Motorization and Commuting Mode Choice of Residents in a New Suburban Metro Station Area in Shanghai

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1. ABSTRACT

Large cities in China are building extensive rail transit systems in combination with transit-oriented development (TOD) in suburban areas, so that public transportation can play a leading role in supporting rapid urban expansion. Shanghai has been a leader in this planning approach. Its experience can be valuable for other cities that are facing similar pressures of urbanization, suburbanization and motorization while striving to improve livability and reduce GHG emission. To gain useful insights from Shanghai, we conducted a travel survey of residents in a recently developed suburban metro station area to examine how the city's Mass Rapid Transit (MRT) has influenced residents' travel and car ownership. Applying statistical methods, including logistic regression, we found that: (1) the MRT is generally adequate in supporting the station area's economic relationships with the central city and local employment locations, (2) a high percentage of residents intended to commute by the MRT when they moved to the suburban station area, and their original intention has positively influenced their current travel and car ownership, and (3) rail transit may help temporarily reduce the pace of motorization among households near suburban metro stations by delaying car purchase and lowering the probability of car use in commuting. However, we also found that car ownership has been increasing quite rapidly despite the positive effects of a much expanded and improved metro system, and that once a person owns a car, s/he will most likely drive to work.

1. **INTRODUCTION**

Large cities in China have continued to grow rapidly over the last decade. The most recent census demographic data show that the 2010 populations of Beijing and Shanghai were 19.6 million and 23.0 million, respectively, which represented 42% and 38% increases from the 2000 figures (National Bureau of Statistics of China, 2011). In the meantime, urban growth has become spatially more expansive and decentralized with an increasing number of people locating in suburban areas. In Shanghai, for example, the census data indicate that the populations of the far suburban districts of Songjiang and Minhang grew by 146.8% and 99.6%, respectively, during the 10 year period. These urbanization and suburbanization trends are expected to continue in China, posing a great challenge for urban planners.

Alternative planning strategies for accommodating rapid growth in cities, especially in the outlying areas of cities, can generate diverse transportation outcomes that have significantly different environmental and social consequences. A common approach for large cities in China is to construct a rail transit (metro) system to facilitate a decentralized but clustered spatial pattern of urban growth. Chinese urban planners hold a high expectation for rail transit to be an attractive transportation option for both urban and suburban residents. Especially, for residents of suburban areas, rail transit is even more significant as an alternative to the automobile because in these areas, if there were no metro system, cars would dominate.

Recent travel data for Beijing and Shanghai illustrate this increasing auto orientation among suburban residents (Zhao, 2010; Shanghai City Comprehensive Transport Planning Institute, 2010). Planners hope that by providing rapid rail transit to counter the fast expansion of the freeway network, auto-oriented suburbanization and the subsequent gridlocks and growth of GHG emissions can be moderated.

Shanghai has been a leader in planning for transit-supported urban expansion through the construction of one of the world’s largest metro systems, known as the MRT (mass rapid transit). Its experience is valuable for the future practice of coordinated transportation and land use planning in large Chinese cities. It can also serve as a useful reference for cities in other developing countries that are facing similar pressures of urbanization and motorization. To draw lessons from Shanghai, this paper examines commuting and car ownership of residents in a recently developed suburban metro station area.

2. REVIEW OF EXISTING LITERATURE

For many decades the question of how land use and transportation should be mixed and matched to create economically, socially and environmentally desirable patterns of urban growth has attracted many researchers’ attention (Breheny, 1995; Chen, et al, 2008; Holden and Norland, 2005; Mindali, et al, 2004; Owens, 1986; Schwanen, et al, 2004; Shen, 2000). The growing concern over global climate change has led to a large number of new studies in this field, with a strong focus on GHG emissions reduction as the key desired outcome (Dulal, et al, 2011; Grazi, et al, 2008; Ng, et al, 2010; VandeWeghe and Kennedy, 2007). This is because travel demand can be modified by changing built environment (Dulal, et al, 2011; U.S. Environmental Protection Agency 2011). Our limited review here only focuses on selected publications most directly related to our research.

