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FLOATING POPULATION AND DEMAND FOR MOVIE THEATERS IN METROPOLITAN CITIES*

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Abstract

Using novel subway passenger and theater information data, we examine how the demand for a theater in a densely populated metropolitan area is affected by the floating population around the theater. We find that the floating population positively affects the demand for a theater and its impact becomes significant and larger in magnitude than the impact of resident population for theaters located in the largest metropolitan cities. Our findings suggest that taking the floating population as well as the resident population into account is necessary for measuring local market size accurately, especially for theaters located in the largest metropolitan cities.

Keywords: spatial competition, floating population, movie theater industry
JEL Classification Codes: D43, L13, L82

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I. *Introduction*

This paper examines the effect of the floating population on the demand for a theater located in densely populated metropolitan areas. Existing studies on spatial competition among movie theaters mostly depend on the resident population in conventional census-style data to measure local market size. However, theaters in a metropolitan area with a small number of residents do not necessarily have low local demand. For example, in the case of a downtown district, although its resident population is usually smaller than that of a commuter town, there is a high volume of foot traffic in general: people crowd into downtown districts for various reasons such as working, shopping, or making appointments. Therefore, the local market size for theaters in a downtown district with a small resident population may be larger than the market size for those located in a residential area. This gap between the resident population and the actual local market size is not restricted to downtown districts only. People move from one place to another for different reasons. In this paper, we call this foot traffic the "floating population". These non-residents are not part of the official census count, but are surely as important a part of local demand as the resident population.

Needless to say, precisely measuring the local demand is a prerequisite to studying various topics of competition among retailers. When the floating population actually makes up a large portion of local demand, neglecting it may produce model misspecification and biased results. However, detailed data on the floating population can be hard to obtain. Therefore, although the importance of considering the floating population has been acknowledged, the resident population has been mainly used to measure local market size in most previous studies.[1]

This paper attempts to contribute to the literature on measuring the local market demand by considering the floating population in the analysis as well as the resident population. We aim to show that including the floating population provides a better measure of local demand for markets with a high volume of foot traffic. To that end, we estimate the effect of floating population on the demand for a theater and theaters' performance. In particular, we compare the analysis based on the three largest cities with one based on all other cities or the whole sample. In the three largest cities, both the floating population and the ratio of floating to resident population are larger than in the other cities in the sample. Hence, from this comparison, we can clearly see the influence of floating population in the markets where its proportion is large. Our hypothesis is that the effect of floating population on the demand for a theater and theaters' performance would be larger in the three largest cities than in other cities in the sample.

Based on this motivation, we consider movie theaters located in the six largest cities in Korea and in Kyunggi province, its most populated province.[2] The number of subway passengers may be a good proxy for the floating population around each theater given that most areas of these cities are well covered by the metro subway system and the subway is considered a major form of transportation. The prevalence of subway transportation also points to the mobility of the population, and taking it into account is essential to precisely measure local

[1] In Jia (2008), on p.1271, "In this paper, a market is defined as a county...Using a county as a market definition also assumes away the cross-border shopping behavior. In future research, any data on the geographic patterns of consumers' shopping behavior would enable a more reasonable market definition."

[2] Detailed descriptions about the data are provided in the next section.

market size for theaters located in these cities.

We acknowledge that not all subway passengers visit a theater. Our reasoning that the number of subway passengers (the proxy of floating population) is related to the market demand of movie theaters (one example of retailers) is based on the general notion that the demand for most goods would be proportional to the size of the population. Given that movies are not consumed only by specific groups or social classes, a higher floating population around theaters may create more demand for them.[3] This reasoning can also be supported by observing retailers' behaviors in choosing location. Retailers tend to cluster in the areas of high volume of foot traffic because they believe that higher sales due to higher demand from the floating population can offset the negative effect from intensified competition. Movie theaters are no exception to this, so the floating population could be considered an important part of demand. In addition, according to recent surveys conducted by the Korean Film Council, 69.2% of the respondents said that they consider adjacency and accessibility through public transport the main factor in choosing theaters.[4] This is another reason to believe that subway passengers could represent a part of market demand for movie theaters.

Using detailed subway passenger and theater information data, we provide evidence of the positive market size effect on the demand and performance for a theater. In particular, we show that, for theaters located in the largest metropolitan cities, the positive effect of the floating population on the market size is significant and larger in magnitude than the effect of the resident population. On the other hand, the analysis where other cities are considered provides evidence that the effect of resident population is significant and larger in magnitude than the effect of floating population. These results imply that the floating population represents the market demand of the three largest cities better than the resident population, so that taking the floating population into account is necessary for measuring its market size accurately. In addition, our analysis also points to the negative competition effect among theaters. In particular, the magnitude of the negative competition effect is larger in the three largest cities than when all cities in the data are considered. In the case of other cities, the negative competition effect is not observed. These results imply fiercer competition in markets where the proportion of floating population is relatively large. As an alternative approach, we focus on the supply side as well, and show that more subway passengers in a local market lead to a greater number of movie theater seats in the market. Our empirical findings are robust to changes in model specification, local market definition, and the measure of the degree of competition. Although we focus on the movie theater market in this paper, our main message that considering floating population is essential in measuring the size of local market where the proportion of floating population is large is not restricted to the movie theater market, but can be applied to many other local retail markets in metropolitan areas.

In the literature on the topic of spatial competition, the papers incorporating commuters are related to this paper in that it is suggested that a commuter's demand should not be restricted to his place of residence.[5] As a commuter pays no incremental travel cost for buying from any

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[3] If subway passengers cannot be interpreted as a part of local demand because not all subway passengers visit a theater, even the resident population, which has been widely adopted as a measure of the local demand in the literature, would not be a good measure because not all residents may consume the good under consideration.

[4] Consumer report 2016, Korean Film Council.

[5] In this sense, the literature on cross-border shopping is also related to this paper. In measuring the demand for markets adjacent to a border, the official census count may underrepresent it because non-residents from other

retailer in the commuting path, the distance from his residence does not matter and so those retailers are spatially undifferentiated. This should be considered in defining the local market size or measuring the demand for retailers in the commuting path. This coincides with our motivation that the non-resident population from other areas should be considered in dealing with metropolitan areas. Claycombe (1991) and Raith (1996) introduce the concept of commuting into a theoretical model of spatial competition with retail goods. The empirical results of Claycombe and Mahan (1993) indicate that retail margins on beef are lower in the cities with more commuters. Cooper and Jones (2007) examine the pricing behavior of gasoline retailers located on commuter routes. In the analysis, they treat each commuting route as a separate market instead of defining the entire city as a single market. Their findings suggest that commuting patterns can be an important factor that determines how market structure affects firms' behavior. Houde (2012) incorporates the mobility of consumers into a discrete-choice model of demand by defining consumers' locations as their entire commuting paths. He shows that retailers' markups estimated under this consideration are small, implying less differentiated products and more intense price competition among retailers. Mazzeo (2002) analyzes product differentiation and market structure using data on motel markets along highways. He considers the annual average daily traffic that passes the highway exit as well as resident population as the local market size for motels. The common finding of these papers is that markets with many commuters are under intense competition among retailers. In addition, Bresnahan and Reiss (1991) include commuters from outside of the county in their structural entry model; by showing that it does not have a statistically significant effect on the market size, they ensure that markets considered in their analysis are adequately isolated. Our model considers the case where the floating population is likely to matter, that is, local markets located in metropolitan areas, and attempts to show that considering floating population is essential in measuring local market size precisely.

