



# Subways near the subway: Rail transit and neighborhood catering businesses in Beijing



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## ABSTRACT

Beijing has made enormous investment in rail transit since the late 2000s. The rapidly growing subway system greatly improves the accessibility of neighborhoods nearby subway stations and often increases neighborhood population and employment densities, both resulting in a larger market for local retail businesses. While numerous studies have shown that rail transit investment tends to raise property value close to stations, few have provided direct evidence on rail transit's effects on local consumer amenities. Using citywide catering establishment data since 2004 from *dianping.com* (China's *yelp.com*), we study the effects of new subway stations on catering openings, diversity and consumer demand in neighborhoods near a subway station opened during 2004–2013. We find that a new subway station positively contributes to the quantity, diversity and consumer demand of nearby food and beverage services. These effects are heterogeneous spatially and in terms of catering types. This study enriches the limited extant empirical evidence on urban rail transit's impact on local economic activities and consumer amenities. In China, where unprecedented rail transit expansion has transformed large cities like Beijing in many ways, our findings can help us better understand how major public investment in cities affects local economy, quality of life, the housing market and related further policy concerns.

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## 1. Introduction

Urban rail transit provides convenient access to important destinations in cities, especially for users residing or working within a short distance from a station. Attention has been paid to the connection between rail transit's accessibility benefits and local property values, development activities and job growth (as reviewed in the following section). However, there is a scarcity of knowledge on rail transit's impacts on local consumer amenities. This prevents us from a deeper understanding of the role rail transit investment plays in cities. As pointed out in Glaeser et al. (2001), the rise of the “consumer city” in an era of increasingly mobile firms is inevitable because talents and hence their employers are attracted to cities with more consumer amenities. At the neighborhood level, important consumer amenities such as retail outlets may contribute to community revitalization even it does not dramatically increase labor market outcomes, such as employment, job participation or wage level (Chapple and Jacobus, 2009).

This study attempts to provide a detailed evaluation on the effects of urban rail transit on neighborhood consumer amenities

that are primarily provided by the private sector (rather than publicly supplied amenities such as parks). We apply data during the decade from 2004 to 2013, a time period when Beijing's subway system received hundreds of kilometers of new lines. Such a rapid expansion of subway at a cost of tens of billions of RMB (1 RMB = about 0.15 USD) each year has helped Beijing to meet its increasing travel demand and relieve surface traffic congestion. The subway expansion has also provided enormous accessibility benefits to the city's businesses, especially in neighborhoods nearby the stations. As one would expect, such accessibility benefits should not only reflect in property prices, but also induce more local economic activities that can provide additional local consumer amenities.

We use panel data from station areas (defined by a range of distances from a subway station) where the stations opened during our study period to examine the response of a broad category of catering (food and beverage) business activities to new subway service. The catering industry is selected because it represents perhaps the most important category of local consumer amenity provided largely by the private sector – it not only meets the daily needs of visitors as well as local residents and workers, but also facilitates face-to-face social interactions, even in a fast food

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restaurant like a Subway store (an American sandwich chain brand). The differentiated timing of subway construction during this study period allows station areas to serve as both the treatment and control groups in different years for statistical identification. We measure both the supply aspect (number and diversity) and the demand aspect (customer volume) of catering businesses by year in each neighborhood using online data from *dianping.com*, China's *Yelp*. We find that subway construction increases the quantity (the number of new catering openings), diversity (the composition of different cuisine genres) and customer volume (proxied by the number of online customer reviews on *dianping.com*) of catering businesses around stations, with interesting heterogeneities in effects spatially and by catering types.

This paper adds to the limited available evidence on the changes in local consumer amenities following rail transit investments. The rest of the paper is organized as follows: Section 2 reviews relevant literature, Sections 3 and 4 describe data and empirical strategy. Section 5 presents the results, followed by conclusions and discussions in Section 6.

## 2. Literature review

It is well known that at the city and urban region levels, rail transit investment contributes to productivity gains (see, e.g., Graham, 2007; Haddad et al., 2015). At the local or neighborhood level, much attention has been focused on property values nearby rail transit projects, especially by economists (see literature reviews by Debrezion et al., 2007; Mohammad et al., 2013). Overall, the extensive literature on the property value capitalization of urban rail transit investment, mostly from the US and other industrialized countries, has found generally positive price premiums of properties closer to rail transit stations, although recent development of this literature has pointed to some structural reasons of the wide variations in the estimated property value effects such as land supply elasticity (e.g., Zheng et al., 2014, Sun et al., 2015).

