Neighborhood Retail Amenities and Shopping Trip Behavior

Kwan Ok Lee[a]
National University of Singapore

Shih-Fen Cheng[b]
Singapore Management University

Abstract

We analyze the impact of newly developed malls on the shopping trip behavior of nearby residents. Using the difference-in-differences approach and big data from a major taxi company in Singapore, we find that households residing within 800 meters from the new mall are significantly less likely to take taxis to other shopping destinations after the mall opening. This travel behavior change encompasses both intensive (share of the number of shopping trips out of total taxi trips originated from each residential building) and extensive (share of shopping trip distance out of total taxi trip distance) margin responses. We further demonstrate that the magnitude of this shopping trip reduction is more significant during PM peak hours and for residential buildings that are located farther from the Central Business District and in less self-sufficient communities. Our research provides suggestive evidence on the significant role of neighborhood retail amenities to the change in mode and destination choices for shopping. An important policy implication is that improving self-sufficiency for suburban neighborhoods could not only enhance the wellbeing of their residents but also increase aggregate welfare by reducing the level of congestion.

Keywords: neighborhood mall, retail amenity, shopping trip, self-sufficiency, travel behavior, congestion

[a] **(Corresponding author)** Department of Real Estate, NUS Business School, National University of Singapore, 15 Kent Ridge Drive, Singapore, 119245; Phone: (65) 6516 6254; Email: kwan.lee@nus.edu.sg

[b] School of Computing and Information Systems, Singapore Management University, Singapore; Email: sfcheng@smu.edu.sg

1. Introduction

Shopping trips account for a significant portion of daily trips and the average distance traveled for shopping has significantly increased over time (Land Transport Authority Singapore, 2012; UK Department for Transport, 2015). And a significant portion of these trips occur during peak hours (Martinson, 2014). Although shifting shopping trip behaviors is less challenging compared with business and school, existing literature tends to focus less on these behaviors when discussing planning approaches to reduce vehicle trips and traffic congestion (Pan et al., 2009). For example, the provision of new retail amenities in residential neighborhoods that used to have no amenities nearby may substantially decrease residents' travel costs for shopping and, in turn, lead to the change in their choice of the shopping destination. If such amenities are provided within a short distance from their homes, residents may choose to walk or cycle instead of drive or take a taxi for their shopping.

Our research question focuses on the impact of the proximity to the newly provided retail amenities on changes in shopping trip behaviors of surrounding residents in Singapore. The Singapore contexts provide a unique opportunity to answer this question as retail shops are distributed across various geographic locations such as new town areas and shopping trips account for the highest percentage of non-work trips in the country (Land Transport Authority Singapore, 2012). Specifically, we use the opening of neighborhood shopping malls as a shock for retail amenities not only because the malls feature retail clustering including eateries, groceries and other shops but also because Singapore consumers show a strong preference for indoor malls as their shopping destination.

For the travel mode, we focus on taxis of which a substantial proportion (21.1%) is used for shopping trips in Singapore. By doing so, we not only take advantage of the trip-level big data provided by the major taxi company but also account for the shoppers' preferred travel mode in Singapore (Ibrahim, 2005). To estimate the isolated effect of a mall opening on the share of taxi trips to other shopping destinations out of all taxi trips originated from nearby residential buildings, a difference-in-difference (i.e., variations in the distance from new neighborhood malls and the pre/post of mall opening) is used as the main empirical strategy. The treatment group is composed of residential buildings located within 800 meters from a new mall and the unit of analysis is the monthly taxi trips originated from each residential building. As we observe patterns of using taxis for a shopping purpose relative to general taxi trip patterns, our main interest is on changes in shopping destination choices rather than changes in choices between taxis and alternative travel modes. Also, our observed changes could be expanded to patterns of driving for shopping because taxis are considered a substitute for private vehicles and users of two modes share similar characteristics (Conway et al., 2018).

Analysis results discover that taxi trips to other shopping destinations fall by 33 per month, or the share of shopping trips out of total taxi trips decreases by 1.4 percentage points for residential buildings within 800 meters from the neighborhood malls after these malls open. We also find a similarly significant reduction in the distance traveled to other shopping destinations only for residential buildings that are within walking distance from newly opened malls. Interestingly, the magnitude of the shopping trip reduction is much more significant during the PM peak hours than off-peak hours, which suggests significant effects on traffic congestion reduction. We also find the heterogeneous results by location and type of residential buildings. Residential buildings that are located farther from the central business district (CBD) and in less self-sufficient communities are likely to experience a higher reduction in shopping trips by taxi after a mall opening. These results suggest that the level of residents' travel behavior adjustment depends on the existing conditions of the neighborhood.

This study directly contributes to the literature on the role of urban forms to travel behavior. While researchers were interested in diverse aspects of urban forms ranging from density and building shape to streetscape and the proximity to transport facilities (e.g., Appleyard, 1980; Cervero and Duncan, 2008; Pan et al., 2009; Gehl, 2011; Kahn et al., 2014), the spatial distribution of different land uses is considered as a key factor influencing travel behaviors. As the land use distribution is directly associated with actual and perceived costs of the trips, it would influence people's decisions on the mode of travel. Studies in the fields of urban planning and public health report that mixing land uses and increasing the non-residential uses within a neighborhood have a positive relationship with the general probability of walking or cycling (Krizek, 2003; Cervero and Duncan, 2003; Krizek and Johnson, 2006; Ewing and Cervero, 2010). Our research differs from them because we examine how the smaller-scale change in land use distribution, such as the opening of a new neighborhood mall, directly affects the shift in the residents' mode of travel for the single purpose of shopping. Our focus is on the magnitude of the project- and shock-based behavior change and thus has a more meaningful and practical planning implications for established neighborhoods.

Next, our analysis results add insights to the understanding of shopping trip behavior. While there is voluminous research on how people choose the mode of travel and destination for shopping purposes, existing empirical evidence tends to be based on the non-causal framework as they rely on cross-sectional administrative data or information from the small-scale survey and experiment (e.g., Handy, 1993; 1996; Greenwald, 2003; Rajamani et al., 2003; Ibrahim, 2003; 2005). To our best knowledge, this is the first study to quantify the casual effect of neighborhood retail amenities on residents' choice of shopping trips by examining the trip-level taxi trips together with the detailed residential and retail locations across an entire nation. Few studies on the dynamics between shopping trip choices and neighborhood retail amenities use the land use mix diversity as a proxy of the accessibility to and availability of these amenities and only observe the average outcomes (Greenwald, 2003; Rajamani et al., 2003). Our research advances them by using a more direct measure of the proximity to a new neighborhood mall, which is the clustered retail amenity, as well as by providing heterogeneous outcomes across times of the day and the location of residential buildings.

Finally, this study contributes to the literature on land use planning especially for suburban neighborhoods. Originated from the Garden City movement by Ebenezer Howard (1902), satellite new towns have been developed in many countries around the world (He et al., 2020). Although Singapore shows one of the most prominent examples of new town planning that achieved a relatively higher level of self-containment, there are some neighborhoods lacking access to retail amenities. Our research analyzes the extent to which residents in these neighborhoods rely on taxis for shopping trips and rigorously tests the importance of retail service provision to altering such reliance. And we note that taxi trips contribute significantly to traffic congestion and air pollution because they occupy the roads like private cars (He et al., 2013). Hence, the implications of proper community planning go beyond the well-being of residents in these community by suggesting that changes in their taxi-trip behavior significantly affects aggregate-level welfare.

