Validating overbuilding of shopping centers in Shanghai and identifying which with investment potential

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Introduction

At present, number of shopping centers opened or to be opened in Shanghai will be as high as 419. For 2020, The area of shopping centers per person is 0.97 sqm. Both count and area of malls are dramatically increasing since 2009. Considering the consumption capabilities, the supply area of shopping centers in Shanghai is almost 3 times of that in the United States. Overbuilt may cause severe energy waste and disturb the social economics.

This research aims to use econometric model to validate if shopping center overbuilt exists in Shanghai. For the overbuilt districts, a regression model is built to identify surplus shopping centers with investment potential for future regeneration or redevelopment.

For government, it is necessary to take actions to control over development of real estate. Instead of continuing to plan new commercial land with ignorance of real demand, it is more important to find and activate surplus shopping centers. For real estate investors, this paper offers an efficient tool to identify surplus shopping centers in a relatively good location. Investors could acquire these assets at a lower price and create values with better operation and marketing strategies.

Fig1. Booming of shopping centers since 2009

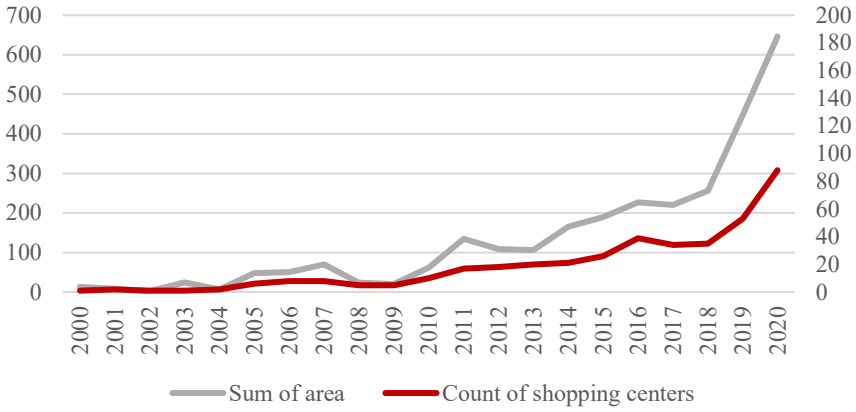
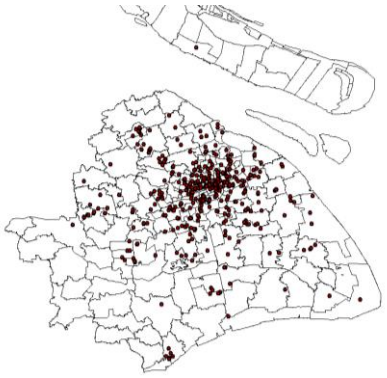


Fig 2. Shopping center points



Literature Review

Over development is an urban issue that real estate supply beyond local demand. It's related with China's real estate dominated economic structure and may bring negative economic and social impacts. Wan Dong (2010) analyze the behavior of local government and real estate development and believes real estate over-development does harm to social welfare. J Li (2018) stated that over development has an inhibitory effect on private investment through vampire effect, raising costs and reducing demand effect. In recent year, over development of residential market in China is validated by many researchers. In 2019, MIT Civic Data Design Lab built a model to identify ghost cities(underused residential areas) using social media data. However, does this problem also exists in

other real estate types, like commercial, industry, office etc.? Currently, there is no quantitative research on these topics. In western countries, it is common to control development area based on an econometric demand model. For instance, Robert M. Lillibridge(1952) came up with a method to estimate shopping center area income and population data, which is still widely used by planners.

In conclusion, overdevelopment brings negative economic and social effects. There are researchers validated overdevelopment of residents in China. This paper fills the research gap of shopping center over development and build a tool to identify surplus area at a building scale.