Besides property value impacts, planners have examined categories of broader impacts such as land development and employment. Giuliano (2004) systematically reviews studies of important urban rail systems such as San Francisco's BART, Washington, D.C.'s METRO, and Atlanta's MARTA from the 1970s to the early 2000s. She concludes that rail transit's local land use, land value, population, and employment effects are highly localized and uneven across systems and station areas. The variation in local impacts seems to be affected by whether rail transit has a significant impact on local accessibility (e.g., impacts tend to differ between fast-growing and heavily congested areas and areas dominated by automobiles), local zoning and transportation policies, and availability of development subsidies. Similar conclusions appear in more recent studies such as Mejia-Dorantes and Lucas (2014) review of the property value, development density and employment effects of London's Jubilee Line Extension and the Madrid Metrosur.

However, relative to property value and land use effects, there seems to be limited evidence on the changes in local consumer amenities following rail transit investments. The available studies on rail transit and neighborhood amenities primarily focus on local retail activities measured by either the employment or the quantity (density) of retail businesses. The theoretical underpinning of this is obvious. Rail transit decreases transportation costs between its station areas and the rest of city and increases local consumer base as more jobs and housing agglomerate nearby station areas. Increases in both local demand density and neighborhood accessibility result in significantly expanded market potential of local retail businesses. As a result, the number and diversity of local

retail businesses increase as suggested by standard economic theory of firm location choice (Berry, 1967; Stern, 1972; Fischer and Harrington, 1996).

Applying a simultaneous model of census tract population and employment data in 1980 and 1990, Bollinger and Ihlanfeldt (1997) find no impact of Atlanta's MARTA (built between 1979 and 1990) on either commercial or total employment in station areas after controlling for a range of neighborhood land-use and socio-economic characteristics. In fact, they find that MARTA has altered the composition of employment in station areas in favor of the public sector. In four large California metropolitan areas, Schuetz (2015) examines whether rail and bus rapid transit (BRT) investment stimulates retail employment within a quarter mile from rail and BRT stations built during 1992–2009. She does not find any positive effect on retail employment in rail/BRT station neighborhoods. A major explanation for the insignificant retail effect of rail transit provided by Bollinger and Ihlanfeldt (1997) and Schuetz (2015) is the minimal role of rail transit in urban transportation in either the Atlanta region or the large California cities.

However, using panel data of annual census tract retail employment density during 1991–1994 also in Atlanta, Bowes and Ihlanfeldt (2001) estimate a random effects model and find that tracts between one-quarter and one-half mile of a station experience the greatest increase in retail employment density, an effect increases with distance from the city center. Bowes and Ihlanfeldt's findings, while different from those of Bollinger and Ihlanfeldt (1997) and Schuetz (2015), are supported by a recent study in Beijing, China. Among the first to relate rail transit with nearby private consumer amenities in less developed countries, Zheng and Kahn (2013) find that the construction of five subway lines in Beijing during 2003–2009 associates with more chain restaurants (mainly catering to the upper-middle class consumers) nearby subway stations. Their finding, while limited to high-end restaurant businesses, is not surprising because of the more salient role played by rail transit in urban passenger transportation of the dense cities in a developing economy. Compared to the automobile-dominant large cities in the US, rail transit carries a significant share of riders from all socioeconomic classes in Beijing, one of the most motorized cities in China. For example, three out of the four largest California cities have a rail mode split of about 0.5% among commuters during 2005–2009 (Schuetz, 2015), while Beijing's subway carries almost one third of commuters.

## 3. Background and data

Beijing has experienced massive subway construction since the late 2000s. From 2007 (all the pre-2007 subways were built before 2004) to 2013, 12 new subway lines were put into use, increasing the total number of subway stations from 70 to 274. By the end of 2013, Beijing's subway reached a total revenue length of 476 km, with a typical daily ridership of more than 10 million. The rapid expansion of Beijing's subway system has been reshaping the intra-city geography of jobs, housing and consumption activities. In this paper, we call a subway station a new station if it was opened in 2007 or later.

Our analysis focuses on the impacts of subway development on neighborhood catering businesses in Beijing during the decade of 2004–2013. We rely on two datasets including: first, when and where a new subway station was opened during the study period; and second, annual catering openings, diversity of catering businesses and the number of online customer reviews in the new subway stations' neighborhoods.

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