1. Backgrounds

2.1. The role of urban forms to travel behavior

An emerging question in the urban planning literature has been how to plan neighborhoods to reduce vehicle trips and traffic congestion. To investigate how to shift people's travel choices from automobiles to non-motorized modes such as walking and cycling, scholars have explored diverse aspects related with the built environment and urban forms. For example, Appleyard (1980) and Gehl (2011) focus on urban design elements related with pedestrian environment such as sidewalk widths, building setbacks and variation in building materials. Khan et al. (2014) show the importance of street connectivity, the density of bus stops, and accessibility to non-motorized trips to lowering vehicle ownership and increasing non-motorized mode choices. Pan et al. (2009) suggest that changes in urban forms have a stronger impact on travel mode choices for non-work travelers than commuters.

Many studies have considered the distribution of different land uses as a main factor that could change travel behavior. The job-housing balance at the reginal level is known to shorten commuting distances and durations (Guiliano and Small, 1993; Frank and Pivo, 1995; Sun et al., 1998). At the neighborhood level, researchers focus on how mixing residential and non-residential uses such as retail shops impacts travel patterns of residents. Cervero and Duncan (2008) report that job-housing balance yields more significant reduction in travels than the accessibility to retail shops. Other studies demonstrate a positive relationship of mixed land uses with the probability of inducing people to non-motorized travel modes such as walking and biking (Krizek, 2003; Cervero and Duncan, 2003; Krizek and Johnson, 2006; Ewing and Cervero, 2010).

Krizek and Johnson (2006) is the closest to our study in a sense that they estimate the relationship between the distance to neighborhood retail establishment and individual travel modes. Using the trip diary data of 1,635 individuals in the Twin Cities of Minneapolis and St. Paul, Minnesota, they find that only individuals residing within 200 meters from a retail establishment are likely to increase the probability of walking compared with those who have no retail establishment within 600 meters from their residences. As their analyses do not specify the purpose of trips, however, the results do not suggest whether the proximity to retail establishments plays a role to general mode of travel or shopping trips specifically.

2.2. Travel destination and mode choices for shopping purposes

While the main interest for the above studies is the association between urban forms and travel behaviors in general, there is a strand of research focusing on shopping trips. As shopping trips are considered inessential trips, accessibility in terms of travel time is a main determinant for the individual choice of shopping destination (Koppelman and Hauser, 1978; Recker and Kostyniuk, 1978; Landau et al., 1982; Kitamura and Kermanshah, 1984; Timmermans, 1996). In modelling the shopping destination choice, therefore, it is common to use travel time constraints to restrict alternative choice sets (e.g. Thill and Horowitz, 2002). Building on this framework, Huang and Levinson (2015) suggest that people are likely to choose a shopping destination with shorter travel time and with more walkable opportunities. In line with this evidence, we hypothesize that there is a high probability for residents to switch their shopping destination from retail establishments requiring automobile trips to new neighborhood malls within walking distance.

Few studies examine the direct role of the urban environment to travel mode choices for shopping trips, and they offer solid foundations for our research. For example, Rajamani et al. (2003) use the Portland Metropolitan Area Activity Survey data and demonstrate that the land use mix diversity index has a significant, positive association with the probability to choose walking for non-work trips. Based on their analysis using the household survey data in 22 neighborhoods in Iran, Etminani-Ghasrodashti and Ardeshiri (2016) also find that residents in neighborhoods with more mixed use tend to use non-motorized modes for their non-work trips. We could treat the opening of the mall as a small-scale change in the land use mix and expect the similar increase in the probability of walking or cycling. Using the Seattle Obesity Study data, Jiao et al. (2011) suggest that the probability of driving decreases when the distance between homes and grocery stores is shorter and when stores are clustered. This provides good motivation for our empirical approach using the neighborhood mall as a clustered retail amenity as well as our hypothesis that the distance to the newly opened mall affects the change in taxi trips for shopping purposes.

2.3. Singapore's contexts

As a well-known shopping destination, Singapore presents a wide array of retail amenities in both the downtown and suburban areas (Henderson *et al.*, 2010). While retail facilities were concentrated in the CBD before the 1960s, public housing programs initiated by the government agency, the Housing Development Board (HDB), have led to suburban new towns and provided a planned hierarchy of retail services in these towns.[1] People make shopping trips not only to purchase needs or the desire to acquire product information but also as a weekly family ritual in Singapore (Chua, 2003). Also, because most women work, it is common to dine out frequently. Almost two thirds dine out at least four times a week (Health Promotion Board Singapore, 2010). For their retail activities, Singapore residents show strong preference for indoor, air-conditioned shopping malls that incorporate fringe services such as banks as well as recreational and entertainment components such as cinemas (Ibrahim and Ng, 2002; Davies, 2012).[2] As of August 2020, there are 171 shopping malls in Singapore, which is significantly more than the 65 in New York City.[3] There is also evidence that Singapore residents are willing to pay the premium for housing units that are closer to shopping malls. Deng et al. (2012) suggest that the proximity to shopping malls leads to a significant increase in housing prices in Singapore.

According to the Household Travel Survey 2012 by the Land Transport Authority, 63% of Singapore commuters use public transport for their daily trips. Among the public transport modes, taxi ridership accounts for 14 to 15% over the period of 2009–2012 compared to the 16 to 17% ridership of light rail transit (Singapore Statistics). Despite the increasing trend of public transport usage, many people still prefer private vehicle trips and this preference is strong especially for shopping trips. Due to the extremely high costs of car ownership from the implementation of the Vehicle Quota System (VQS) and Electronic Road Pricing (ERP),[4] however, only 46% of households own cars in Singapore. In this context, taxis are considered an ideal substitute that incur much lower costs. In fact, people perceive

[1] Still, most large-scale malls are located in city centers. For example, Orchard Road, which is the principal shopping belt in the CBD area, has more than 30 malls.
[2] This is in line with Bloch et al. (1994) that malls are considered not only as shopping destinations but also as places for entertainment and social interactions.
[3] Source: Wikipedia. The population of Singapore and New York City are 5.7 million and 8.4 million, respectively. E-commerce challenges are less relevant to our study period of January 2009–September 2012.
[4] The main purpose for these measures is to mitigate road traffic congestion. Still, in 2015, Singapore was ranked 38th in a global index which measures the severity of traffic congestion on roads during peak hours by TomTom. Drivers in Singapore spend 33% extra time stuck in traffic across the day, and up to 65% more time during the evening peak. This adds up to 126 hours of extra travel time a year (www.tomtom.com).

taxis to meet the similar level of travel qualities to the private car, including 'travel time', 'suitability' and 'practicality' (Ibrahim, 2005). In particular, when shoppers have to carry many things from shopping, they are likely to choose taxis among the public transport modes. As a result of the strong taxi demand, about 28,000 taxis and 99,000 licensed taxi drivers provide more than 1 million taxi trips daily in Singapore.

