# Comparison of Observed Trip Patterns: Relation of Number of Trips and Purposes of Trips in Tokyo and in Matsuyama City Regional Area

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## 1. Introduction

In this paper, we analyzed the people flow data of 24 hours' moving behaviors of about 20,000 persons in Matsuyama City, Ehime, Japan (surveyed in Oct. 1st, 2007) and about 500,000 persons in Tokyo metropolitan area (surveyed in Oct. 1st, 2008), and investigated the relation between the number of trips and purposes of trips. We also investigated the combinations of different trip purposes (trip patterns) and the relation between gender and these patterns.

## 2. Relation between the number of trips and purposes of trips

In the people flow data, "trip" is a movement from a origin zone to a destination zone. Flow data include the attributes of the purpose and the mode of each trip. We focused on the number of trips of each person in a day and the purpose of each trip, and investigated the relationships.

Table 1. The number of samples for each number of trips

| Tokyo | | | | Matsuyama | | | |
|---|---|---|---|---|---|---|---|
| No. of trips | No. of samples | Ratio % | Accu. ratio % | No. of trips | No. of samples | Ratio % | Accu. ratio % |
| 0 | 39 | 0.01 | 0.01 | 0 | 0 | 0 | 0 |
| 1 | 11043 | 2.29 | 2.30 | 1 | 0 | 0 | 0 |
| 2 | 282641 | 58.57 | 60.87 | 2 | 12183 | 60.76 | 60.76 |
| 3 | 73115 | 15.15 | 76.02 | 3 | 2461 | 12.28 | 73.04 |
| 4 | 71932 | 14.91 | 90.92 | 4 | 3225 | 16.08 | 89.12 |
| **5** | **20615** | **4.27** | **95.19** | **5** | **911** | 4.55 | **93.67** |
| 6 | 12898 | 2.67 | 97.87 | 6 | 626 | 3.12 | 96.79 |
| 7 | 5731 | 1.19 | 99.05 | 7 | 327 | 1.63 | 98.42 |
| 8 | **3689** | 0.76 | 99.82 | 8 | **247** | 1.23 | 99.65 |
| 9 | **354** | 0.07 | 99.89 | 9 | **33** | 0.17 | 99.82 |
| 10 | 199 | 0.04 | 99.93 | 10 | 17 | 0.08 | 99.90 |
| 11 | 130 | 0.03 | 99.96 | 11 | 8 | 0.04 | 99.94 |
| 12 | 66 | 0.01 | 99.97 | 12 | 7 | 0.04 | 99.98 |
| 13 | 46 | 0.01 | 99.98 | 13 | 2 | 0.01 | 99.99 |

Table 1 shows the numbers of persons of different number of trips observed in Tokyo and Matsuyama city region. From these results, in both city regions, we found that (1) the number of the people of one to four trips amount to nearly 95%, and (2) the number of the people of nine trips is about 1/10 of eight trips. This means that there should be a common threshold value of the number of destinations in a day's movement in every city region.

Figure 1 and Figure 2 show a ratio of trip purposes for each trip. In these figures, we illustrated only "Shopping", "Commute", "School commute" and "Returning home" trips.