There have been several articles that study spatial competition among movie theaters.[6] Davis (2006a) explores the effect of entry of a new theater on the revenue of an incumbent theater either owned by a rival (business stealing) or within the same circuit (cannibalization) and the effect on total industry revenues (market expansion). He finds that the business stealing effect is more prevalent than the cannibalization effect, whereas the majority of theater revenues come from market expansion effects.[7] Davis (2006b) shows that the population near a theater increases demand, but cross price elasticities between theaters are low due to travel costs. Chisholm and Norman (2012) study the competition effect of movie theaters in two major metropolitan markets: Boston and South Florida. They show that the competition effect dominates the agglomeration effect in movie-theater demand, and so attendance at a theater is negatively affected by proximity to its nearest rivals. Like these previous works, we examine the effect on revenues of spatial competition among nearby theaters. Unlike previous research,

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jurisdictions or countries must be a part of it. For recent articles in this literature, see Knight and Schiff (2012), Chandra, Head, and Tappata (2014), and Chen, Devereux, and Lapham (2017).

[6] McKenzie (2012) provides a comprehensive survey of papers on topics in the movie industry other than spatial competition.

[7] Several papers study the business stealing effect in other markets. (For example, see Joskow, Werden, and Johnson (1994), Ailawadi, Zhang, Krishna, and Kruger (2010), and Berry and Waldfogel (1999).) Kalnins (2004) is another paper that studies the cannibalization effect using revenue data from the lodging industry by differentiating the behavior of company-owned and franchised chains.

however, we use data on the floating population as well as the resident population to capture local market size.

The remainder of the paper is organized as follows. In Section II, we provide background information on the movie theater market and metro subway systems in Korea, and describe the data. In Section III, we introduce the empirical model and summarize the empirical findings. We conduct robustness checks in Section IV and conclude in Section V.

II. *Background and Data*

1. Movie Theater Industry and Subway System in Korea

The Korean movie theater industry has been growing quickly and is a highly competitive market. In 2014, the aggregate box office revenue was $1.5 billion, the sixth largest in the world, while the average annual per capita attendance (4.19) was the world's highest. According to the Korea Film Council (KOFIC) annual report, there were 333 theaters with 2,184 screens in Korea as of December 2013.

In this paper, we consider movie theaters located in the six largest cities of Korea (Seoul, Busan, Incheon, Daegu, Daejeon, and Gwangju), each with a population of at least 1.5 million and in Kyunggi province, the most populated province, where over 10 million people reside. 70 percent of movie theaters in Korea (236 out of 333) are located in these areas. To understand the nature of competition among theaters in these areas, it is important to address the mobility of consumers in the analysis. The number of subway passengers may be a good proxy for the floating population around each theater given that most areas of these cities are well covered by the metro subway system. For example, as of 2015 Seoul Metropolitan Subway is one of the world's largest subway systems with 606.1 miles of track and 311 stations and one of the world's busiest subways with 2.6 billion passengers per year.[8] In Seoul alone, approximately 5 million passengers used the subway each day in 2009. Also, in 2012 around 8.5 million passengers used the subway each day in both Seoul and the metropolitan areas of Kyunggi province. Subways account for 17.2% of the total passenger traffic in Korea in 2010, and this percentage is higher in the cities considered in this paper because the subway system is only available in these cities. Figure A-1 in the Appendix shows the location of theaters and subway stations in the Seoul metropolitan area (Seoul, Incheon, and Kyunggi province).

Admission price is almost uniform across movies and theaters with the exception of 3D, 4D, and Imax movies, but can be different across days.[9] Orbach and Einav (2007) regard the uniform pricing strategy by movie theaters as puzzling and propose that the profits of exhibitors may increase by charging different ticket prices across times. The admission price is also rigid. For instance, Davis (2005) finds that the effect of local competition and ownership structure on ticket prices is only marginal. In Korea, the ticket price has been constant for a long period of

[8] http://www.citymetric.com/transport/what-largest-metro-system-world-1361

[9] Korean movie theaters used uniform ticket pricing till 2000. Since the early 2000s, theaters employed some forms of price discrimination depending on the show time (weekday or weekend) and format. However, this trend of price discrimination has been almost uniform across theaters operated by three major cinema chains that have 90 percentage of the market share in Korea.

time. In the case of theaters operated by three major cinema chains, the admission price (for a weekday daytime show) has increased uniformly across theaters only twice since 1996 till 2013. It has increased from $6 to $7 in 2000 and from $7 to $8 in 2009. Consequently, we assume that the admission price is exogenously given in the analysis.

2. Data Description

We collect information on theaters located in 88 districts in the six largest cities and Kyunggi province for 2012 and 2013 from the Korean Film Council.[10] After excluding opening and exiting theaters as well as art theaters, we have 176 theaters in 2012 and 186 theaters in 2013.[11]

For the analysis, we define an area of one mile around a theater as its local market. This definition is not only widely used in the literature to define local retail markets where retailers are directly competing with each other (Hastings, 2004; Ren, Hu, Hu, and Hausman, 2011), but also based on the preliminary estimation results, presented in Table A-1 in the Appendix, which reveal that theaters outside of the one mile distance from a theater have no statistically significant direct effect on its revenue. Accordingly, theaters located within a one mile radius of a theater are defined as its competitors. Later, we conduct a robustness check considering a two mile and a five mile radius as the local market.

We calculate the resident and floating populations within the local market, using the Korean Population Census and station-level subway passenger data for 2010.[12] Specifically, the resident population for a theater is the sum of the resident population of every *Dong* whose office is located within one mile of the theater. Note that the administrative divisions of Korea for metropolitan areas are i) *City*, ii) *Gu* (District), and iii) *Dong* (neighborhood) in descending order of size. As for the floating population, we first identify subway stations located within one mile of each theater. Then, the average daily number of passengers who get off at these stations serves as a proxy for the daily floating population for the theater. We also measure the quality of a theater by the ratio of the number of screens which can play 3D movies (3D screens) to the total number of screens in the theater. It is expected that theaters with good facilities have a high ratio of screens capable of screening 3D movies, whereas out-dated theaters have a limited number of screens that can play those movies.

Table 1 presents the descriptive statistics for the key variables. Daily audience is simply the yearly audience divided by 365. The average theater attracts 2,249 consumers each day. Also, each theater is equipped with 1,311 seats on average and faces 1,946 seats provided by competitors. As for the local market size, on average a theater has 133 thousand nearby residents, and 67 thousand daily subway passengers get off at stations located within its one mile radius. 43 percent of screens in a theater can play 3D movies on average.