2. Data and methods

3.1. Data

This study utilizes data coming from several sources. The first is a dataset on taxi trips. Our taxi-trip data is provided by one of the largest taxi operators in Singapore, covering periods from January 2009 to September 2012. The market share of this taxi company is around 50–60% (in terms of the number of taxis), and the monthly ridership is around 11–12 million trips. Due to its dominant market position, the trip data it provides can thus be viewed as a representative sample of the actual taxi trips in Singapore. We focus on the period of 2009-2012 because it is before the entries of ride-hailing, food delivery, and logistics services technology companies which are likely to involve more complicate travel choices and potential confounding issues.[5] For each taxi trip, we have the following two categories of details: (1) the GPS coordinates and timestamps of the trip origin and destination, and (2) the distance, duration, and charged fare of the trip. From the spatiotemporal information of the trip, we could further derive the closest postal codes associated with the GPS coordinates of the trip origin and destination.[6] This is a crucial step, as it allows us to associate the origin and the destination of a trip to postal codes.

[5] Ride-hailing, food delivery, and logistics services technology companies entered Singapore after our research period (e.g., Uber in late 2012 and Grab in 2013), so they should not affect our analyses.
[6] The mapping from a GPS coordinate to the closest postal code is achieved by using the official API service from OneMap, which is an open platform provided by the Singapore Land Authority.

The second data are the land use information of each postal code. The postal code system utilized in Singapore is unique in that each postal code is associated with a building and unique XY coordinates. Because of this, we could easily determine the land use (e.g. residential, retail, etc.) of the origin and destination postal codes. We determine the land use of each postal code mainly based on the 2008 Master Plan, which is the statutory land use plan in Singapore (https://www.ura.gov.sg/Corporate/Planning/Master-Plan) and official property database including the Urban Redevelopment Authority's (URA) REALIS portal and the Housing Development Board[7] resale transaction database. For some ambiguous cases, usually because of the mixed land use of a particular building, we rely on the Google Street View and PropertyGuru (an online property platform) to determine the most appropriate land use for the building. This postal code system also allows us to identify the exact location of shopping malls as all malls in Singapore can be uniquely identified by their postal codes. By combining the land use information with the above taxi-trip data by postal codes, we could then determine the time-dependent taxi-trip flows between any pair of postal codes. Note that we focus on trip flows originating from residential postal codes.

Finally, although we focus on the share of shopping trips out of all taxi trips so travel mode choices are less relevant to our analyses, we consider the potential that other modes influence this share.[8] For public transportation accessibility, we collect the distance from each residential postal code to the nearest subway station for each month.[9] To account for the driving option, we collect the vehicle ownership rate at the neighborhood level and calculate the road-based distance of each residential

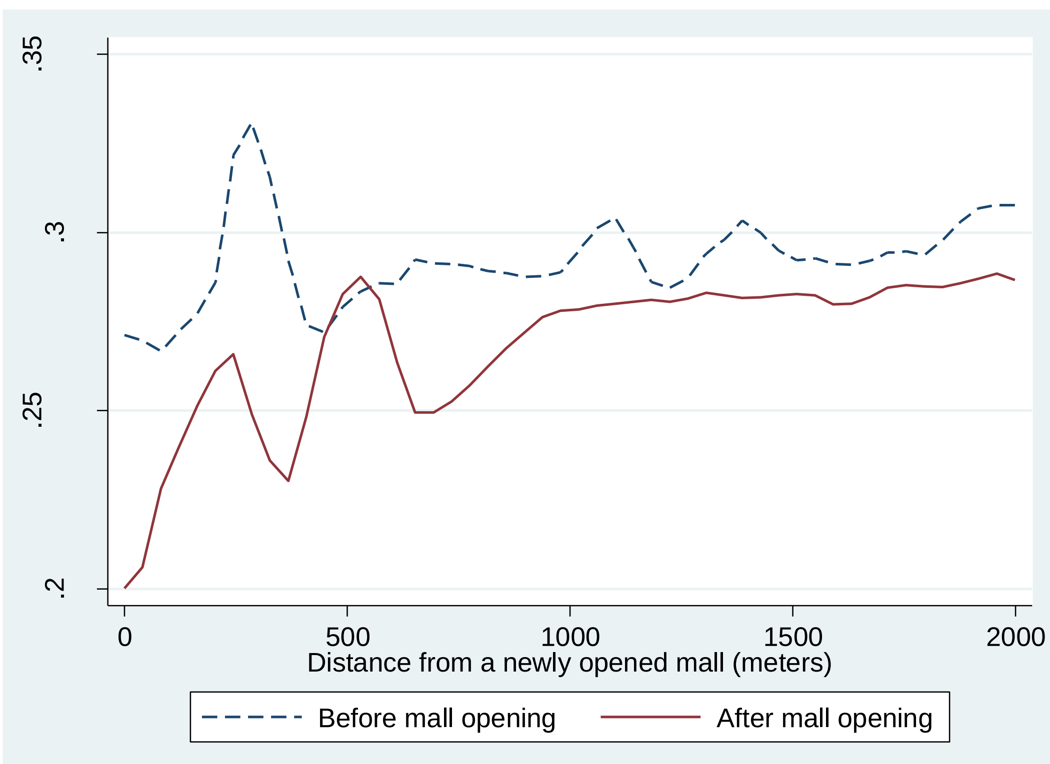
[7] The Housing and Development Board refers to the statutory board of the Ministry of National Development that is responsible for public housing as well as public housing itself in Singapore.

[8] For example, a lot of new subway stations open near shopping areas, some taxi riders may switch to subway for their shopping trips. Similarly, if the road conditions are significantly improved for shopping malls, some taxi riders may switch to driving.

[9] We also collect the distances from each residential postal code to the CBD and the nearest expressway.

building to the shopping mall opened during our study period. The road-based distance is also a better proxy for the walking distance than the straight-line distance used in most previous studies.[10] Based on these distances, two binary variables are generated: (1) whether the nearest shopping mall is located within 800 meters and (2) whether the nearest shopping mall is located within 1,500 meters. The distance criteria are determined following the gradient of taxi trips for shopping by distance from the nearest shopping mall, which suggests that after the opening of the new neighborhood shopping mall, the share of trips to other shopping destinations out of total taxi trips decreases significantly within 800 meters from the mall (see Figure 1).[11] This 800-meter cutoff is also considered as the walkable distance and the extent of the perceived neighborhood boundary in the urban planning literature (Moudon et al., 2006).

Figure 1. Gradient of Taxi Trips for Shopping by Distance from Shopping Malls.



[10] The real walking distance could be between the road-based distance and the straight-line distance as some take shortcuts that are only possible for walkers.
[11] The gradient using the residuals from the log price regression that include all controls but excludes the distance to the closest mall shows a very similar pattern.

Note: This is based on the results from local polynomial regressions of the share of shopping trips out of total taxi trips on the distance from shopping malls.

3.2. Samples

Table 1 provides summary statistics for two primary samples of monthly taxi trips originated from residential postal codes during our study period. The first sample is created by dropping all residential buildings that already had a shopping mall within 1,500 meters before January 2009 or more than one shopping mall within 1,500 meters during the study period (column 1). In other words, this sample is composed of residential buildings that were never near any shopping mall (control group) and those that were near only one shopping mall opened during our study period (treatment group). Following Pope (2008) and Kim and Lee (2018), this restriction is to ensure that being located close to multiple shopping malls do not obscure the treatment effect. The first sample contains 9,133 residential buildings and 359,068 monthly taxi records over 40 months.