2.1. Urban Growth Pattern and Transportation Outcomes

Researchers hold different views on what urban growth pattern is most desirable from the perspective of reducing travel demand, energy consumption, and GHG emissions. For example, t

Dutch researchers gave positive assessments of compact urban development in the Netherlands (Geurs and van Wee, 2006; Schwanen, et al, 2004).

Contrary findings were presented by other researchers. For example, Istanbul's multicentric employment growth was seen as a key reason why the average morning peak-hour trip time for motorized trips in the city decreased from 53 minutes in 1985 to 41 minutes in 1997 (Alpkokin, et al, 2005). In Singapore, relocation of commercial activities from the CBD to the sub-center was found to reduce commute and reliance on the car (Sim, et al, 2001).

Some authors suggest that relative advantages of monocentric compact development and polycentric concentrated development can change, depending on factors such as lifestyle and automobile and building technologies (Holden and Norland, 2005), as well as coordination of policies. If spatially decentralized urban growth is supported only by automobiles, jobs, services and people will become scattered rather than clustered. As shown in most U.S. metropolitan areas, the resulting dispersed development will make the transit-dependent populations, which consist of disproportionately the low-income people, spatially truly disadvantaged (Shen, 1998; Modarres, 2011). However, it is equally true that an extensive rail transit system—unless coordinated with strong public policy initiatives to channel urban growth to station areas—has by itself rather limited capacity to stimulate multi-centered compact development in a metropolitan area (Cervero and Landis, 1997).

What seems insufficiently explored in the existing literature is the extent to which a metro system with extensive coverage and good service, coupled with city government's strong land use planning function, can effectively support a spatially decentralized but compact pattern of suburbanization. To succeed with such an urban growth pattern, the city center-suburban clusters connection must be strong and each suburban cluster must serve as the employment location for a large share of residents living nearby. Conceptually, advanced rail transit can provide strong connections between urban center and suburban clusters while facilitating the formation of suburban employment centers. However, more empirical evidence is needed.

Relevant studies from fast-growing cities in developing countries are especially needed to advance knowledge and practice in this field. Such cities not only are facing extremely challenging transportation problems caused by rapid motorization and inadequate infrastructure to accommodate fast-increasing travel demand, but also have different historical paths in transportation and, hence, must be very careful in interpreting the experiences from developed countries (Gakenheimer, 1999). On the other hand, many of them have been highly innovative in in urban transportation planning and management, and therefore have accumulated their own experiences that can be learned by other cities.

2.2. Urban Growth Patterns and Transportation Challenges in China's Large Cities

For the past three decades, the extraordinarily high growth rates of economic production and urban population have been followed by extraordinarily high growth rates of motorized travel and auto ownership in China. Observing the fast-increasing travel demand, Shen (1997) proposed that enhancing accessibility without inducing additional motorized travel should serve as a basic guideline for integrated urban land use and transportation planning. Heightened environmental concerns, especially the critical issues of energy security and climate change, have recently prompted many researchers to explore alternative paths to future mobility and accessibility. Researchers have pointed to the integration of land use planning with taxation of motor vehicles, road pricing, and the prioritization of public and non-motorized transport as the most promising approach (Ng, et al, 2010).

Large cities such as Beijing and Shanghai have been trying to guide their expansion through coordinated transportation and land developments. In Shanghai, for example, since the opening of MRT Line 1 in 1995, more than a dozen MRT lines have been constructed. During the same time period, numerous residential development projects have been completed, including many transit-oriented development (TOD) projects located near metro stations. These transportation and residential developments must meet the housing and mobility needs of more than 20 million people.