Data

Table 1. Data resources and types

Categories	Resources	Columns	Type
Shopping centers	Wrangled from Yingshang.com	building_area	float
		rentable_area	float
		built_year	integer
	Baidu Map API	coordinate	geometry
Socioeconomics	Chinese socioeconomical year book of 2020	population	integer
		disposable_income	integer
		consumption expense	integer
Social Media	Dianping.com	customer_gradings	integer
Urban environment	Purchased from third party	road	geometry
		parks	geometry
		subway_station	geometry
		POIs	geometry
		building_outlines	geometry

Methods

· Gravity model

The gravity model of international trade states that the volume of trade between two countries is proportional to their economic mass and a measure of their relative trade frictions. In this research , gravity model is used to calculate the potential number of customers in each neighborhood

$$P_{ij} = \frac{W_i / D_{ij}^{\alpha}}{\sum_{i=1}^{n} \left(W_i / D_{ij}^{\alpha} \right)}$$

- Pij = the probability of consumer j shopping at store i.
- Wi = a measure of the attractiveness of each store or site i.
- Dij = the distance from consumer j to store or site i.

· **Supply & demand estimation model**

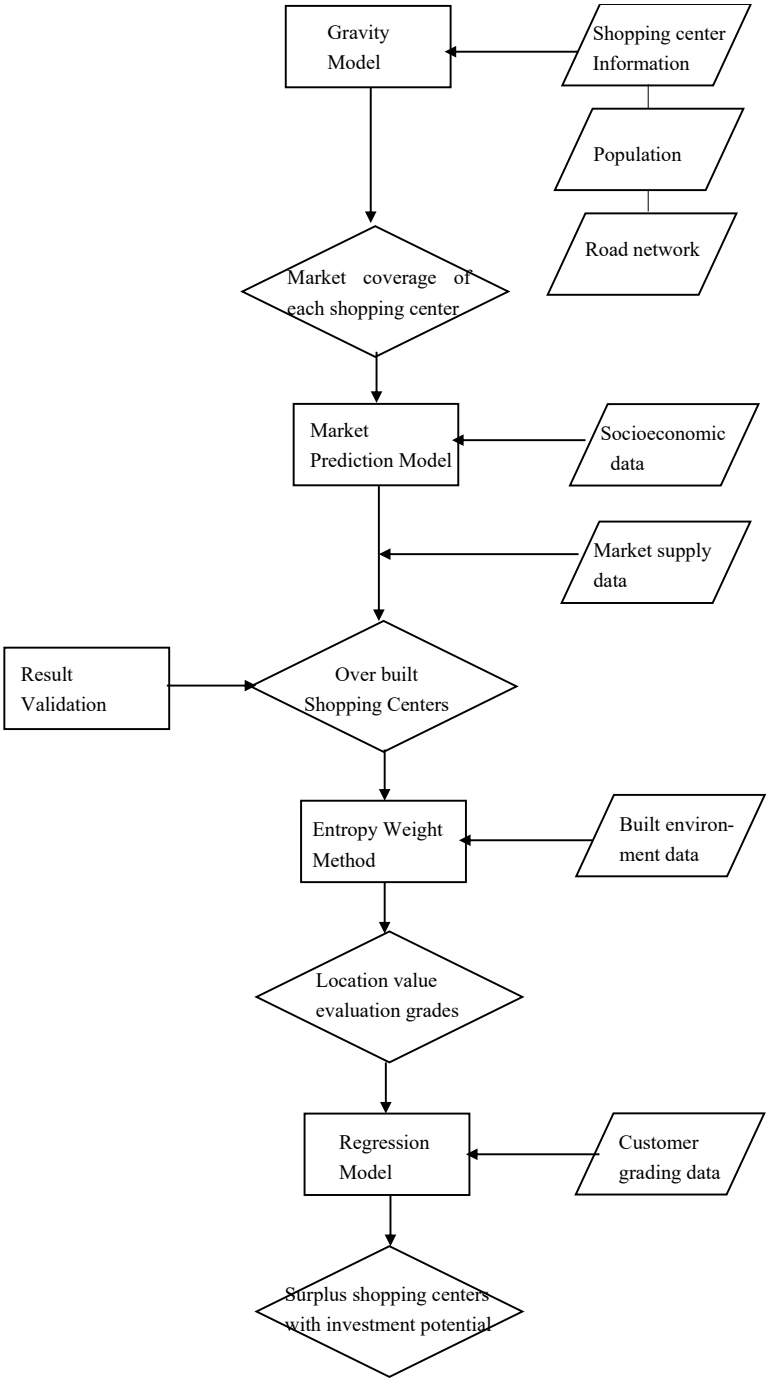
$$S=N*I*R$$

- N = count of customers in market area
- I = average consumption expense
- R = market penetration rate

$$D_{min}=A*S$$

- A = rentable area
- S= minimum sales income per sqm to pay off the building and operation fees within 40 years mortgage(assuming 10,000 RMB/sqm/year)