The second sample is created by dropping all residential postal codes in the first sample that are located further than 1,500 meters from the shopping malls that opened during our study period (column 2). By doing so, each newly opened shopping mall creates a "mall" area with the average area of about 7 square kilometers and the sample consists of 1,164 residential buildings.[12] This mall area is based on the location rather than an administrative boundary, so it may better control for neighborhood characteristics. As the size of the mall area–based sample is significantly smaller than the first sample, and the postal sector fixed effects should effectively control for spatial confounding, analyses using the second sample are reported as supplementary results to those from the first sample.

[12] There are 80 postal sectors based on the first two-digit of the unique six-digit postal code system in Singapore. The size of residential postal sectors varies between 0.1 and 3 km^2. We use the postal sector fixed effects for analyses with the full sample.

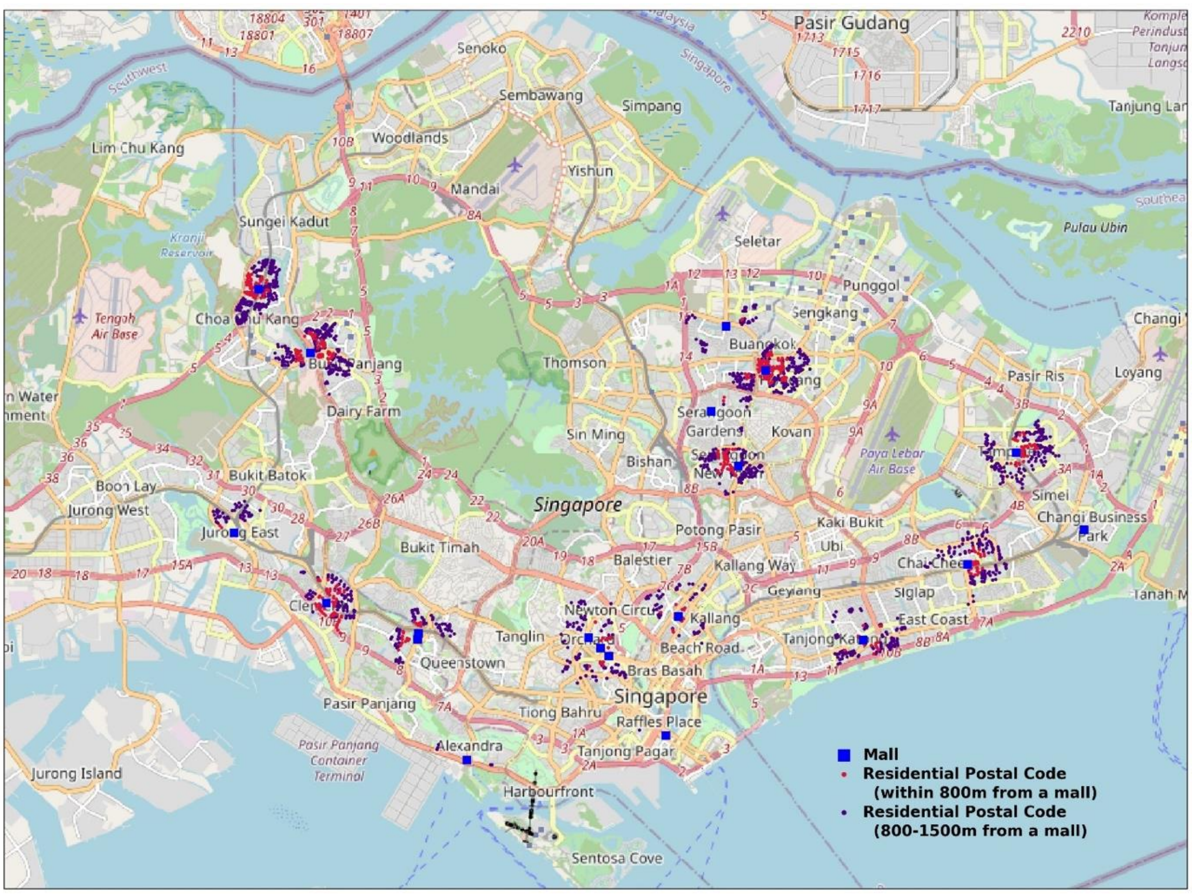
Table 1. Summary Statistics

	(1)		(2)		(3)	
	Cleaned full sample of residential postal codes * month (January 2009–September 2012)		Subsample of postal codes within 1500 meters from newly opened mall * month (Mall Areas)		Subsample of postal codes within 800 meters from newly opened mall * month (Treatment Group I)	
Number of observations	359,068		46,546		6,120	
Number of residential postal codes	9,133		1,164		153	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Taxi trips per 1 month originated from each residential building						
Total number of taxi trips	325.344	533.123	381.607	559.730	386.979	560.439
Total number of trips to shopping destination	95.986	158.335	110.496	165.291	111.957	174.798
Share of no. shopping trips out of total trips	0.288	0.111	0.285	0.100	0.280	0.083
Total distance traveled to shopping destination (km)	936.741	1,386.465	1,045.760	1,437.130	1,069.935	1,484.466
Share of shopping trip distance out of total trip distance	0.280	0.114	0.280	0.102	0.279	0.086
Total number of trips to mall	21.574	31.920	25.348	32.108	24.371	34.924
Share of no. mall trips to mall out of total shopping trips	0.078	0.065	0.076	0.055	0.071	0.045
Location characteristics						
Distance to the closest subway station (m)	1,633.211	893.101	1,426.539	807.606	1,413.081	932.103
Distance to the CBD (m)	11,716.540	4,591.265	11,094.610	3,794.992	11,070.390	3,282.347
Distance to the closest expressway (m)	1,007.020	814.808	991.790	601.669	1,336.956	610.767
Other characteristics						
Car ownership per population (proxied from survey)	0.132	0.096	0.117	0.060	0.105	0.025
Within 800 meters from a shopping mall newly opened between 2009 and 2012	0.017	0.129	0.131	0.338	1.000	0.000
Between 800 and 1,500 meters from newly-opened mall	0.113	0.316	0.869	0.338		

Note 1: The unit of analysis is the monthly taxi trip record originated from each residential building.

The subsample of the treatment group I is composed of residential buildings located within 800 meters from a newly opened shopping mall (column 3). There are 153 residential buildings and 6,120 monthly observations under this category. Figure 2 exhibits the mapped locations of 20 shopping malls that opened between January 2009 and September 2012 (blue squares) and residential postal codes (black dots) for the cleaned full sample. The green circles represent the 800-meter buffer from each mall, and residential buildings within these circles belong to the treatment group. Pink circles represent 1,500-meter buffers, mall areas introduced above. Units within the pink circles but outside of the green circles are used as the treatment group II for the analysis using the first sample as well as the comparison group for the analysis using the second sample.

Figure 2. Spatial Distribution of Newly Opened Shopping Malls between 2009 and 2012 and Residential Postal Codes.