A number of studies have been completed to understand the effects of spatially decentralized urban growth on people's accessibility and travel behavior. Cervero and Day (2008) examined the impacts of relocation to three outlying areas on commuting mode choice and duration in Shanghai. They found that the movers' motorized travel and average commute duration increased substantially, whereas job accessibility dropped substantially. They also found, however, that relocating to an area near a metro station moderates losses in job accessibility and encourages switches from non-motorized to transit commuting.

Zhao (2010) noticed that urban growth on the fringe of Beijing is characterized by low density and dispersed development, as well as a low degree of local mixed land use. This pattern has caused trip distance and car use to increase substantially. He argued that urban growth management would help contain the growth of motorized travel in the suburbs.

In a recently published paper, Yang and his co-authors (2012) use three decades of census data to describe Beijing's spatial development trajectory and a household survey to assess its transport impacts. Their empirical results indicate that over-concentration of jobs and residents stemming from featureless expansion of the central built-up area leads to an increase in commuting time and congestion. They propose that Beijing should achieve its vision of compact development by taking a multi-nuclei form with high-density suburban clusters around public transit nodes, especially rail stations.

The existing literature reflects various recent research activities that have generated many useful insights about urban growth patterns and transportation challenges in China's large cities. Much more research is required to provide urban planners with the knowledge essential for effective practice of coordinated land use and transportation planning in the future.

3. RESEARCH QUESTIONS AND METHODOLOGY

3.1. Research Questions

This study aims at addressing the following questions:

1. What are the main characteristics of travel by people living near suburban metro stations?
2. Do many of these people intend to use rail transit as the primary transport mode when moving to suburban metro station areas? If so, to what extent do they fulfill the wish by actually riding the MRT for daily activities?
3. What are the key factors influencing these residents' car ownership and travel mode? In particular, does the rail transit service negatively affect car ownership among these residents? How do they choose between the competing modes of car and rail transit?

3.2. Methodology

Because of limited resource available, we decided to focus our effort on a station area that is quite typical in terms of geographic location and land development characteristics, and hence can serve as an empirical basis for obtaining preliminary but insightful answers to the questions. We selected the area within 3km radius from Jiuting metro station, which is a station on the recently opened MRT Line 9, to conduct our travel survey (Figure 1). The 3km radius approximately captures the geographic extent of local influence of a typical metro station in Shanghai (Pan and Zhong 2008).

In order to differentiate residents by proximity to the metro station, the study area was divided into three consecutive zones. Inner Zone covers the area within 1000 meters from the station, Middle Zone 1000-1500 meters, and Outer Zone 1500-3000 meters.

The survey was conducted by interviews with all wage earners in 400 randomly selected households. A total of 609 survey questionnaires were filled, and 606 of the completed responses (99.5% of the total) were valid as shown in Table 1. The questionnaire asked for a rich set of information, including the residents' socioeconomic characteristics, previous residential location, intention to use rail transit as the primary travel mode at the time of relocating to current residence, present travel characteristics, and car ownership, use and purchasing plan.