The correlations among the resident population, the number of subway passengers, and the total theater audience sizes of 88 districts in the sample data presented in Table 2 demonstrate

[10] Korean Film Council: http://www.kofic.or.kr/kofic/business/main/main.do

[11] For instance, if a theater opened in November of 2012, it is included only for the year 2013.

[12] Korea Transportation Data Base: http://www.ktdb.go.kr/web/guest/home. As subway passenger data for Seoul metropolitan area (Seoul, Incheon, and cities in Kyunggi Province) is not available for 2010, we instead use data for 2009 for this region.

TABLE 1. DESCRIPTIVE STATISTICS

Variable	Avg.	Std. Dev.	Min.	Max.
Dependent variable				
Daily audience	2,249	1,487	8	11,103
Regressors				
Number of seats	1,311	594	118	4,242
Number of competitors' seats	1,946	2,588	0	11,913
Resident population	133	61	0	294
3 largest cities	145	62	0	294
Other cities	121	58	0	294
Number of subway passengers	67	97	0	534
3 largest cities	114	119	0	534
Other cities	22	30	0	118
Theater quality (%)	43	25	0	100
Instrumental variables				
Rchange (%)	17	8	-2	45
Landval	7	8	0	68

Note: The units of population and number of subway passengers are thousands of persons. The unit of Landval is one million Korean won per square meter.

TABLE 2. CORRELATIONS

Panel A. All Cities *(88 districts)*

	Agg. Audience	Agg. Population
Agg. Population	0.30	
Agg. Passenger	0.51	0.26

Panel B. 3 Largest Cities *(40 districts)*

	Agg. Audience	Agg. Population
Agg. Population	0.26	
Agg. Passenger	0.59	0.19

Panel C. Other Cities *(48 districts)*

	Agg. Audience	Agg. Population
Agg. Population	0.29	
Agg. Passenger	0.35	0.33

the importance of considering the floating population in measuring the local market demand of movie theaters located in metropolitan areas. *Agg. Audience* is the sum of audiences of all theaters within a district. Given the uniform admission price for movie theaters, it measures the total theater revenue in the district. *Agg. Population* and *Agg. Passenger* are the resident population and the number of subway passengers in a district, respectively. Three observations seem important to us. First, correlation between *Agg. Population* and *Agg. Passenger* (0.26) is relatively low, which alleviates the concern of significant overlap between these two measurements of local market size. Second, *Agg. Audience* is more correlated with *Agg. Passenger* (0.51) than with *Agg. Population* (0.30). Third, when we consider only the 40 districts in the three largest cities (Seoul, Busan, and Incheon), each with population over 2.5 million, these tendencies get stronger. For these cities, the correlation between *Agg. Audience* and *Agg. Passenger* is 0.59, whereas it is 0.35 in the case of other cities. These findings support our motivation that, in the case of the large metropolitan cities, the resident population may not be enough to capture local market size, and thus considering the floating population is essential. In addition, in Table 1, we find that both the floating population and the ratio of floating to resident population are sufficiently larger in the three largest cities than in other cities. In the three largest cities, the ratio of floating to resident population is 44 percent, while it is merely 15 percent in other cities. This observation and the third preliminary result mentioned above provide a rationale for the comparison of analyses between the three largest cities and other cities in the sample. Here, the three largest cities represent the markets where the proportion of floating population is relatively high.

III. *Empirical Analysis*

In this section, we conduct the empirical analysis. The main hypothesis to test is that the effect of floating population on the demand for a theater and theaters' performance would be larger in the three largest cities than in other cities in the sample.

1. Empirical Model

Given the fixed admission price, theaters are engaged in quantity competition. The demand for a theater is affected by the degree of competition and the local market size as well as theater characteristics. Therefore, we consider the following regression model to estimate the demand function for a theater:

$$Daily\ audience_{it} = \alpha_0 + \alpha_1 Cseats_{it} + \alpha_2 Rpop_i + \alpha_3 Fpop_i + \mathrm{x}_{it}\beta + \varepsilon_i, \qquad (1)$$

where the dependent variable, $Daily\ audience_{it}$, is the daily audience size of theater i at year t.

$Cseats_{it}$ is its competitors' total number of seats within the local market. As Davis (2006a) and Chisholm and Norman (2012) recognize, the number of seats is the best measure of market structure.[13] Because the main focus of this paper is on precisely measuring local market size, we do not separate the business stealing effect from the cannibalization effect, but estimate the competition effect as a whole. $Rpop_i$ and $Fpop_i$ are the resident population and the floating population proxied by the number of subway passengers in the theater's local market, respectively.[14] Together, they measure the local market size.

Vector x_{it} contains theater characteristics as well as a dummy for year 2013. We take heterogeneity in theater characteristics into account by including theater size measured by the

[13] "Using screen counts as our measures of market structure naturally raises some considerable concerns since it implicitly treats all screens as equal when that is clearly not true. Since no data are available on the number of seats within theaters, I have little choice but to proceed pragmatically with this important caveat in the reader's mind ⋯ " (p.302, Davis (2006a)). Estimation results are qualitatively the same when the number of competitors' screens, *Cscreens*, is used as the measure of competition in model (1). See Table A-5.

[14] Note that there is no within-theater variation in the two measures of the local market size, *Rpop* and *Fpop*, as we use the same 2010 census and passengers data for both years.

number of seats (*Seats*), quality proxied by the percentage of 3D screens (*Theater quality*), and chain fixed effects in (1). Theater size may directly affect the demand for a theater. This is because consumers would consider product variety in choosing which theater to visit.[15] Since larger theaters play more movies than smaller ones, they may attract more consumers. Moreover, including the number of seats has the additional advantage of controlling for unobservable factors that may affect the demand for a theater. For instance, a theater located in an attractive location will draw more demand, other things being equal, and as a result it is likely that the theaters located there are of greater capacity. Therefore, including theaters' capacity in the model would at least partially control for the unobservable attractiveness of the location.[16]

The demand for a theater may positively influence the total number of rival theaters' seats, i.e., *Daily audience* and *Cseats* are likely to be jointly determined. This simultaneity would yield inconsistent OLS estimators. In consideration of this possible endogeneity problem, we estimate model (1) by an instrumental variables (IV) method. Using data on yearly land price changes since 2005, we calculate the land price change over the past 8 years of the district where a theater is located, *Rchange*, and employ it as an instrumental variable: given that the admission price is uniform across theaters in different districts, competitors' sizes would have been negatively affected by the rise of the land price. According to Table 1, land price has risen 17 percent on average over the past 8 years, and there is enough variation across districts.

It is also arguable that the number of seats in a theater, *Seats*, may be positively affected by its audience size, *Daily audience*, which raises another concern about endogeneity. To circumvent this issue, we also estimate the model with two instrumental variables, introducing the officially assessed individual land price of the theater, *Landval*, as a second instrumental variable. Most theaters in Korean cities lease space in shopping malls or commercial buildings rather than having their own buildings. Then, as the price of the land (real estate cost) where a theater is placed goes up, the rental cost it has to pay may also increase. Given the rigidity in the ticket price, this implies lower profit per seat. Therefore, the size of a theater is likely to be negatively related to the real estate cost.[17] Table 1 shows that the average appraised land price of a theater is 7 million Korean won (approximately, $7,000) per square meter.