According to Table 1, both the number and distance of taxi trips for shopping originated from residential postal codes that are closer to the newly opened shopping malls (columns 2 and 3) appear to be higher than the average number and distance of taxi trips for shopping (column 1). Areas that are closer to shopping malls also show a larger number of non-shopping trips. These results imply that new shopping malls are likely to be located in areas concentrated with more residential population, which makes sense from the developers' mall-location choice. Alternatively, as these areas have lower car-ownership rates (columns 2 and 3) compared to the national average (column 1), residents in these areas may rely more on taxis than other transport modes. In any event, the important fact is that the shares of the number and distance of shopping trips out of total taxi trips originated from these areas (columns 2 and 3) are not larger than the national average shares (column 1). This suggests that the taxi travel patterns of residents in the treatment and comparison group do not significantly differ from those in other areas of Singapore. More importantly, there is little heterogeneity in most attributes between the mall areas (column 2) and treatment group I (column 3) and this ensures random distribution of the new shopping mall location within the mall areas.

3.3. Empirical methodology

A simple cross-sectional model that uses the distance of a residential building to the nearest shopping mall to estimate the relationship between the proximity to the neighborhood mall and taxi trips for shopping would be as follows:

$$Log(T_{ijt}) = \beta D_{ijt}^{800} + X_i'\gamma + \varphi_t + \alpha_j + \varepsilon_{ijt} \qquad (1)$$

where T_{ijt} is the share of the number (or distance) of taxi trips for shopping out of the total number (or distance) of taxi trips originated from the residential building *i* in postal sector *j* in month *t*, D_{ijt}^{800} is a binary indicator of whether any shopping mall is located within 800 meters from residential building *i*. Note that we observe the tax trips for a shopping purpose relative to all taxi trips instead of the raw number or distance taxi trips for shopping. By doing so, we try to make our analyses less relevant to choices of other travel modes. X is a control vector of location-specific characteristics, including the distance to the closest subway station, the distance to CBD and the distance to the closet expressway. Because our taxi data do not have sociodemographic information which may influence the tendency to use taxi for a shopping purpose relative to use taxis in general, we include spatial and temporal controls, such as postal sector fixed effects (φ_j) and year-month fixed effects (α_t). These controls help increase the probability that the treatment effect is as exogenous as possible. ε_{ijt} is an *i.i.d.* error term. To account for potential serial correlation of residuals within a neighborhood, standard errors are clustered at the postal sector level j following the recommendation of Bertrand, Duflo, and Mullainathan (2004) and Cameron and Miller (2015).

However, it is possible that the opening of neighborhood shopping malls is correlated with unobserved location characteristics and with a temporal market trend. Cross-sectional regressions cannot avoid being subject to the problem of unobserved spatial heterogeneity and an omitted variable bias. For example, if some unobserved negative attributes already exist at or near the location of the shopping mall, those factors would reduce taxi trips for shopping within 800 meters from this location right before the shopping mall is opened. As the main goal of this analysis is to estimate the isolated, causal effect of the opening of the shopping mall on nearby residents' taxi-trip behavior for shopping, a difference-in-differences (DID) using the full sample (see Table 1, column 1) is employed as the main empirical strategy as follows:

$$Log(T_{ijt}) = (\beta D_{ijt}^{800} + \delta D_{ijt}^{1500}) + (\theta D_{ijt}^{800} + \lambda D_{ijt}^{1500}) \times Post_{it} + X_i'\gamma + \varphi_t + \alpha_j + \varepsilon_{ijt}. \quad (2)$$

The main difference of this DID equation from the cross-sectional specification shown in Equation (1) is the inclusion of the interaction between the distance of residential postal codes to the nearest shopping mall and *Post*, a binary indicator of the retail taxi trips originated from the residential postal code *i* in month *t* occurred after the opening month of the nearest shopping mall. θ and λ pick up the opening effect of the shopping mall within 800 meters and between 800 and 1,500 meters on taxi trips for shopping, respectively. D_{ijt}^{1500} is a binary indicator of whether this shopping mall is located within 800 and 1,500 meters (i.e., outside the treatment area but within the 1,500 meter) of residential building *i*. The interaction term between D_{ijt}^{1500} with *Post* is added to estimate counterfactual treatment effects by using the units that are located slightly farther away from the shopping mall. Again, because we measure the change in the share of shopping trips out of all taxi trips after the mall opening, changes in transport mode choices are less relevant to our DID analyses.

As mentioned earlier, the subsample located within 1,500 meters from the newly opened shopping mall (mall area) is based on location of each mall. The dependent variable for the DID model using this subsample is T_{ikt}, the share of the number (distance) of taxi trips for shopping out of the total number (distance) of taxi trips originated from residential building *i* in mall area *k* in month *t*. Here, mall area-by-year fixed effects (δ_{ky}) are included and standard errors are clustered at the mall area level. Other variables are same as the ones used for equations (1) and (2).

Table 2. Cross-sectional Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Cleaned full sample	Cleaned full sample	Subsample of Mall Areas	Cleaned full sample	Cleaned full sample	Subsample of Mall Areas
VARIABLES	Number of shopping trips	Share of no. shopping trips out of total taxi trips		Distance to shopping destinations	Share of shopping trip distance out of total taxi trip distance	
Within 800 meters from newly opened mall	18.5107	-0.0044	-0.0028	152.8658	-0.0042	-0.0042
	(13.3864)	(0.0041)	(0.0050)	(127.3092)	(0.0030)	(0.0053)
Between 800 and 1,500 meters from newly opened mall	10.8446	-0.0006		104.1363	0.0002	
	(9.4175)	(0.0027)		(79.7881)	(0.0029)	
Constant	328.9920***	0.3557***	0.3479***	1256.7780	0.1521***	0.1467***
	(9.5992)	(0.0042)	(0.0077)	(83.6019)	(0.0048)	(0.0077)
Observations	359,068	359,068	46,546	359,068	359,068	46,546
R-squared	0.085	0.124	0.144	0.046	0.027	0.043
Distances to MRT, CBD, and expressways	Yes	Yes	Yes	Yes	Yes	Yes
Car Ownership Rate	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Postal Sector FE	Yes	Yes	NO	Yes	Yes	NO
Mall area-year FE	NO	NO	Yes	NO	NO	Yes

Note 1: Standard errors clustered at the postal sector level are reported in parentheses.

*Note 2: *** p<0.01, ** p<0.05, * p<0.1*

3. Results

4.1. The impact of the neighborhood shopping mall opening on taxi trips for shopping

Table 2 presents estimates of the cross-section model presented in Equation (1). The analysis results from this specification show the difference between taxi trips for shopping originated from residential buildings within 800 meters from newly opened malls and those from other residences in Singapore. The average difference in the number of monthly shopping trips is about 18.5 when we include all controls including the year-month fixed effects, but it is not statistically significant (column 1). When changing the dependent variable to the share of the number of monthly shopping trips, the average difference is less than 0.01 and statistically insignificant for both the full sample (column 2) and subsample of residential buildings within 1,500 meters from new malls (column 3). Similarly, we do not find any substantial difference in terms of the taxi-trip distance for shopping by the distance of residential buildings to new malls (columns 4-6). Taxi trips for shopping originated from residences between 800 and 1,500 meters from newly opened malls are also not significantly different from those from other residential buildings (columns 1, 2, 4 and 5). These results suggests that households residing near the location of new malls (treatment group) do not take taxis to shopping destinations more or less significantly than other households (control group).