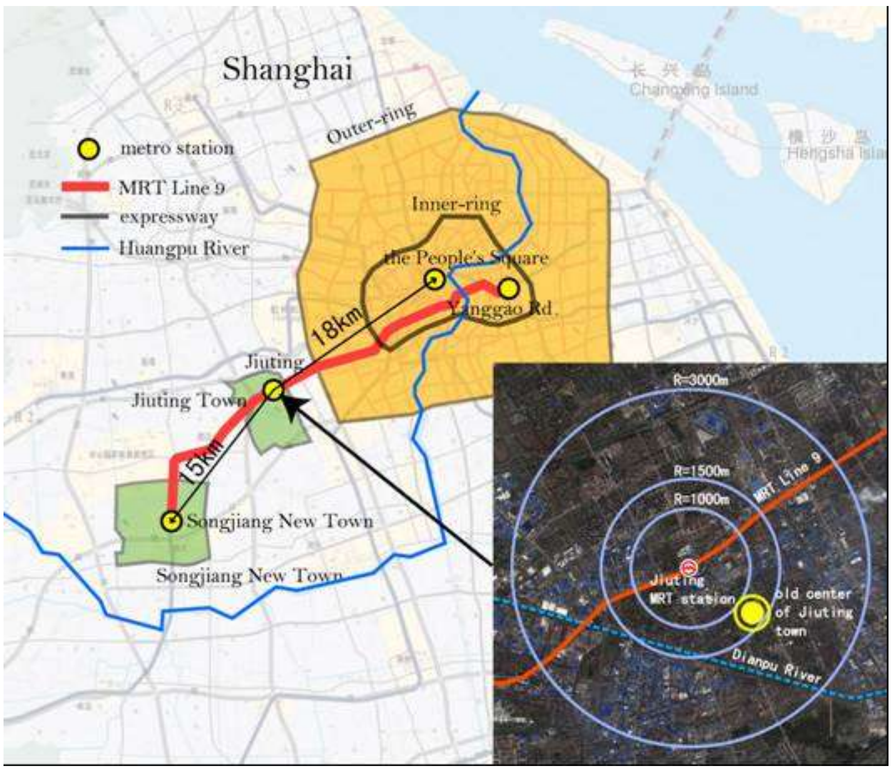

Figure 1. The Jiuting Metro Station Area and MRT Line 9 in Shanghai

Table 1. Survey Respondents by Residential Location

	Inner Zone (0-1000m)	Middle Zone (1000-1500m)	Outer Zone (1500-3000m)	Total
Households sampled	100	115	185	400
Survey respondents	140	192	277	609

Valid responses	139	191	276	606

Guided by our research questions, we employed statistical methods to analyze the survey data. Our focus was on residents' commuting, which indicates the fundamental economic relationships between the case study area and other parts of Shanghai. Two binary logit models were estimated to examine how residents' car ownership and commuting mode, respectively, are related to their demographic, economic and location characteristics, as well as original intention to commute by the MRT.

3.3. The Case Study Area

Situated about 18 km southwest of Shanghai's city center, Jiuting is a far-suburban town in Songjiang District. The town has a total residential population of 230,000. Only 29,000 of these residents are locally registered, however; most of the population are recent migrants from Shanghai's central city (defined as the whole territory within the Outer-ring Expressway) or from other provinces.

Jiuting Station is on MRT Line 9 which connects Songjiang New Town to downtown locations in Shanghai's central city. This metro line has been in service since 2007. The station is located just 1km from the town center of Jiuting, which is planned primarily as a major commercial housing development area in Shanghai (Songjiang Bureau of Planning and Land Administration, 2010).

4. EMPIRICAL RESULTS

Our survey data show that, 92.2% of all respondents have moved to their current residence after 2002 when the construction of MRT Line 9 beganThe survey data indicate that the foremost reason for people to live in Jiuting station area is the low housing price (cited by 56.8% of the respondents), the second most mentioned factor is the good natural environment (31.1%), and the convenience to take the metro is the third frequent consideration (23.3%).

The respondents are on average 36 years old, and 56.8% of them are male. Most respondents are white-collar employees or managers. The households are mostly middle class, with an average annual income of approximately 85,000 Yuans. About a third of them have at least one child 12 years of age or younger.

4.1. Characteristics of Residents' Commuting Trips

We first examined the spatial distribution of residents' job locations. Overall, 58.1% of the employees included in our sample work in the central city, 26.7% work more locally in Songjiang, and only 15.2% are employed in other suburban locations. This commuting pattern indicates that the case study area has not only a strong economic connection with the central city, but also a substantial economic tie to the local district.

We then investigated the role played by the MRT in supporting these economic relationships. Overall, 44.9% of the respondents commute by the MRT. In particular, 66.5% of the commuting trips destined for the central city are by rail transit. On the other hand, as one would expect, rail transit is chosen for a much lower share, 9.3%, of local commutes within Songjiang District.