To further address the endogeneity concern that both the audience size and subway passengers might be affected by unobserved area-specific factors, we also consider adding two

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[15] See Brynjolfsson, Hu, and Smith (2003); Kahn (1995); Quan and Williams (2018); Bils and Klenow (2001). In particular, Rao and Hartmann (2015) propose that variety is an important factor moviegoers consider in choosing a theater. Davis (2006b) also considers the product characteristics such as the number of screens as a variable in consumers' utility from watching a film.

[16] The observed audience size of a theater may underestimate the real movie demand for the theater. This happens when consumers are turned away because they can not find a seat for their favorite movies, especially popular movies on weekends or holidays. However, consumers can almost always find a seat. Moreover, even if a movie is sold out in a popular time and date, consumers can always find other times or dates when the movie is available (weekday afternoons, for instance). Since consumers can check the availability of seats on the theater's website in advance and change their choices of movies, times, and dates, we assume that the capacity constraint would not be a serious issue in our case. If the capacity constraint binds, however, then we may underestimate the effect of the floating population on the movie demand. In that sense, our estimate can be interpreted as the lower bound of the effect.

[17] Real estate price information is collected from the following sources: the rates of change of land prices are downloaded from the Korean Statistical Information Service (http://kosis.kr/), and the officially assessed individual land price per square meter is obtained from the website of each city or province.

TABLE 3. SPATIAL COMPETITION: 2SLS WITH ONE ENDOGENOUS VARIABLE

Variable	All cities		Three largest cities		Other cities	
	(1)	(2)	(3)	(4)	(5)	(6)
Cseats	-0.153**	-0.243*	-0.476***	-0.734*	0.171	0.148
	(0.073)	(0.127)	(0.143)	(0.402)	(0.143)	(0.127)
Rpop	2.743***	2.581***	-2.072	-3.156	6.576***	6.395***
	(0.976)	(0.975)	(1.968)	(2.970)	(1.869)	(1.359)
Fpop	1.891	2.093	5.828***	8.464*	-11.660	-11.038
	(1.301)	(1.530)	(1.980)	(4.737)	(9.348)	(6.813)
Seats	1.788***	1.824***	1.908***	1.917***	1.289***	1.318***
	(0.197)	(0.198)	(0.180)	(0.180)	(0.311)	(0.277)
Theater Quality	14.902***	14.582***	11.947***	12.493**	21.330***	20.846***
	(2.532)	(2.561)	(4.496)	(5.700)	(4.017)	(3.800)
% Commercial		20.364		22.132		2.035
		(19.015)		(29.600)		(21.741)
% Unemployment		-4.964		-289.102		27.871
		(71.941)		(443.052)		(103.190)
Constant	-803.913***	-776.459**	-4.363	1,505.016	-1,051.377***	-1,122.459***
	(242.780)	(354.398)	(411.069)	(2,362.397)	(269.679)	(379.333)
Fixed effects						
Chain	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
DWH Test	0.47	1.00	6.85	3.25	3.27	4.56
p-value	0.49	0.32	0.01	0.07	0.07	0.04
Observations	362	362	175	175	187	187

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. The endogenous regressor, *Cseats*, is instrumented by the instrumental variable, *Rchange*. Standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

district-level variables, ratio of commercial area and unemployment rate, in empirical model (1); both movie demand and floating population are likely to be high when the district has a high ratio of commercial area, whereas they would be negatively affected by a high unemployment rate.[18]

2. Estimation Results

Table 3 presents 2SLS estimates of a just identified model with one endogenous variable, *Cseats*.[19] As for the impact of the local market size, when all observations are considered, an additional 1,000 residents in a market implies 2.7 more daily consumers for a theater, whereas the effect of floating population is positive but not statistically significant. Thus, if we take the theater at the 75th percentile of the distribution of the resident population (168 thousands) and

[18] Also, one may argue that the number of subway passengers around a theater may be positively affected by the movie theater visitors, which raises a concern over another potential endogeneity problem. Therefore, we use the number of subway stations located within a one mile radius of a theater, *Nstations*, as the instrumental variable for the number of subway passengers. 2SLS estimates of a just identified model where two variables – *Cseats* and *Fpop* – are assumed to be endogenous are reported in Table A-4. The estimation results are consistent with those in Table 3.

[19] See Table A-2 for the first stage regression estimates. *Cseats* is negatively correlated with the instrumental variable, *Rchange*, as expected. The first-stage F-statistics are above or close to 10 (a rule of thumb suggested in the literature) in most cases, suggesting that the set of instruments considered is strong enough.

TABLE 4. SPATIAL COMPETITION: 2SLS WITH TWO ENDOGENOUS VARIABLES

Variable	All cities		Three largest cities		Other cities	
	(1)	(2)	(3)	(4)	(5)	(6)
Cseats	-0.139*	-0.232	-0.475***	-0.674**	0.218	0.205
	(0.077)	(0.160)	(0.147)	(0.303)	(0.277)	(0.313)
Rpop	3.013***	2.671**	-2.065	-3.060	7.266*	7.035**
	(1.093)	(1.180)	(2.095)	(2.721)	(3.877)	(3.309)
Fpop	1.860	2.035	5.830***	7.551**	-14.398	-13.013
	(1.332)	(1.673)	(1.944)	(3.506)	(16.913)	(12.520)
Seats	1.526***	1.720***	1.894***	2.287***	0.976	0.902
	(0.363)	(0.559)	(0.512)	(0.654)	(1.487)	(1.815)
Theater Quality	15.262***	14.714***	11.927***	12.937**	22.882***	22.744**
	(2.732)	(2.740)	(4.521)	(5.439)	(8.189)	(9.217)
% Commercial		19.184		19.672		-4.049
		(21.760)		(26.812)		(38.231)
% Unemployment		2.672		-176.617		63.726
		(90.738)		(360.653)		(184.130)
Constant	-516.199	-687.936	16.315	411.933	-819.068	-880.988
	(373.406)	(422.626)	(606.719)	(1,764.526)	(1,135.670)	(1,132.398)
Fixed effects						
Chain	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
DWH Test	0.63	0.83	4.84	2.68	1.67	2.70
p-value	0.53	0.44	0.01	0.07	0.19	0.07
Observations	362	362	175	175	187	187

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. Two endogenous regressors, *Seats* and *Cseats*, are instrumented by two instrumental variables, *Landval* and *Rchange*. Standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

compare it to the theater at the 25th percentile of the distribution (90 thousands), this estimate implies that the daily audience would be higher in the former by 210. When only theaters in the three largest cities are considered, an additional 1,000 market subway passengers implies 5.8 more daily customers, whereas the effect of the resident population is not statistically significant. For example, the theater at the 75th percentile of the distribution of subway passengers (133 thousand) has 560 more daily consumers than the theater at the 25th percentile of the distribution (36 thousand). Given that the average daily audience size is 2,249 (and 2,280 among theaters in the three largest cities), this finding suggests that floating population is one of the key determinants of the demand for a theater in the three largest cities. In contrast, when theaters located in other cities are considered, the result is reversed: an additional 1,000 market resident population implies 6.6 more daily customers, whereas the effect of the floating population is not statistically significant.