As the main quasi-experimental treatment of this analysis is being located within 800 meters from new malls, the treatment effect is estimated after these malls open using the DID specification in Equation (2). Results using the full sample shown in Table 3 demonstrate that the mall opening within 800 meters causes a significant reduction in the number of taxi trips to other shopping destinations (columns 1 and 2). Prior to the mall opening, the number of taxi trips for shopping originated from these residential buildings was not significantly different from that of trips from other residences with similar locational attributes that did not have any new malls nearby and in the same postal sector and year-month (columns 1 and 2). However, after the new mall opens, each residential building located within 800 meters from the mall originates 33 fewer taxi trips to other shopping destinations per month on average, compared to the number of trips from the same buildings before the mall opening (columns 1). As a result, the share of the number of shopping trips out of total taxi trips also decreases by 1 percentage point and the reduction is statistically significant at the 3% level (column 2).

For residential buildings located between 800 and 1,500 meters, the estimated reduction in taxi trips for shopping after new malls open was close to zero compared to the pre-opening period (columns 1 and 2). This is statistically insignificant and negligible compared to the 33-trip decrease or 1 percentage point decrease in the share of shopping trips out of total taxi trips that originated from residential buildings within 800 meters. Hence, the treatment effect of the mall opening on taxi-trip behaviors for shopping is highly significant for households that reside within the 10-minute walking distance to the location of the mall and dissipates beyond this distance. This 800 meters is a longer distance than the 200-meter cutoff that Krizek and Johnson (2006) found to be significant for increasing the probability of walking. Although our data do not allow us to investigate the travel mode changes of individual households, therefore, we could infer that people in Singapore are willing to walk a longer distance than those in the U.S., or some households in Singapore chose other modes such as cycling to travel to the neighborhood mall.[13]

[13] According to the statistics reported by the Land Transport Authority, 70% of commuters in Singapore use the subway within a radius of 800 meters or about 10 minutes walking distance.

Table 3. Effect of Neighborhood Mall Opening on Taxi Trips to shopping destination (Difference-in-Difference Regression Results)

	(1)	(2)	(3)	(4)	(5)	(6)
	Cleaned full sample	Cleaned full sample	Subsample of Mall Areas	Cleaned full sample	Cleaned full sample	Subsample of Mall Areas
VARIABLES	Number of shopping trips	Share of no. shopping trips out of total taxi trips		Distance to shopping destinations	Share of shopping trip distance out of total taxi trip distance	
Within 800 meters from newly opened mall	23.1752	-0.0048	-0.0010	206.0464	-0.0031	-0.0028
	(13.4788)	(0.0046)	(0.0045)	(119.5305)	(0.0030)	(0.00520)
Within 800 meters from newly opened mall & trips made 1 month after mall opening	-33.0979**	-0.0101**	-0.0142***	-354.7235***	-0.0114**	-0.0110**
	(12.8581)	(0.0046)	(0.0035)	(115.526)	(0.0054)	(0.0053)
Between 800 and 1,500 meters from newly opened mall	11.3230	-0.0026		109.5551	-0.0001	
	(9.7736)	(0.0029)		(81.87469)	(0.0034)	
Between 800 and 1,500 meters from newly opened mall & trips made 1 month after mall opening	-0.1931	0.0020		19.56641	-0.0013	
	(10.0363)	(0.0019)		(88.88411)	(0.0041)	
Observations	359,068	359,068	46,546	359,068	359,068	46,546
R-squared	0.085	0.125	0.145	0.046	0.027	0.043
Distances to MRT, CBD, and expressways	Yes	Yes	Yes	Yes	Yes	Yes
Car Ownership Rate	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Postal Sector FE	Yes	Yes	NO	Yes	Yes	NO
Mall area-year FE	NO	NO	Yes	NO	NO	Yes

Note 1: Standard errors clustered at the postal sector level (for Columns 1, 2, 4 and 5) and the Mall Area level (for Columns 3 and 6) are reported in parentheses.

*Note 2: *** p<0.01, ** p<0.05, * p<0.1*

A potential concern of these results based on the full sample is that the relationship between taxi-trip behaviors for shopping are systematically different between within and outside the mall areas. To address this concern, the treatment effect is re-estimated using the subsample of residential postal codes located within 1,500 meters from the new malls. Results suggest that after the neighborhood mall opens, individuals residing within 800 meters from the mall reduce their taxi trips to other shopping destinations significantly and, in turn, the share of shopping trips out of total taxi trips decreases by about 1.4 percentage points and it is significant at 1% even after clustering standard errors at the mall area level (column 3). As this is consistent with results in columns 1 and 2 while the magnitude of the shopping-trip reduction becomes slightly larger, it demonstrates that using additional residential postal codes outside of mall areas does not lead to statistical bias.

While the reduction in the number of taxi trips for shopping accounts for intensive margin responses to the mall opening, the distance traveled to other shopping destinations by taxi indicates extensive margin changes in travel behaviors. Results in Table 3 show that the mall opening does reduce the taxi-trip distance for shopping (columns 4 and 5). After the neighborhood mall opens, individuals in each residential building within 800 meters from the mall decrease their taxi trips to other shopping destinations by about 355 km per month on average, compared to the distance from the same building before mall opening (columns 4). The share of the shopping-trip distance out of total taxi-trip distance also decreases by 1.1 percentage points (column 5). When using the tightly bounded subsample of the mall areas, this 1.1 percentage point decrease remains consistent (column 6), which is about a 4% reduction of taxi trips for shopping.[14]

We interpret our results aggregated at the residential building level as suggestive evidence of travel

[14] The average share of shopping-trip distance out of total taxi-trip distance is 0.279 (Table 1).

behavior changes of individuals. They suggest the important role of neighborhood retail service provision to the residents' shopping travel patterns. When a new neighborhood mall opens, residents who used to take taxis to other retail establishments for shopping are likely to choose the new mall over others as their shopping destination. And when this new mall is located within walking distance, residents may switch their travel mode from taxis to walking or cycling. This confirms the external validity of existing evidence on the effect of the proximity to retail establishments on the choice of non-motorized travel modes (Cervero and Duncan, 2003; Krizek and Johnson, 2006) in the high-density environment. Further, we suggest that travel behavior change induced by new malls would be particularly significant in cities where a lot of shopping activities happen in indoor malls. For example, the trips to shopping malls account for about 23% out of total shopping trips (or 8% of total taxi trips) in Singapore. The back-of-the-envelope calculation based on the above results suggest that the 20 malls the opened in Singapore between January 2009 and September 2012 reduced 5,049 taxi trips for shopping and 54,315 km traveled on the road per month.

4.2. Mall treatment effects during different times

Results shown above are the average monthly effect of the new mall opening on taxi-trip behaviors for shopping. There is evidence that many trips for shopping activity occur during the peak hours and add even more congestion on the road (Kim et al., 1994). If new neighborhood shopping malls can reduce shopping-trip demand by taxis during peak hours, therefore, they may play a more significant role to mitigating congestion. To test this, we create new dependent variables by calculating the shares of the number/distance of shopping trips out of total taxi trips generated from each residential building during the PM peak hours (5 p.m.–midnight), off-peak hours (10 a.m.–5 p.m.), and weekends and estimate mall treatment effects during these time periods.

