

Rail transit proximity and CO2 emissions from commuting

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Promoting green transportation and improving urban environment is issue we are most concerned about. We will see how rail transit works on reducing CO2 emissions through Shanghai case. We expect much on city future though, how we could have a promising future still needs to be figured out. In order to solve the problem of excessive traffic flow brought by Expo(2010), Shanghai has carried out a large-scale rail transit construction. In some years, it reached a maximum of 10km per month to ensure the smooth conduct of the Expo. Through the success of the Expo traffic organization, people began to realize the role of rail transit to solve the traffic problem in big cities. At present, many cities has begun to build large-scale subway system. What is the impact of such a large-scale construction on reducing CO2 emissions? What is the relationship between this large-scale construction and population density, car ownership and income? These issues require further study. In this way we can take more effective and comprehensive measures, rather than relying solely on the construction of subway system.

Here we estimate CO2 emissions of commuting trip based on different modes of transport. We can see that the emission intensity of the taxi is relatively high, the emission intensity of the car is very high, and the subway and the bus are relatively much lower. Therefore the mode of transport and people's travel distance have a great impact on CO2 emissions. If we take some restrictions on the use of cars in terms of modes of transport, it will obviously reduce the emissions of carbon dioxide. Another key factor is population density. We can increase the density by reducing the barrier green spaces in the city to enhance the connections between people.

In order to compare the impact of rail transport, we chose the Shanghai suburb of two places: Xinzhuang and Jinqiao area. Xinzhuang area was imported a large number of people since the completion of Rail Transit Line 1, and in the Jinqiao, which has many residential areas developed, there is no subway system support for a

long time.

In both areas, we investigated the whole process of commuting in several different residential quarters through questionnaires and calculated the amount of carbon dioxide emissions based on the travel modes and travel distances. Research variables include the following: gender, age, occupation, family structure, income, employment location, when to live here, having cars or not, commuting travel modes, of public transport (including subway) services in residential areas, and the density of residential areas.

From the survey results, Jinqiao area is higher than the Xinzhuang area in terms of income. In Jinqiao 80% of the families had at least one car, and in Xinzhuang car family accounted for 46%. In terms of composition of emissions, the proportion of CO₂ in the top 20% emitters is as high as 80%. It also shows that policies must be devised more specifically for these parts of people in order to reduce CO₂ emissions. Look back at the income variable, with the increase in people's income, CO₂ emissions are indeed different in the subway and no subway area. In Xinzhuang area with subway support, with the increase in income, CO₂ emissions became much lower than Jinqiao area.

When we put the socio-economic variables in the model, some variables are significant while some are not. There are several variables that are noticeable: income, having a car or not, Housing area, etc. These factors are related to CO₂ emissions significantly.

If we look at the relations between bus/subway service and CO₂ emissions, we will find two very different situations: In Jinqiao area CO₂ emissions are low when the subway service level is high, while in Xinzhuang area CO₂ emissions are high with a high level of subway service. The reason is that we do not combine rail transport services with the housing area and parking control. Because of the housing appreciation, relatively high income people who have higher level of car ownership are more willing to choose to live around the subway station, their car has a higher level of ownership. In Jinqiao area, high-income groups did not take the subway as a factor in the choice of housing since the subway was built later.

The study of density shows that if the density is relatively low, commuting CO2 emissions would be higher, and travel distance would be longer; CO2 emissions will drop to a low level when density is high. Therefore we should have proper restrictions on the low-density development model.

Through research, we can conclude that CO2 emissions will be increased with the increase in income, and the construction of subway and public transport is important to reduce CO2 emissions, but its role is not the same in different areas.

We need more targeted policies, so that the top 20% emitters could be under control. The car's restriction policy is effective in Shanghai case. There are subway construction though, people will still tend to travel by car without restrictions, resulting in increased CO2 emissions. Moreover, low-density development really needs to be limited.