We also find that coefficients of Seats and Theater quality are statistically significant. The audience size of a theater is positively influenced by its own number of seats and theater quality. The coefficient of Cseats is statistically significant among theaters in the three largest cities, while there is no statistically significant evidence of negative effect of competition on the audience size in other cities. These findings imply fiercer competition in markets where the proportion of floating population is relatively large.

Next, 2SLS estimates of a just identified model with two endogenous variables are reported in Table 4. The effects of the resident population and the number of subway

TABLE 5. AUDIENCE PER SEAT AS THE DEPENDENT VARIABLE

Variable	All cities		Three largest cities		Other cities	
	(1)	(2)	(3)	(4)	(5)	(6)
Cseats	-0.028*	-0.047*	-0.092***	-0.146**	0.023	0.028
	(0.015)	(0.028)	(0.024)	(0.065)	(0.036)	(0.034)
Rpop	0.799***	0.812***	-0.049	-0.281	1.530***	1.615***
	(0.257)	(0.254)	(0.363)	(0.472)	(0.476)	(0.387)
Fpop	0.664***	0.768**	1.541***	2.127***	-1.265	-1.700
	(0.239)	(0.312)	(0.345)	(0.799)	(2.376)	(1.879)
Seats	0.038	0.046*	0.049*	0.050	-0.032	-0.037
	(0.025)	(0.027)	(0.025)	(0.033)	(0.074)	(0.072)
Theater Quality	3.694***	3.678***	2.604***	2.705**	5.421***	5.528***
	(0.723)	(0.734)	(0.981)	(1.176)	(1.140)	(1.164)
% Commercial		4.159		4.136		0.953
		(4.033)		(4.801)		(5.473)
% Unemployment		-14.611		-67.460		-11.239
		(20.957)		(79.899)		(28.316)
Constant	341.839***	387.382***	517.038***	866.681**	245.230***	269.723**
	(62.477)	(101.400)	(79.624)	(407.157)	(89.406)	(116.658)
Fixed effects						
Chain	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
DWH Test	0.15	0.54	4.10	3.66	1.05	2.23
p-value	0.70	0.46	0.05	0.06	0.31	0.14
Observations	362	362	175	175	187	187

Note: The table presents 2SLS estimates using audience per seat as the dependent variable. The endogenous regressor *Cseats* is instrumented by the instrumental variable, *Rchange*. Robust standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

passengers around a theater show similar patterns to those of the previous estimates; the effect of the floating population on theater demand increases, whereas the influence of the resident population decreases, as we restrict the analysis to the three largest cities. They also show that the spatial competition effect remains negative and statistically significant for theaters in the three largest cities. Overall, when competitors' total number of seats increases by 1,000, the daily audience size decreases by 139. The negative competition effect triples when we consider only theaters in the three largest cities.[20]

Instead of estimating the effect of floating population on the demand for a theater, we can estimate its effect on theaters' performance. This can be done by using (yearly) audience per seat as the dependent variable. Kosová, Lafontaine, and Perrigot (2013), for example, use a similar specification to estimate the effect of chain affiliation on hotel performance. 2SLS estimation results in column (1) of Table 5 show that when all observations are considered, 1,000 more subway passengers in a market increases the yearly audience per seat of a theater by 0.66. Given that an average theater has 1,300 seats, this implies an increase of the yearly audience size by 860. Consistent with our previous findings, the effect of the floating population on theaters' performance is much higher (1.54 and 2.13) when only the three largest

[20] The first stage regression estimates in Table A-3 report that both *Cseats* and *Seats* are negatively affected by the two instrumental variables, *Landval* and *Rchange*, as predicted. The Cragg-Donald test for weak instruments suggests that the set of instrumental variables considered may not be strong enough.

cities are considered, while in the case of other cities the coefficient of floating population is not statistically significant.

IV. *Robustness*

1. Fixed-effects Model

Given that the data set is a two-year panel, we can exploit within-theater variations to identify the effect of floating population on the audience size. To perform the panel-data analysis, we additionally collect subway passenger data for the years 2012 and 2013.[21] Unfortunately, for these years, subway passenger data are available only for the Seoul metropolitan area (Seoul, Incheon, and Kyunggi province). Moreover, we could not obtain data on yearly changes in the resident population, since the census is taken in Korea every five years. Unlike the floating population, however, it may not vary much over the two years, as relocation is not a short-term decision. Therefore, we consider the following specification:

$$Daily\ audience_{it} = \gamma Fpop_{it} + \psi_i + \psi_t + \varepsilon_{it}, \qquad (2)$$

where subscripts i and t denote theater and year, respectively. ψ_i is a theater fixed effect, which captures characteristics specific to each theater, such as theater capacity and quality, and ψ_t is a year fixed effect, which captures shocks common to all theaters. The variables that may not vary much over years, such as resident population, would be absorbed in ψ_i as well. This model exploits the within-theater variation in the audience size and floating population over the two years.

Table A-6 reports the results based on the fixed-effects model and shows that floating population has a positive effect on the audience size of a theater. For example, when a one mile radius around a theater is defined as its local market, an additional 1,000 subway passengers implies 4.2 more daily customers. To see also how competition affects the demand for a theater, we add competitors' total number of seats in the model. As the results in the second column show, we found no significant effect. This result may be due to lack of variation in entry and expansion that can be exploited in the panel data analysis, rather than suggesting that there is no competition effect. Moreover, the effect of floating population on the audience size remains positive and significant when a broader local market definition, a two mile radius, is used.

2. Market-level Supply of Theater Seats

Here, as an alternative approach, we focus on the supply side. Specifically, we investigate how aggregate theater capacity in a local market is affected by market size. For this analysis, it is important to properly identify local movie theater markets. Whereas previous studies consider only small, isolated cities and towns in their analyses (Bresnahan and Reiss, 1991; Mazzeo, 2002; Gowrisankaran and Krainer, 2011; Han and Hong, 2011), theaters in our data are located in densely populated metropolitan cities. Alternatively, we treat a group of theaters as being in the same local market, if for each of them there are one or more competitors within one mile

[21] Note that for the analysis in the previous section, we use the station-level subway passenger data for 2010.

(1.61 kilometer).[22] For example, suppose that there are three theaters, x, y, and z, and the distances between x and y and between y and z are each less than one mile. Then, we regard them as being in the same market, even if theaters x and z are located farther than one mile from each other. The advantage of this approach is that it puts a theater, all its nearby rivals, and some of its distant rivals into the same market. As an example, Figure A-2 shows that, in the northern region of Seoul, we can define three local movie theater markets. As a matter of fact, the market with nine theaters corresponds to one of the major downtown areas in Seoul.

In this way, we are able to define 124 local markets in the sample data. In a small market, there is a local monopoly, while a cluster of theaters is observed in a large market. The distance between any pair of theaters in a market does not exceed 2.2 miles, indicating that our approach of defining local markets works well with the sample data. Figure A-3 shows that there are 81 local monopoly markets, 23 duopoly markets, 10 markets with 3 theaters, 4 markets with 4 theaters, and 6 markets with 5 or more theaters, while the total number of seats is smaller than 5,000 in most markets.