The average one-way commuting time is 42.6 minutes for all trips and 53.8 minutes for trips to central city locations. The corresponding times for MRT commuting trips are, respectively, 56.2 minutes and 53.1 minutes. In comparison with other modes, rail transit is competitive in terms of time cost for travel to the central city.

The MRT seems to provide adequate connection between the station area and the central city. Given the relatively long commutes to the central city, however, it is desirable to strengthen the station area's economic relationship with local employment centers. This will increase the percentage of residents working locally, and consequently reduce their average commuting time. Workers who are employed within Songjiang District on average spend only 19.1 minutes on one-way commute, much lower than the average for those employed in the central city.

Next, we analyzed the modal split and time costs for access trips to Jiuting metro station. The survey data indicate that, overall, 96% of the MRT commuters travel to the station by walking, bike, e-bike or bus. While mode shares for, and variations across, the three residential zones are broadly consistent with previous findings for Shanghai (Pan, Shen and Xue, 2010), it is worth noting that bike and e-bike play a more prominent role as feeder modes for MRT riders in this case study area, especially those residing in Outer Zone.

As shown in Figure 2, the average time for station access trips is 18.1 minutes, which is quite long. Even the Inner Zone has an average of 15.4 minutes, much longer than the 5 minutes suggested by various proponents of transit oriented development (TOD) (Calthorpe, 1993).

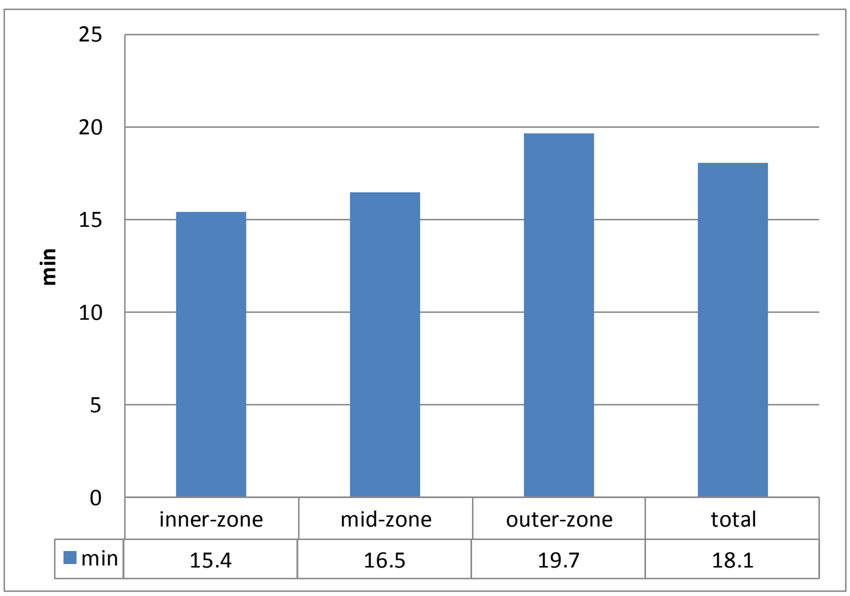

Figure 2. Metro Station Access Time by Proximity

In terms of mode choice for station access, the fastest way to reach the station is by non-motorized vehicle, i.e. riding a bike or e-bike, which takes 12.5 minutes on average. The longest access time is by bus, which takes 21 minutes. Average walking time to the station is 16.6 minutes. These results suggest that shortening metro station access time can significantly raise the travel efficiency of metro riders.

4.2. Residents' Intention to Use the MRT

Our data indicate that 55% and 31% of the respondents relocated from, respectively, the central city and outlying areas of Shanghai, and the rest 14% of them migrated from other provinces. 45.4% of all respondents intended to choose the MRT as their primary commuting mode when they moved into Jiuting station area. Overall, residents who previously lived in the central city or in other provinces were more inclined to consider commuting by the MRT, as indicated by more than 50% of them picking the MRT as their intended primary mode for journey to work.