Table 4 suggests how the extent to which the mall opening reduces shopping trips is largest during the

PM peak hours. The new neighborhood malls within 800 meters lead to a reduction in the share of the number of shopping trips out of total taxi trips by 18.5 percentage points during the 5 p.m.–midnight (column 1) period while the reduction is only 3.36 and 2.62 percentage points during off-peak hours and weekends, respectively (columns 2 and 3). Results on the distance traveled to other shopping destinations consistently report the most significant post–mall opening effect during the PM peak hours. Individuals in each residential building within 800 meters from the new mall decrease the trip distance to other shopping destinations out of their total taxi-trip distances by about 21 percentage points (column 4). This contrasts to the null effect during the off-peak hours (column 5) and a 2.7 percentage point reduction during weekends (column 6).

These results suggest the new shopping malls could have positive externality to traffic reduction, especially if locating them close to residential buildings that generated many taxi trips to shopping destinations. And this reduction appears to be greater in PM peak hours, during which traffic congestion is most serious (see Footnote 4). Although this study does not directly estimate the traffic-reduction effect during different times, we argue that the effect during peak hours could be even more significant than what we observe from regression results. Traffic congestion happens if the sum of different types of vehicular trips, such as commuting, shopping, and other trips, reaches beyond the road's maximum traffic capacity (Baht and Steed, 2002). As commuting trips are likely to consume most of this capacity and leave the roads quite congested during peak hours, therefore, the traffic-reduction effect caused by mall openings would be even more notable.

Table 4. Mall Treatment Effects on Taxi Trips during Different Time Periods

	(1)	(2)	(3)	(4)	(5)	(6)
	During PM peak hours (5 pm–midnight)	During off-peak hours (10 am–5 pm)	During weekends	During PM peak hours (5 pm–midnight)	During off-peak hours (10 am–5 pm)	During weekends
VARIABLES	Share of no. shopping trips out of total taxi trips			Share of shopping trip distance out of total taxi trip distance		
Within 800 meters from newly opened mall	0.0528	-0.0006	0.0011	-0.1162	-0.0715	0.0032
	(0.0548)	(0.0075)	(0.0071)	(0.0754)	(0.0432)	(0.0065)
Within 800 meters from newly opened mall & trips made 1 month after mall opening	-0.1851***	-0.0336***	-0.0262***	-0.2101***	0.0231	-0.0269***
	(0.0544)	(0.0074)	(0.0063)	(0.0691)	(0.0329)	(0.0076)
Between 800 and 1,500 meters from newly opened mall	-0.0165	0.0017	0.0008	-0.0235	-0.0369	0.0041
	(0.0189)	(0.0058)	(0.0037)	(0.0804)	(0.0228)	(0.0035)
Between 800 and 1,500 meters from newly opened mall & trips made 1 month after mall opening	-0.0049	-0.0015	0.0021	-0.1923	-0.0177	-0.0002
	(0.0124)	(0.0054)	(0.0028)	(0.0811)	(0.0222)	(0.0054)
Observations	359,068	359,068	359,068	359,068	359,068	359,068
R-squared	0.015	0.047	0.056	0.004	0.001	0.017
Distances to MRT, CBD, and expressways	Yes	Yes	Yes	Yes	Yes	Yes
Car Ownership Rate	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Postal Sector FE	Yes	Yes	Yes	Yes	Yes	Yes

Note 1: Standard errors clustered at the postal sector level are reported in parentheses.

*Note 2: *** $p<0.01$, ** $p<0.05$, * $p<0.1$*

4.3. Heterogonous mall effects by residential buildings

As the location of residential buildings within a city is an important determinant of travel modes and shopping destinations, it could possibly influence the magnitude of the mall-opening treatment effect on shopping-trip behaviors of households residing nearby. For example, the taxi-trip reduction for shopping may be higher if residential buildings are located farther from areas with a main retail agglomeration. In other words, households who used to have to travel by taxis more frequently and longer distance for shopping are more likely to be willing to adjust their travel behavior after they find new neighborhood malls within walking distance. On the other hand, if their residences were relatively closer to other retail amenities even before a mall opening, they may have lower incentives to change their shopping habits. To analyze heterogeneous effects of mall openings on taxi-trip behaviors for shopping, we first stratify the sample by the tertile measures of the distance to downtown areas.

Table 5 presents significant heterogeneous mall-opening effects between the bottom 33% and top 33% in terms of the distance to downtown. First, residential buildings in the top 33% of the distance to downtown experience an approximately 1.2 percentage point reduction in the share of the number of shopping trips out of total taxi trips after a shopping mall within an 800-meter boundary opens (column 2). Conversely, the result suggests that residential buildings in the bottom 33% do not experience any significant reduction in shopping trips (column 1). Hence, results support the above hypothesis that residents in suburban locations are more likely to adjust their taxi trips to other shopping destinations than those residing closer to downtown areas after the new neighborhood mall opens nearby.

Table 5. Heterogeneous Mall Effects by Location and Type of Residential Buildings

	(1)	(2)	(3)	(4)
	Subsample of residential buildings in the bottom tertile of the distance to downtown	Subsample of residential buildings in the top tertile of the distance to downtown	Subsample of public housing buildings	Subsample of condominium buildings
VARIABLES	Share of no. shopping trips out of total taxi trips			
Within 800 meters from newly opened mall	-0.0069	-0.0035	-0.0044	0.0064
	(0.0089)	(0.0015)	(0.0039)	(0.0164)
Within 800 meters from newly opened mall & trips made 1 month after mall opening	0.0050	-0.0119***	-0.0083*	-0.0239**
	(0.0053)	(0.0025)	(0.0044)	(0.0103)
Between 800 and 1,500 meters from newly opened mall	-0.0093	-0.0075	-0.0041	0.0091
	(0.0075)	(0.0018)	(0.0030)	(0.0068)
Between 800 and 1,500 meters from newly opened mall & trips made 1 month after mall opening	0.0025	0.0035	0.0027	0.0106
	(0.0098)	(0.0021)	(0.0023)	(0.0056)
Observations	120,396	121,966	273,842	85,226
R-squared	0.069	0.037	0.107	0.117
Distances to MRT, CBD, and expressways	Yes	Yes	Yes	Yes
Car Ownership Rate	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Postal Sector FE	Yes	Yes	Yes	Yes

Note 1: Standard errors clustered at the postal sector level are reported in parentheses.

*Note 2: *** $p<0.01$, ** $p<0.05$, * $p<0.1$*

Another potential variation in mall-opening effects could come from planned features of broader communities that residential buildings belong to. As mentioned in the previous section, the majority of public-housing buildings in Singapore are located in suburban areas called new towns.[15] HDB has been responsible for public-housing development and followed the principles of self-containment and full-service provision to residents including retail shops in town centers and neighborhood centers. Hence, even though public-housing buildings do not have any shopping malls nearby, they are likely to have retail establishments for daily needs including food courts and grocery stores in a proximate distance. In contrast, private housing, referred to as condominiums, is usually designed as purely residential purposes with a much smaller scale. Table 5 reports stratified results for the subsamples of public housing and condominium buildings. While condominiums within 800 meters from new shopping malls experience about a 2.4 percentage point drop in the share of the number of shopping trips out of total taxi trips after the mall opening (column 4), public-housing buildings experience less than a 1 percentage point reduction (column 3). This suggests that residents in condominiums are more sensitive to a new retail amenity provision within a short distance of their residence and are more likely to change their shopping-trip behaviors than those in public housing.