Fig 3. Workflow



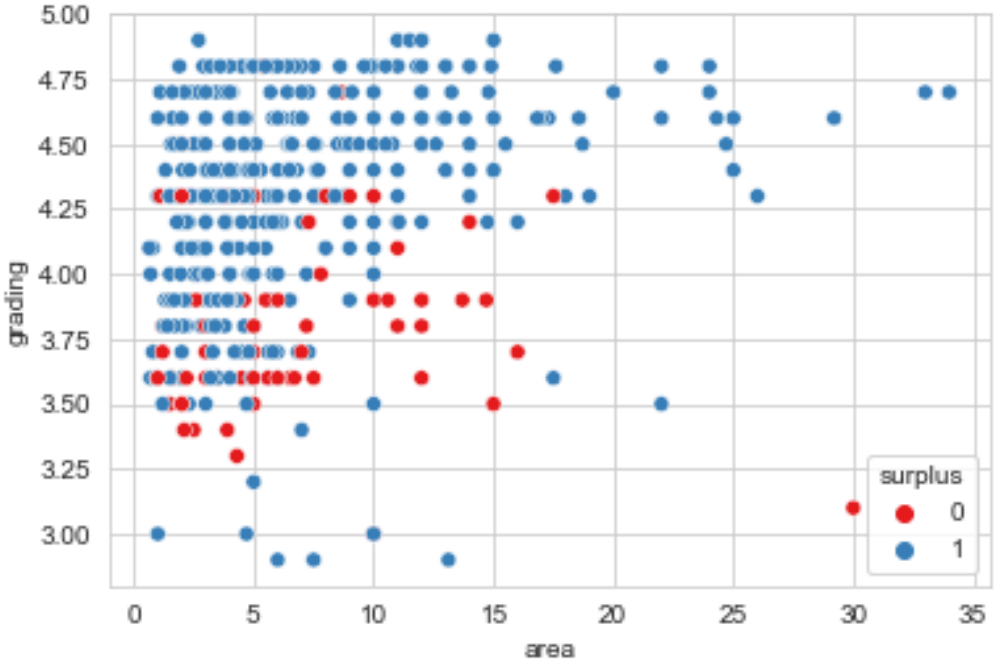
The regression model demonstrates correlation between location value grades(X) and customer gradings(Y). Normally, there is positive correlation between two variables. Outliers beneath the regression line are regards as surplus shopping centers with investment or regeneration potential. If there is no significant correlation between two variables in the result, alternative methods will be applied.

Summary of data exploration

Table 2. Example result of gravity model

	1	10	100	101	102	104	105	106	107	108	...	93	94	95	96	97
0	0.001741	0.000152	0.000580	0.001578	0.004740	0.003061	0.000196	0.001601	0.015114	0.006493	...	0.000623	0.005329	0.003351	0.002660	0.002303
1	0.001761	0.000157	0.000597	0.001542	0.004887	0.003114	0.000203	0.001729	0.010063	0.006131	...	0.000623	0.005482	0.003378	0.002697	0.002285
2	0.001002	0.000065	0.000298	0.002049	0.002515	0.001983	0.000095	0.000426	0.000705	0.029481	...	0.000518	0.002707	0.002420	0.001757	0.002317
3	0.001527	0.000129	0.000496	0.001464	0.004037	0.002662	0.000166	0.001272	0.026363	0.006388	...	0.000557	0.004555	0.002957	0.002327	0.002085
4	0.001128	0.000089	0.000367	0.001402	0.003102	0.002153	0.000125	0.000774	0.015585	0.007256	...	0.000483	0.003354	0.002479	0.001908	0.001869
5	0.001081	0.000068	0.000315	0.003505	0.002893	0.002159	0.000113	0.000421	0.000518	0.055122	...	0.000727	0.002863	0.003234	0.002280	0.002715
6	0.000562	0.000046	0.000192	0.000641	0.001636	0.001085	0.000067	0.000448	0.202322	0.002845	...	0.000237	0.001756	0.001244	0.000972	0.000874
7	0.000541	0.000039	0.000173	0.000755	0.001462	0.001055	0.000057	0.000314	0.001833	0.004872	...	0.000241	0.001579	0.001206	0.000913	0.000997
8	0.001935	0.000135	0.000574	0.002055	0.004850	0.003710	0.000179	0.000922	0.001823	0.022705	...	0.000773	0.005226	0.003800	0.002817	0.004014
9	0.001616	0.000146	0.000554	0.001371	0.004534	0.002858	0.000189	0.001669	0.004567	0.005319	...	0.000564	0.005094	0.003076	0.002467	0.002057