A closer look of the survey data revealed that 72% of the people who previously lived in the central city are still working there. This partly explains why a much higher percentage of them intended to commute by the MRT when relocating their residence.

Table 2. Intended and Actual Commuting Mode Choice

Intention to Commute by MRT at Time of Relocation	**Previous Home Location**	**Actual Commute Mode Choice**				
		MRT	**Bike/e-bike walk**	**Car**	**Bus**	**Total**
MRT as primary mode	Central city of Shanghai	129 (74.6%)	15 (8.7%)	16 (9.2%)	13 (7.5%)	173 (100%)
	Suburbs of Shanghai	31 (68.9%)	4 (8.9%)	8 (17.8%)	2 (4.4%)	45 (100%)
	Other provinces	24 (58.5%)	7 (17.1%)	4 (9.8%)	6 (14.6%)	41 (100%)
	Total	184 (71.0%)	26 (10.0%)	28 (10.8%)	21 (8.1%)	259 (100%)
MRT as secondary mode	Central city of Shanghai	37 (33.3%)	20 (18.0%)	36 (32.4%)	18 (16.2%)	111 (100%)
	Suburbs of Shanghai	10 (24.4%)	6 (14.6%)	14 (34.1%)	11 (26.8%)	41 (100%)
	Other provinces	4 (20.0%)	3 (15.0%)	6 (30.0%)	7 (35.0%)	20 (100%)
	Total	51 (29.7%)	29 (16.9%)	56 (32.6%)	36 (20.9%)	172 (100%)
MRT not considered	Central city of Shanghai	13 (31.0%)	6 (14.3%)	18 (42.9%)	5 (11.9%)	42 (100%)
	Suburbs of Shanghai	5 (16.1%)	12 (38.7%)	13 (41.9%)	1 (3.2%)	31 (100%)
	Other provinces	6 (31.6%)	5 (26.3%)	6 (31.6%)	2 (10.5%)	19 (100%)
	Total	24 (26.1%)	23 (25.0%)	37 (40.2%)	8 (8.7%)	92 (100%)

It is interesting and important to find out whether people who intended to commute by the metro at the time of relocation are actually riding Line 9 now. By cross-tabulating the actual mode choices and the intended uses of rail transit, we can see clearly that people who planned to ride the MRT as their primary commuting mode are much more likely to actually commute by the MRT today. As shown in Table 2, overall 71% of the respondents who intended to use the metro as the primary commute mode are actually riding it to work, compared to only 29.7% and 26.1%, respective, for people who considered the metro as a secondary commute mode or not a commute mode.

4.3. Factors Influencing Residents' Car Ownership and Travel Mode

Of the 400 households, 128, or 32% of the sample, own private cars. Among the households that moved into Jiuting station area before the opening of MRT Line 9 and did not have a car at that time, 13.8% bought cars before the metro line started service, and another 11.7% bought cars after. Among households that moved into the area after the opening of Line 9 and did not own a car at the time of relocation, 15.2% have since bought cars. The time gap between household relocation and car purchasing has become shorter. The transit service improvement brought by the rail does not appear to have much an impact on households' motorization trend.

Among the households that own one or more cars and have at least one regular commuter, 92.1% of them use the car for commuting by driving for the entire journey or for metro station access; only 7.9% of them do not use the car for commuting. Most importantly, 94.3% of the residents who were already car commuters when relocating to the study area still regularly drive to work today. It seems that the desire and habit of driving does not change easily even after moving to an area well served by rail transit.

However, the rate of car ownership could have increased much faster if there were no rail transit serving this area. Similarly, driving could have been more prevailing if MRT Line 9 were not built. More sophisticated analyses are required to better understand the effects of the MRT on station area residents' car ownership and driving.