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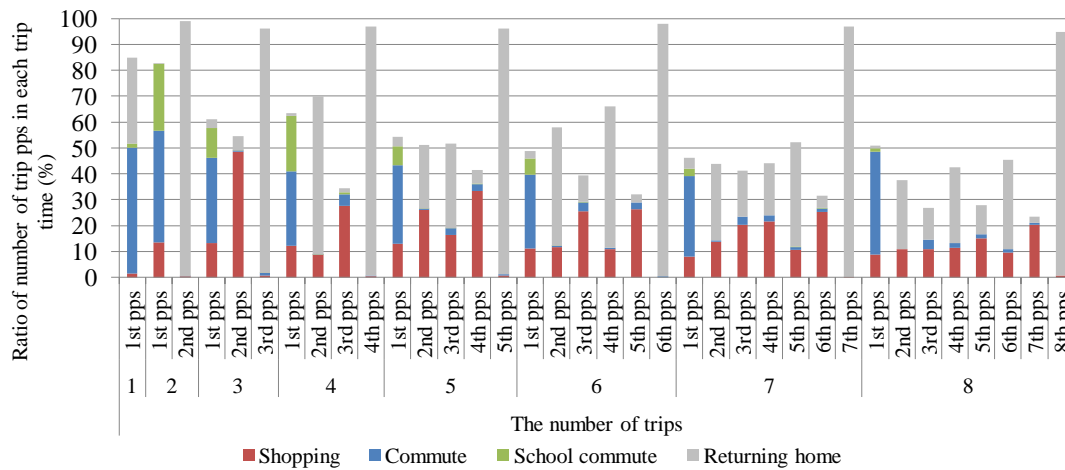
Figure 1. Ratio of trip purposes for each trip in Matsuyama
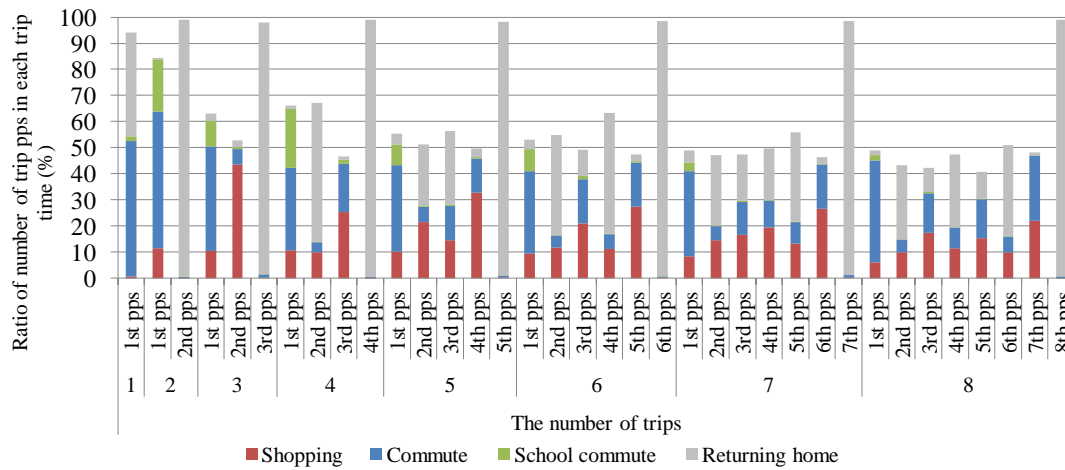


Figure 2. Ratio of trip purposes for each trip in Tokyo

From these results, we found the following common tendencies in two city regions: (1) shopping trip ratio are bigger larger before the final trip (Returning home), and (2) shopping trips are dispersed if the number of trips is larger.

Besides, although commute trips in Tokyo are distributed, in Matsuyama, they are concentrated in the 1st trip of the day. Accordingly, we thought that megacity dwellers' multifarious lifestyles reflect to their moving behaviors.

## 3. Relation between trip patterns and personal attributes

We aggregated each person's trip pattern (combinations of trip purposes) by regions and gender, then analyzed their characteristics and differences.

### 3.1. Differences of trip patterns by city region

We found the difference of lifestyles add trip patterns by city region. For example, in Table 2, Matsuyama has trip patterns that have "Picking up" in higher rank. We presume that the reason relates to the condition of the transportation in Matsuyama, which means people use a private automobile mainly. In contrast, Tokyo has trip patterns that have "Dinner/Social/Recreation", which is not higher-ranked in Matsuyama, in higher rank. We presume the reason is that the reflection of urban city dwellers' lifestyle: they commute by public transportation and drop in shops and restaurants near their transfer station after their work.

Table 2. Frequently trip patterns by the number of trip

| | | | Top five patterns in sample numbers | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | | | 1st | 2nd | 3rd | 4th | 5th |
| The number of trips | 2 times | Tokyo | Comm.-Home 145946 51.6% | School-Home 56370 19.9% | Shop-Home 32200 11.4% | Other private -Home 11026 3.9% | **Dinner/Social/ Recreation** -Home 8601 3.0% |
| | | Matsuyama | Comm.-Home 5241 43.0% | School-Home 3133 25.7% | Shop-Home 1603 13.2% | **Pick up**-Home 1038 8.5% | Dinner/Social -Home 248 2.0% |
| | 3 times | Tokyo | Comm.-Shop -Home 13301 18.2% | Comm.- **Dinner/Social/ Recreation** -Home 5262 7.2% | Other private -Shop-Home 4283 5.9% | Shop-Shop-Home 4000 5.5% | School -Other private -Home 3553 4.9% |
| | | Matsuyama | Comm.-Shop -Home 489 19.9% | **Pick up** -Shop-Home 319 13.0% | Shop-Shop-Home 156 6.3% | School-**Pick up** -Home 155 6.3% | **Pick up-Pick up** -Home 101 4.1% |
| | 4 times | Tokyo | School-Home -Other private -Home 10008 13.9% | Comm.-Meeting/ Domiciliary -Comm.-Home 3195 4.4% | School-Home -**Dinner/Social/ Recreation** -Home 2133 3.0% | Comm.-Home -Shop - Home 2098 2.9% | Comm. -**Dinner/Social/ Recreation** -Comm.-Home 1645 2.3% |
| | | Matsuyama | School-Home -**Pick up**-Home 411 12.7% | **Pick up**-Home -Shop-Home 153 4.7% | Comm.-Home -Shop-Home 148 4.6% | Comm.-Home -Comm.-Home 93 2.9% | Shop-Home -Shop-Home 91 2.8% |

3.2. Differences of trip patterns by gender

We considered about relationship between gender and moving behaviors. From Figure 3, we found about both cities that the ratio of Commute-Home trip is higher in male and the ratio of Commute-Shopping-Home trip is higher in female. This result means that many women juggle their job and housework in comparison with men, and we thought that this is consistent with a custom in current Japan.

