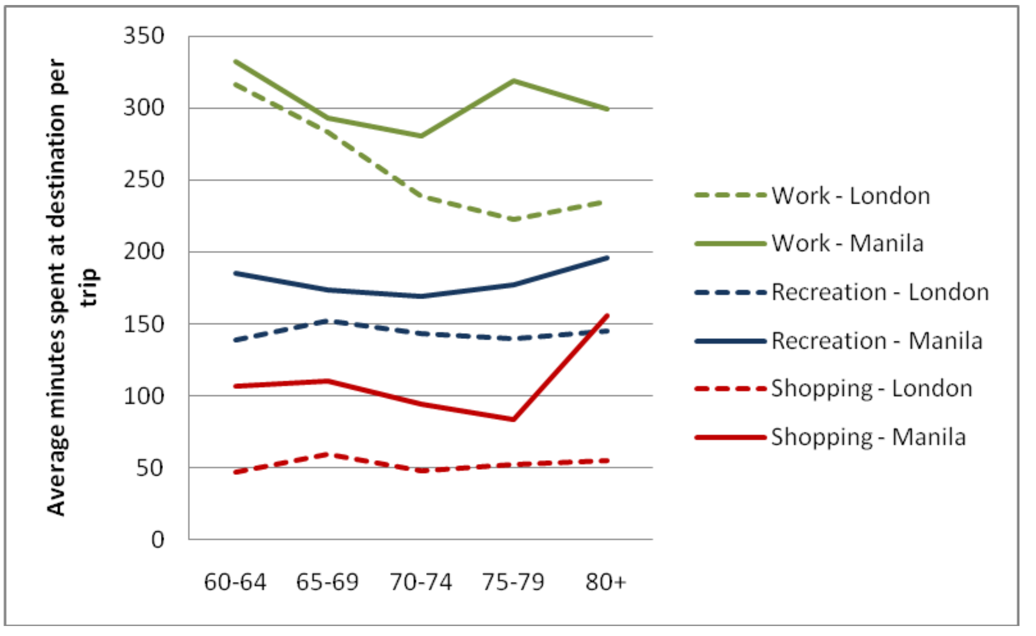

Figure 8: Average time spent at the destination

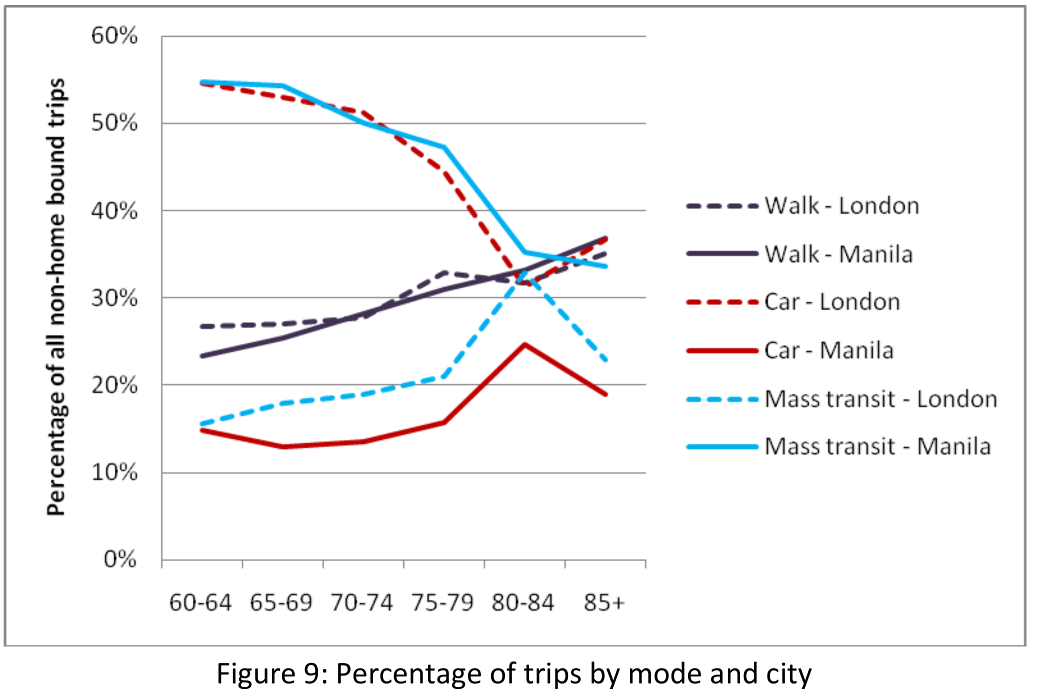

Figure 9: Percentage of trips by mode and city