Using data for 2013, we estimate the following linear model of market-level seating capacity:

$$Seats_m = \delta_0 + \delta_1 Rpop_m + \delta_2 Fpop_m + \delta_3 Landval_m + \varepsilon_m, \qquad (3)$$

where the subscript *m* represents market, and *Seats*, *Rpop*, and *Fpop* are the total number of seats, the resident population (in 10,000), and subway passengers (in 10,000) in the market, respectively. We calculate the resident population of a market as the sum of the resident population of every *Dong* whose office is located within the market.[23] As for the floating population, we first identify the subway stations located within the market. Next, the sum of the average daily number of passengers who get off at these stations serves as a proxy for the daily floating population for the market. *Landval* is the average land price of theaters in the market. We expect that the first two variables have a positive effect, while high land price has a negative effect on seat numbers in the market. We also estimate the model without *Fpop* to see more clearly the effect of incorporating the floating population into the analysis.

OLS estimation results in Table A-7 have several interesting points. First, the estimators of the effect of *Fpop* and the effect of *Rpop* take positive and significant values when both market subway passengers and resident population are included in the model, implying that the market floating population does not overlap significantly with the market resident population. Specifically, when the market resident population and subway passengers increase by 10,000, the market number of seats is expected to increase by 75 and 148, respectively. Second, the *R*-squared almost doubles and the effect of land price becomes negative and significant as expected when *Fpop* is considered together with *Rpop*. Third, when only the three largest cities are considered, the effect of the market resident population is smaller in magnitude and insignificant, whereas the effect of the floating population remains the same in magnitude and significant. These findings support our argument that the floating population is an essential part

[22] The one mile threshold value is based on the preliminary estimation, represented in Table A-1 in the manuscript, which reveals that cinemas farther than one mile from a theater have no statistically significant direct effect on its revenue. The one-mile threshold value is also used to separate collocate rivals from distant ones in the literature (Hastings, 2004; Watson, 2009; Ren, Hu, Hu, and Hausman, 2011)

[23] As was described, the administrative divisions of Korea for metropolitan areas are i) City, ii) Gu (District), and iii) Dong (neighborhood) in descending order of size.

of the local market size.

3. Other Specifications

We further test the robustness of our empirical findings in the following ways.[24] First, we note that the number of subway passengers who get off at nearby stations of a theater may not properly measure the floating population for the theater. This is because our subway passenger data do not tell us how many people are traveling to or from the area where the station is located. On one hand, if a station is located in a residential area, then people who get off at the station are more likely to be returning from other places such as downtown districts. On the other hand, if the station is in a downtown area, people who get off at the station are more likely to be traveling to that area. Therefore, simply counting the number of passengers getting off at a station may overestimate the floating population for theaters located in residential districts. To alleviate this concern, we adjust the floating population for theater i in the following way:

$$Adjusted\ Fpop_i = \frac{\#\, Stations_i}{14} Fpop_i,$$

where *#Stations* is the number of subway stations located within one mile of the theater, and 14 is the maximum value of *#Stations* in our data. The idea is that subway lines are more numerous and stations are closer together in downtown areas than in residential districts. According to Table A-8, estimation results are similar to those without adjusting the floating population. The positive and significant impact of the floating population (6.89) dominates the negative but insignificant impact of resident population (-1.59) for theaters in the three largest cities. Also, competition negatively affects theater demand (-0.17), and this negative competition effect is larger for those that are located in the three largest cities (-0.52).

Second, we add demographic information in the model that may help control for unobservable market heterogeneity. Specifically, we consider the ratio of females (*Female*), the ratio of people aged between 20 and 30 (*Twenty*), and the per capita income (*PCI*) in the district where the theater is located in 2010. In Korea, (i) females and (ii) people aged between 20 and 30 are known to go to the theater more often than others.[25] Also, income may positively affect movie demand in the region.[26] According to the 2SLS estimation results

[24] Also, as an additional robustness check, we exclude outliers in the estimation of model (1). Note that there is a theater with only eight daily consumers. This theater, Bupyung Daihan Cinema, opened in 1973 and has only two screens; it is the only theater with a daily audience size below 20 in the data. In addition, there are seven theaters with no resident population, that is, no *Dong*'s office within one mile, while 62 theaters have no floating population, that is, no subway stations within one mile. To check whether our estimation results are driven by these outliers, we estimate model (1) excluding these outliers one after another. Estimation results presented in Table A-13 are consistent with the results for the full sample, and show that the effect of floating population on movie demand is statistically significant and large in magnitude for theaters in the largest metropolitan cities.

[25] Movie theater consumer survey, Korean Film Council, 2010.

[26] The descriptive statistics for these three variables are reported in Table A-9. On average, there are slightly more females than males in a district, while the 20-30 age group takes between 10 and 22 percent of the population. The average per capita income in 2010 is 38.7 million Korean won or approximately 33.6 thousand USD. Although the unemployment rate would be another good demographic variable to be considered, that information is available only at the city level in Korea. However, we expect that its effect on movie demand would be controlled for, at least partially,

reported in Table A-10, the higher the female ratio and the higher the ratio of the 20-30 age group, the larger the audience size of the theater. For instance, a one percentage point increase in the female ratio would increase the daily audience size by 190. Interestingly, when we consider only the theaters in the three largest cities, none of these demographic characteristics have a significant effect on the audience size. In contrast, the effect of floating population on movie demand becomes larger in magnitude and statistically significant. This finding addresses the importance of controlling for the floating population in analyzing the demand for movie theaters, especially those located in the metropolitan areas.

Third, to see how sensitive our findings are to a change in local market definition, we consider a two mile and a five mile radius around a theater as its local market. Estimation results reported in Table A-11 show that the effect of floating population on the audience size is statistically significant under all specifications; however, unsurprisingly, the broader the local market, the smaller the impact of the floating population.

Finally, despite the uniform pricing practice, in principle, admission price should be considered in estimating movie demand. Therefore, we conduct the analysis including admission price as a regressor in model (1). We download admission price data from the Korea Box Office Information System for 346 out of 362 theater-year combinations in our sample.[27] Given that the admission price *Price* is an endogenous variable, we estimate the model with the IV method. As argued in the manuscript, the land price may negatively affect entry of theaters. Moreover, an increase in the land price may induce the admission price to increase. Therefore, we use *Rchange* and *Landval* as the two instrumental variables for *Price* and *Cseats*. First stage estimation results reported in Table A-12 show that an increase in land price *Rchange* indeed positively affects admission price. The coefficient of the admission price in the second stage is negative but insignificant. This may be due to the lack of price variation across theaters to measure the effect of prices on movie demand. Also, similar to our previous findings, the effect of floating population is positive when all theaters in the sample are considered and becomes statistically significant when only the three largest cities are considered.

V. *Conclusion*

In this paper, we emphasize the importance of considering the floating population as well as the resident population to precisely measure local market size for movie theaters located in metropolitan areas. Due to the mobility of people living in this region, local market size may not be well represented by the resident population. For instance, despite the relatively small size of the resident population in downtown districts of a city, their market sizes can be very large as people from other parts of the city travel to these districts for various reasons.