Moreover, we understood that the ratio of male of Commute-Shopping-Home trip in Tokyo is higher than Matsuyama. We thought the reason is that more one-person households are in Tokyo than Matsuyama, hence a ratio of men who do housework themselves become higher.
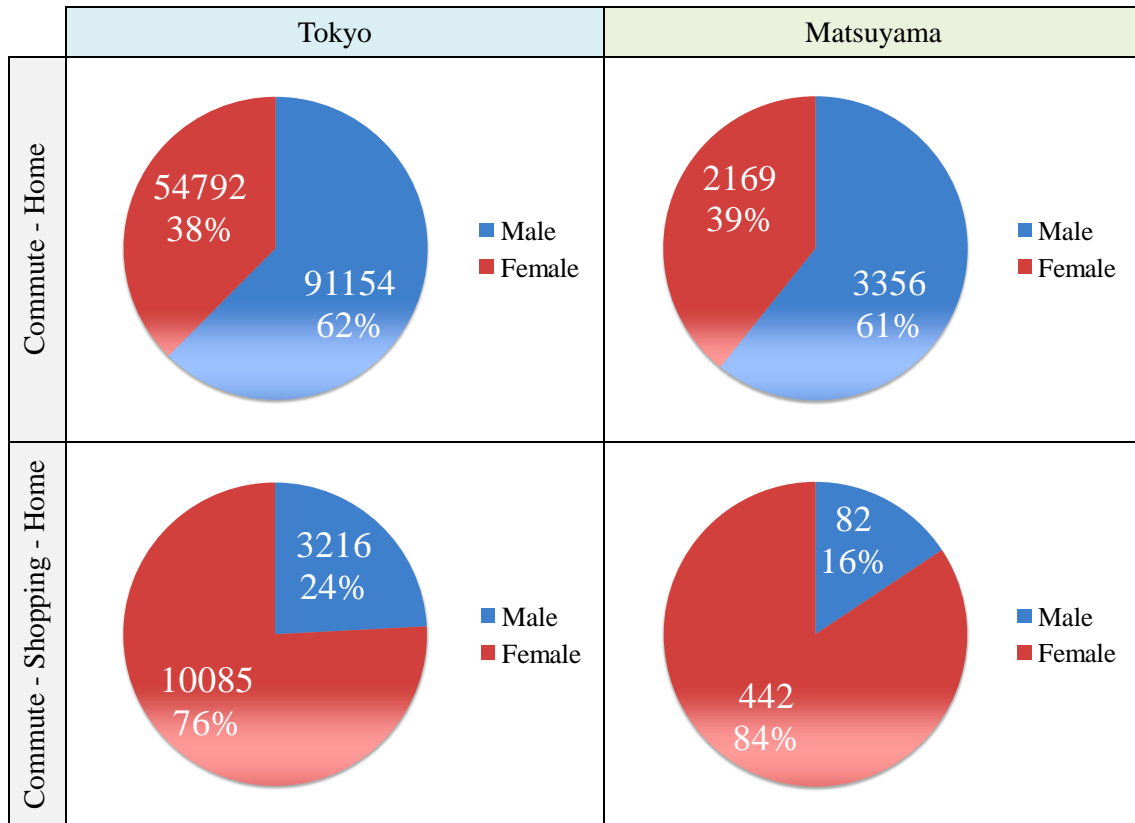
| | Tokyo | Matsuyama |
|---|---|---|
| Commute - Home | 54792 38% / 91154 62% ■Male ■Female | 2169 39% / 3356 61% ■Male ■Female |
| Commute - Shopping - Home | 3216 24% / 10085 76% ■Male ■Female | 82 16% / 442 84% ■Male ■Female |

Figure 3. Sex ratio of Commute - Home trip and Commute - Shopping - Home trip

## 4. Conclusion and discussion

According to the above results, we understood that the number of trips, gender and characteristics of each city region are greatly related to purposes of trips and trip patterns, which are important factors to specialize moving behaviors.

For the future, we think that we use these results to set the parameters for modeling of peoples' moving behaviors.

*Keywords: Person Flow Data, person trip data, trip patterns*