These results suggest that the role of expanded retail amenities to taxi-trip behaviors for shopping is more significant if these amenities are provided in suburban locations and near residential areas without existing retail establishments in a proximate distance. At the same time, they indicate the importance of proper community planning, especially retail service provision to residents within a walking distance, efficient distribution of shopping trips, and mitigation of traffic congestion. The urban planning literature tends to highlight minimizing commuting and school trips for the goal of well-planned self-sufficiency in suburban new towns (Hamilton & Röell, 1982; Hui and Lam, 2005; He

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[15] The land size of new towns ranges from 3.84 to 13.09 km^2 and cover up to more than 70,000 housing units.

et al., 2020). Our findings add suggestive evidence on the positive externality of proper community planning linked with less wasteful shopping trips and welfare gains from the reduced congestion and air pollution at the aggregate-level.

4.4. Robustness tests

There is a potential concern that the change in taxi-travel behavior that we observe might come from a shopping-trip reduction right before the new neighborhood mall opens. Hence, a falsification test is performed using false dates of mall openings that are 6 months and 1 year before the actual opening. As shown in Appendix 1, the regression results reveal no evidence that shopping trips in treatment areas closer to new neighborhood malls were experiencing a significant downward trend before the actual mall opening.

In addition, the underlying assumption imposed by our DID model is that residential buildings in the treatment and control groups have parallel trends of taxi-trip behaviors for shopping. An event study identification is helpful to validate this assumption as time horizons are less restrictive. Hence, a robustness test is done by specifying a series of interactions of 12 time dummies (i.e., −36 to −30 months, −30 to −24 months . . . +24 to +30 months, +30 to +36 months). As presented in Figure 3, shopping-trip gradients do not evolve much prior to mall openings. Six months after the opening, there is a drop in shopping trips by taxi only for residential buildings within 800 meters. Similarly, Appendix 2 reports no significant change in taxi-trip patterns for shopping is found before the mall opening for the treatment group within 800 meters from neighborhood malls. The shopping trip reduction in terms of both the number and distance appears to begin only after 6 months of a mall opening and remain significant up to 3 years afterward.

Figure 3. Gradient of Taxi Trips for Shopping by Distance from Shopping Malls: 6-18 Months Before and After the Mall Opening

4. Conclusion

This study analyzes the causal impact of newly developed malls on the taxi-trip behavior of nearby residents. We reveal that residential buildings within 800 meters of recently opened neighborhood malls experience a significant drop in taxi trips to other shopping destinations. The number of trips fall by 33 per month or the share of shopping trips out of total taxi trips decreases by 1.4 percentage points. We also find a similarly significant reduction in the distance traveled to other shopping destinations only for residential buildings that are within walking distance from newly opened malls. Based on the mean monthly taxi trips for shopping in Singapore, these results, based on 17 newly opened malls in Singapore, translate into the reduction of 5,049 taxi trips and 54,315 km traveled per 1 month.

Given that shopping trips account for the highest percentage of non-work trips and a substantial proportion (21.1%) of the taxi trips in Singapore, our findings suggest that providing a new shopping mall with clustered stores in neighborhoods with many residents could be an effective way to reduce their daily travel distances, and particularly taxi trips, to farther shopping destinations. At the same time, residents are likely to switch to non-motorized travel modes such as walking or cycling for their shopping activities. As a result, these residents could save their travel costs while enjoying a similar level of retail amenities. This strategy is a smaller-scale change compared to increasing land use diversity as a whole and could be used even for established neighborhoods.

Our results also suggest that the substitution of shopping destinations in closer neighborhood malls and the change to non-motorized travel modes may reduce taxi-travel demand more substantially during PM peak hours compared to other times. Therefore, the decline in taxi trips to shopping destinations caused by the opening of new neighborhood malls is expected to have a non-trivial impact on congested roads, even at the margin, because the impact of one additional taxi on a congested network is not linear but exponential. In particular, the congestion-reduction effect, along with additional positive externalities like the mitigation of air pollution, is likely to be even more significant and, in turn, enhance public welfare at the aggregate level.

Finally, we report that residents in neighborhoods that are farther from the CBD and in less self-sufficient communities are more likely to adjust their taxi-trip behaviors for shopping after a mall opening. These results echo the importance of self-sufficiency of suburban neighborhoods and the role of proper community planning. In particular, in achieving self-sufficiency, community planners should search for strategies to improve retail service provision within walking distance to homes in addition to job-housing balance.

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Appendix 1. Falsification Test

	(1) Cleaned full sample	(2) Cleaned full sample
	6 months prior to actual mall opening	1 year prior to actual mall opening
VARIABLES	Share of no. shopping trips out of total taxi trips	
Within 800 meters from newly opened mall	-0.0033	-0.0019
	(0.0063)	(0.0066)
Within 800 meters from newly opened mall & trips made 1 month after mall opening	-0.0069	-0.0082
	(0.0057)	(0.0053)
Between 800 and 1,500 meters from newly opened mall	-0.0040	-0.0047
	(0.0036)	(0.0040)
Between 800 and 1,500 meters from newly opened mall & trips made 1 month after mall opening	0.0015	0.0022
	(0.0040)	(0.0046)
Observations	359,068	359,068
R-squared	0.1247	0.1247
Distances to MRT, CBD, and Expressways	Yes	Yes
Car Ownership Rate	Yes	Yes
Year-Month FE	Yes	Yes
Postal Sector FE	Yes	Yes

Note 1: Standard errors clustered at the town level are reported in parentheses.

*Note 2: *** p<0.01, ** p<0.05, * p<0.1*

Appendix 2. Difference-in-Differences Model Results: Taxi-trip Trends Over Time

		(1)	(2)
VARIABLES		Number of shopping trips	Distance to shopping destinations
Within 800 meters from newly opened mall		29.7793	251.8760
		(17.9571)	(191.6237)
		Trips during ___ month(s) *before* mall opening	
Within 800 meters from newly opened mall	30 to 36	31.9977	264.7433
		(34.3121)	(312.5933)
	24 to 30	15.4475	128.0709
		(25.9534)	(247.7982)
	18 to 24	-2.1066	-2.4525
		(23.5268)	(224.0038)
	12 to 18	-14.4391	-95.6131
		(22.0942)	(201.9560)
	6 to 12	-21.0831	-145.0747
		(19.3599)	(184.2906)
	0 to 6	-16.3446	-105.4538
		(18.8300)	(172.4477)
		Trips during ___ month(s) *after* mall opening	
Within 800 meters from newly opened mall	0 to 6	-9.8519	-84.79102
		(22.1294)	(190.1904)
	6 to 12	-41.7623**	-333.8887*
		(18.7311)	(169.2605)
	12 to 18	-44.2513**	-368.3387**
		(18.6714)	(169.6521)
	18 to 24	-43.7666**	-345.4633**
		(19.0746)	(165.5600)
	24 to 30	-27.5194*	-286.1080*
		(16.8163)	(149.4308)
	30 to 36	-35.6179**	-404.2203**
		(16.1486)	(151.4146)
Observations		359,068	359,068
R-squared		0.0852	0.0466
Distances to MRT, CBD, and expressways		Yes	Yes
Car Ownership Rate		Yes	Yes
Year-Month FE		Yes	Yes
Postal Sector FE		Yes	Yes

Note 1: Standard errors clustered at the postal sector level are reported in parentheses.

*Note 2: *** p<0.01, ** p<0.05, * p<0.1*

Note 3: The regression models do include the variables between 800 and 1,500 meters but results are omitted for better illustration.