4.3.1. Logistic Regression Analysis of Residents' Car Ownership Status

To rigorously examine the effects of rail transit on residents' car ownership, we estimated a binary logit model in which a household's car purchasing decision after moving to the metro station area is a function of household wage earners' intended and actual use of the MRT for commuting, as well as its demographic, economic, and location characteristics.

The variables and regression outcome are displayed in Table 3. Several key results are discussed here. First, both the intention to commute by MRT and actual commuting by MRT show statistically highly significant negative associations with car purchase after moving to the station area. This result is encouraging. The estimated coefficients indicate that residents who currently commute by rail transit are much less likely to have purchased a car, and that residents who intended to commute by rail transit also are less likely to have become car owners. In other words, residents' attitude (i.e. intention to commute by the MRT) may have a separate negative influence on car purchase.

Household income shows a strong positive association with car purchase, as expected. There is some weak evidence that having young children increases the probability of having bought a car, but it is not statistically significant.

Table 3. Binary Logit Model of Car Purchase after Moving to Metro Station Area

Variable	B	S.E.	Wald	Significance	Exp(B)
MRT Intention (1-yes)	-1.019	.390	6.821	.009	.361
MRT Commute (1-by MRT)	-2.921	.584	25.049	.000	.054
Household Income (10k yuan)	.248	.049	25.247	.000	1.281
Young Children (1-with child aged 12 or younger)	.533	.343	2.419	.120	1.704
Home in Inner Zone (1-yes)	-.389	.410	.902	.342	.678
Work in Central City (1-yes)	.484	.409	1.400	.237	1.623
Work in Songjiang (1-yes)	-.106	.510	.043	.835	.899
Commuting Time*	-.005	.006	.666	.414	.995
Station Access**	-.435	.341	1.624	.203	.647
Constant	-2.042	.629	10.540	.001	.130
Selected Cases: 303; Cox & Snell R Square: 0.279 Nagelkerke R Square: 0.442; Correctly Predicted: 83.2%					

*. Sum of one-way commute times for household (minutes)

**. 1-if all respondents in household are satisfied with the conditions for walk, bike, and bus access to MRT station; 0-otherwise

Proximity of home and work location to metro station does not show a statistically significant relationship with car ownership. Multicollinearity among the location variables and the MRT commute variable may partly explain why the location variables are all insignificant. Also insignificant is the *Station Access* variable. This is probably because the variable is subjectively measured by respondents who may not have consistently evaluated the conditions for walk, bike, and bus access to MRT station. These results warrant further investigation.

While the regression analysis of residents' current car ownership status strongly suggests that the MRT has so far helped reduce the number of cars purchased by households living in the station area, the positive effect may not last for long. Our analysis of respondents' car purchasing plans for the next three years, unfortunately, resulted in a much less encouraging finding. It shows that neither the original intention to commute by the MRT, nor the current MRT commuting, is negatively related to the plan to buy a car in the future. What it suggests is that although many MRT commuters have not bought a car so far, they have increasingly recognized the value of owning a car and may soon become car owners.

4.3.2. Logistic Regression Analysis of Commuting Mode

Residents typically consider factors such as trip distance and traffic condition, as well as their own demographic and economic conditions, when choosing among different commuting modes. We again used the binary logistic regression to model the residents' commuting mode choice between car and metro. The independent variables include residents' original intention to use the metro system for commuting when moving to the station area, car ownership, age, age-squared (to capture the possible nonlinear relationship between mode choice and age), gender, income, home and work locations, commuting time (a proxy for distance), and subjective evaluations of metro station access condition for alternative modes.

The regression outcome is displayed in Table 4. Original intention to commute by the MRT, car ownership, being male, annual income, living in Inner Zone, and commuting time are statistically significantly associated with residents' choosing of car over metro for commuting. In fact, five of these six explanatory variables are highly significant at the level of 0.01. The regression coefficients suggest that intention to commute by metro when moving to the station area likely reduces, whereas owning a car greatly increases, the probability of commuting by car rather than metro. The very strong positive relationship between car ownership and car driving is consistent with the observation made earlier in this section.