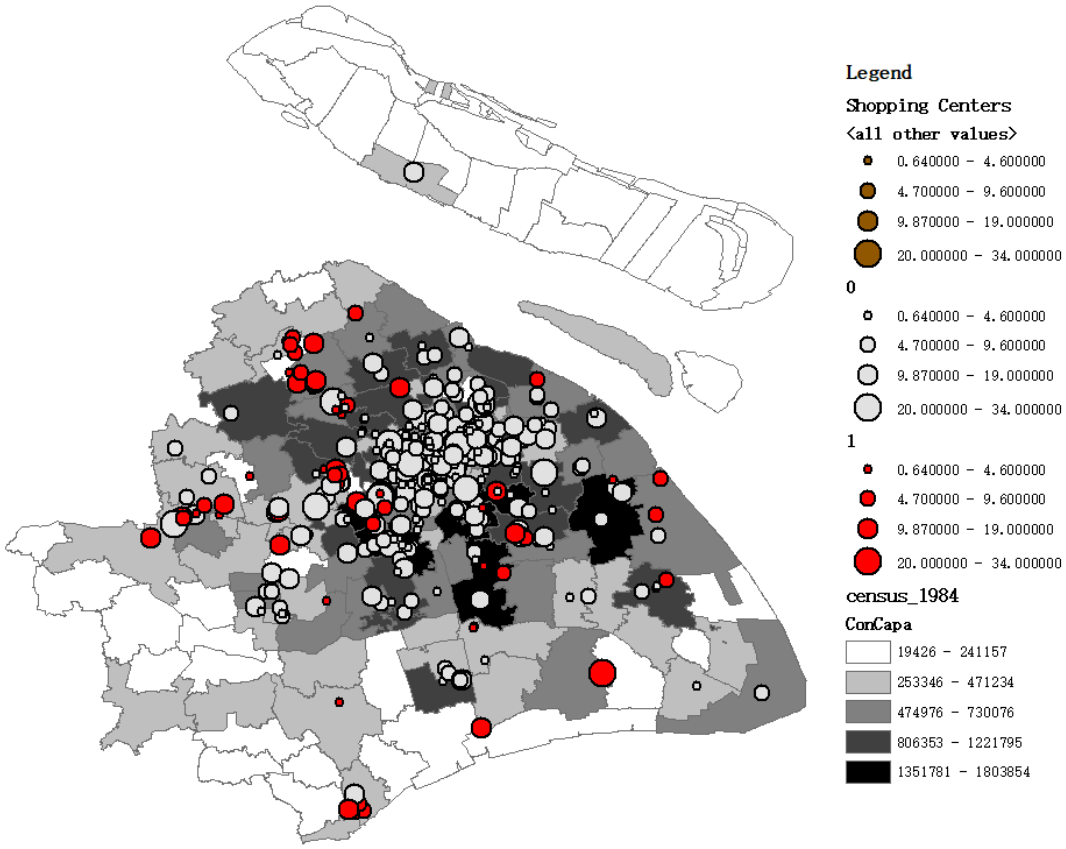
Fig 4. Characteristic of identified surplus malls (red point)



With current model, 68 out of 419 shopping centers are identified as surplus property which accounts for 15% of total area. Seeing from the Fig 4. low graded and median-scale malls are identified.

From the perspective of spatial distribution, most of surplus malls locate at suburban area where the total consumption capacity is small.Some surplus malls located at urban center periphery where the market is competitive.

Fig 5. Spatial distribution of surplus malls(red point for surplus)



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