Using the number of subway passengers as a proxy for the floating population, we find empirical evidence that the floating population explains a significant amount of variation in the theater audience for theaters in the largest metropolitan cities. When we consider only theaters

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by per capita income.

[27] Since prices are lower for first turn and weekday showings, we use the weekend average prices excluding the first turn showing prices in the analysis. Using average prices of all showings or weekday showings does not change the empirical results.

located in these cities, the floating population seems to better represent local market size than the resident population. The estimation results also reveal that the greater the level of competition is, the fewer consumers a theater attracts. This negative spatial competition effect is larger for theaters located in the largest metropolitan cities. These results are intuitive because the floating population is more likely to make up a large proportion of local demand in larger cities.

In conclusion, our findings suggest that controlling for the floating population as well as the resident population is necessary for an accurate analysis of theater revenues and spatial competition among theaters in large metropolitan areas. In our analysis, we did not control for demographic information on subway passengers. Taking it into account would improve our understanding of the determination of local demand for movie theaters. Finally, the importance of incorporating the floating population into the analysis should not be restricted only to the movie theater industry. We hope that this work sheds light on research into the effects of the floating population on other retailer markets in metropolitan areas.

Appendix: Additional Tables and Figures

Table A-1. Preliminary Analysis

Variable	Coeff.	Std. Err.
$Cseats^{0-1mi.}$	-0.128	(0.055)**
$Cseats^{1-2mi.}$	-0.028	(0.033)
$Cseats^{2-3mi.}$	0.001	(0.028)
$Cseats^{3-4mi.}$	-0.015	(0.022)
$Cseats^{4-5mi.}$	-0.011	(0.018)
$Rpop^{0-1mi.}$	2.326	(1.274)*
$Rpop^{1-2mi.}$	-0.148	(0.877)
$Rpop^{2-3mi.}$	0.524	(0.588)
$Rpop^{3-4mi.}$	0.392	(0.479)
$Rpop^{4-5mi.}$	-0.204	(0.326)
$Fpop^{0-1mi.}$	1.521	(1.447)
Seats	1.735	(0.192)***
Theater quality	14.889	(2.495)***
Fixed effects		
Chain	Yes	
Year	Yes	
Observations	362	
R-squared	0.727	

Note: The table presents OLS estimates using *Daily audience* as the dependent variable. Standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

TABLE A-2. FIRST STAGE ESTIMATION RESULTS: ONE ENDOGENOUS VARIABLE

Variable	All cities		Three largest cities		Other cities	
	(1)	(2)	(3)	(4)	(5)	(6)
Rchange	-121.502***	-67.074***	-109.527***	-65.579**	-62.459***	-71.412***
	(22.591)	(16.729)	(24.952)	(28.226)	(22.030)	(20.255)
Rpop	-6.156***	-3.219*	-8.372***	-6.660***	-9.468***	-5.978
	(1.661)	(1.635)	(2.169)	(2.395)	(3.141)	(3.797)
Fpop	16.419***	11.325***	14.154***	12.201***	57.018***	37.178*
	(1.195)	(2.127)	(1.504)	(2.354)	(7.986)	(19.266)
Seats	0.351	0.395	0.093	0.073	1.229***	1.270***
	(0.265)	(0.255)	(0.291)	(0.284)	(0.434)	(0.405)
Theater Quality	-8.357	-5.129	4.308	3.592	-14.122*	-12.341*
	(5.600)	(5.134)	(7.723)	(7.652)	(8.381)	(7.109)
% Commercial		98.068***		40.587		92.671*
		(25.228)		(24.447)		(52.830)
% Unemployment		-305.797**		-371.672		-612.552***
		(132.620)		(479.826)		(182.868)
Constant	3,950.268***	3,140.861***	3,751.015***	4,216.591**	1,833.946**	3,336.027***
	(735.499)	(824.483)	(845.101)	(2,037.271)	(850.229)	(1,178.702)
Fixed effects						
Chain	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic	73.21	21.39	39.35	5.81	9.36	11.87
Observations	362	362	175	175	187	187

Note: The table presents first-stage estimation results of the 2SLS procedure, using *Daily audience* as the dependent variable. The endogenous regressor, *Cseats*, is instrumented by the instrumental variable, *Rchange*. Robust standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

TABLE A-3. FIRST STAGE ESTIMATION RESULTS: TWO ENDOGENOUS VARIABLES

Variable	All cities				Three largest cities				Other cities			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Seats	Cseats	Seats	Cseats	Seats	Cseats	Seats	Cseats	Seats	Cseats	Seats	Cseats
Landval	-33.358***	-58.291***	-33.047***	-69.436***	-29.922***	-49.087**	-29.853***	-54.096**	-46.504***	-112.386	-48.413***	-170.155*
	(7.535)	(18.117)	(7.679)	(20.999)	(7.516)	(20.269)	(7.698)	(20.742)	(16.287)	(87.393)	(17.510)	(85.997)
Rchange	-5.055	-121.307***	-5.303	-65.775***	-1.913	-110.135***	10.680	-64.541**	-8.885*	-70.205***	-10.221*	-80.817***
	(5.553)	(21.715)	(5.227)	(16.654)	(10.459)	(24.150)	(13.028)	(27.798)	(5.170)	(22.787)	(5.727)	(19.354)
Rpop	0.859	-5.664***	0.784	-2.495	0.501	-8.178***	0.940	-6.368***	1.374*	-7.277**	1.348	-3.202
	(0.622)	(1.631)	(0.636)	(1.576)	(1.193)	(2.067)	(1.212)	(2.188)	(0.778)	(3.040)	(0.817)	(3.446)
Fpop	2.914***	20.460***	2.840***	16.167***	2.395***	17.513***	2.308**	15.552***	2.032	62.142***	2.864	46.336**
	(0.848)	(1.668)	(1.039)	(2.589)	(0.910)	(1.824)	(1.038)	(2.394)	(1.427)	(10.359)	(2.726)	(22.396)
Theater Quality	1.918	-6.338	1.828	-2.577	0.702	7.451	0.291	7.184	3.540*	-9.691	3.702*	-7.148
	(1.654)	(5.593)	(1.680)	(5.181)	(2.867)	(7.539)	(2.937)	(7.484)	(1.859)	(8.760)	(1.889)	(7.296)
% Commercial			-0.253	99.433***			3.419	46.693**			-2.269	90.024*
			(6.659)	(22.720)			(11.730)	(22.588)			(7.173)	(52.999)
% Unemployment			18.410	-340.294**			-207.591	-329.286			-27.439	-715.714***
			(50.634)	(134.842)			(191.294)	(467.547)			(70.926)	(208.631)
Constant	1,345.619***	4,447.439***	1,297.202***	3,778.017***	1,468.492***	3,891.177***	2,074.178***	4,076.677**	1,285.409***	3,456.292***	1,399.440***	5,438.587***
	(158.403)	(651.289)	(243.155)	(832.576)	(260.082)	(655.095)	(686.133)	(1,903.659)	(208.753)	(816.932)	(373.436)	(1,397.877)
Fixed effects												
Chain	Yes		Yes		Yes		Yes		Yes		Yes	
Year	Yes		Yes		Yes		Yes		Yes		Yes	
Cragg-Donald F-stat	11.72		3.91		6.19		2.88		1.12		0.76	
Observations	362		362		175		175		187		187	