Being male and having a higher annual income likely also contribute to the choice of car instead of metro as the commuting mode. On the other hand, home location in proximity to the MRT station lowers the likelihood of commuting by car. Also lowering the competitiveness of car against metro as travel mode is the length of commute.

Two of the work location variables show no significant relationship with commuting mode choice between car and metro. However, work location within 500m of MRT station is marginally significant, and its association with the choice of car is negative. Surprisingly, none of the metro station access variables shows a significant statistical association with the dependent variable. This result once again may reflect respondents' inconsistent subjective evaluations, but it warrants further investigation.

The binary logit model is highly effective in explaining the mode choice, as indicated by the Cox & Snell R Square of 0.636, Nagelkerke R Square of 0.884, and 95.0% of cases correctly predicted.

Table 4 . Binary Logistic Regression Model of Commuting by Car Instead of Metro

Variable	B	S.E.	Wald	Significance	Exp(B)
MRT Intention (1-Intented to take MRT)	-2.063	.559	13.602	.000	.127
Car Ownership (1-household owns car)	5.797	.802	52.196	.000	329.436
Age (year)	-.045	.231	.037	.847	.956
Age Squared	.001	.003	.122	.727	1.001
Male	1.906	.608	9.826	.002	6.724
Income (10k yuan)	.531	.135	15.352	.000	1.700
Previous Home in Central City (1-in central city)	.727	.595	1.492	.222	2.069

Home in Inner Zone (1-in inner zone)	-1.577	.716	4.845	.028	.207
Works in Central City (1- in central city)	-.723	.737	.962	.327	.485
Works in Songjiang (1-in Songjiang)	-.287	1.035	.077	.781	.750
Works within 500m of MRT (1-within 500m)	-1.065	.572	3.471	.062	.345
Commuting Time (one way commuting time)	-.100	.022	21.309	.000	.904
Rail Station Walk Access (1-satisfied)	-.275	.789	.122	.727	.759
Rail Station Bike Parking (1-satisfied)	-.619	.816	.576	.448	.538
Rail Station Bus Access (1-satisfied)	.136	.698	.038	.845	1.146
constant	-1.917	4.703	.166	.684	.147
Selected Cases: 403; Cox & Snell R Square: 0.636 Nagelkerke R Square: 0.884; Correctly Predicted: 95.0%					

5. CONCLUSIONS

The survey data also show that a high percentage of working adults, including over half of those who previously lived in the central city, intend to use the MRT for commuting when moving to suburban station areas. Furthermore, many of them, especially those who continue to work in the central city after the residential relocation, actually ride the metro as primary commuting mode.

Most importantly, residents who currently commute by the MRT are much less likely to have already purchased a car, and residents who originally intended to commute by the MRT are also less likely to have already become car owners. Moreover, intention to commute by rail transit, along with proximity of home and job to MRT station, may reduce the probability for residents to choose car over metro as commuting mode.

There are, however, less encouraging findings. The average duration of the whole commuting trip is relatively long. Improving the environment for biking and e-biking, which on average are the fastest ways to reach metro stations, can help shorten the commuting time and make the rail transit-supported decentralized urban growth more effective. Increasing job opportunities near station areas is another promising strategy.

The more worrisome finding is that, despite the positive effects generated by the extensive MRT system, motorization in the form of rising car ownership among metro station area households has been continuing at a fast pace. In fact, many current MRT commuters plan to purchase cars in near future. Therefore, in order to moderate the increasing demand for travel by car in newly developed areas, it is not sufficient to depend exclusively on the construction of metro lines. We must adopt complementary planning and policy measures to discourage driving and facilitate alternative travel modes.

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