Note: The table presents first-stage estimation results of the 2SLS procedure, using *Daily audience* as the dependent variable. Two endogenous regressors, *Seats* and *Cseats*, are instrumented by two instrumental variables, *Landval* and *Rchange*. Robust standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

TABLE A-4. 2SLS WITH TWO ENDOGENOUS VARIABLES: *Cseats* AND *Fpop*

Variable	All cities			Three largest cities		
	First		Second	First		Second
	Cseats	Fpop		Cseats	Fpop	
Cseats			-0.143**			-0.445***
			(0.070)			(0.131)
Rpop	-8.700***	-0.148**	2.848***	-11.033***	-0.275**	-1.146
	(1.812)	(0.074)	(0.987)	(2.177)	(0.116)	(1.748)
Fpop			2.185			6.421***
			(1.375)			(2.095)
Seats	0.208	-0.004	1.776***	-0.020	-0.005	1.897***
	(0.221)	(0.009)	(0.202)	(0.213)	(0.010)	(0.185)
Theater Quality	-8.783	0.118	14.602***	1.768	0.141	10.232**
	(5.663)	(0.137)	(2.519)	(7.043)	(0.212)	(4.270)
Rchange	-89.906***	2.020***		-94.335***	1.479	
	(20.825)	(0.555)		(22.216)	(0.930)	
Nstations	542.535***	27.620***		575.581***	33.116***	
	(51.606)	(2.436)		(63.755)	(3.024)	
Constant	3,105.243***	-49.168**	-823.423***	2,584.598***	-59.510*	-160.422
	(680.635)	(19.302)	(236.401)	(818.338)	(30.784)	(363.534)
Fixed effects						
Chain		Yes			Yes	
Year		Yes			Yes	
F test for joint significance	56.74	64.54		52.86	59.97	
	0.00	0.00		0.00	0.00	
DWH Test			0.55			3.49
p-value			0.58			0.03
Observations		362			175	

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. Two endogenous regressors, *Cseats* and *Fpop*, are instrumented by two instrumental variables, *Rchange* and *#of subwaystations*. Standard errors (clustered by theaters) are in parentheses. The notation *** indi-cates significance at 1% level, ** at 5% level, * at 10% level.

Table A-5. The Number of Competitors' Screens as the Measure of Competition Degree

Variable	All Cities		Three largest cities	
	First	Second	First	Second
Cscreens		-26.367* (14.398)		-85.771*** (32.820)
Rpop	-0.032*** (0.010)	2.420** (1.047)	-0.040*** (0.011)	-1.979 (2.322)
Fpop	0.082*** (0.007)	2.077 (1.351)	0.069*** (0.008)	5.573** (2.179)
Screens	0.824** (0.367)	409.302*** (53.888)	0.119 (0.363)	461.642*** (57.919)
Theater Quality	-0.025 (0.030)	20.820*** (2.721)	0.040 (0.039)	16.341*** (5.440)
Rchange	-0.679*** (0.132)		-0.543*** (0.134)	
Constant	17.287*** (4.154)	-1,824.028*** (368.217)	17.820*** (4.746)	-1,237.616** (525.750)
Fixed effects				
Chain	Yes		Yes	
Year	Yes		Yes	
DWH Test	0.06		2.94	
p-value	0.81		0.09	
Observations	362		175	

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. The endogenous regressor, *Cscreens*, is instrumented by the instrumental variable, *Rchange*. Robust standard errors (clustered by theaters) are in parentheses. The number of competitors' screens is used as the measure of competition. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table A-6. Panel Data Analysis

Variable	One mile radius		Two mile radius	
	(1)	(2)	(1)	(2)
Cseats		0.011 (0.043)		-0.030 (0.030)
Fpop	4.248** -1.871	4.306** -1.889	2.963*** -0.918	2.919*** -0.916
Fixed effects				
Theater	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	258	258	258	258

Note: The table presents fixed effects estimators using *Daily audience* as the dependent variable. Standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table A-7. Market-level Capacity Determination

Variable	All Cities		Three largest cities	
	(1)	(2)	(3)	(4)
Rpop	111.458***	74.589***	110.697***	41.066
	(22.614)	(19.946)	(41.216)	(27.893)
Fpop		148.357***		157.546***
		(13.324)		(13.874)
Landval	10.035	-141.656***	17.105	-130.686***
	(57.041)	(26.521)	(64.552)	(27.918)
Constant	364.422	970.772***	350.514	1,275.682***
	(350.753)	(222.807)	(835.647)	(421.452)
R-squared	0.237	0.453	0.184	0.589
Observations	124	124	52	52

Note: The table presents OLS estimates using *Seats*$_m$ as the dependent variable. Robust standard errors are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table A-8. Adjusted Fioating Population

Variable	All Cities		Three largest cities	
	First	Second	First	Second
Cseats		-0.167**		-0.523***
		(0.080)		(0.164)
Rpop	-2.957*	2.938***	-5.477**	-1.587
	(1.679)	(0.904)	(2.170)	(1.934)
Adj Fpop	19.253***	2.001	16.284***	6.886***
	(1.626)	(1.603)	(1.699)	(2.629)
Seats	0.430*	1.810***	0.163	1.947***
	(0.237)	(0.209)	(0.242)	(0.203)
Theater Quality	-6.566	15.328***	6.157	13.735***
	(5.682)	(2.499)	(7.459)	(4.790)
Rchange	-114.608***		-101.159***	
	(22.547)		(25.225)	
Constant	3,617.650***	-796.475***	3,525.505***	100.383
	(724.889)	(242.926)	(831.800)	(446.662)
Fixed effects				
Chain	Yes		Yes	
Year	Yes		Yes	
DWH Test	1.13		10.05	
p-value	0.29		0.00	
Observations	362		175	

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. The endogenous regressor, *Cseats*, is instrumented by the instrumental variable, *Rchange*. Robust standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Table A-9. Descriptive Statistics of Demographic Information

Variable	Avg.	Std. Dev.	Min.	Max.
Female (%)	50.5	0.9	48	52
Twenty (%)	14.8	2.1	10	22
PCI (million KRW)	38.7	65.3	7	377

Table A-10. Adding Demographic Information of Residential Population

Variable	All cities		Three largest cities	
	First	Second	First	Second
Cseats		-0.197***		-0.489***
		(0.071)		(0.182)
Rpop	-6.343***	1.719	-7.775**	-2.326
	(2.013)	(1.114)	(3.150)	(2.224)
Fpop	18.811***	1.520	18.100***	7.281**
	(2.731)	(1.814)	(2.916)	(3.624)
Female	-146.594	192.726**	-171.416	39.732
	(230.084)	(85.416)	(270.812)	(156.576)
Twenty	-33.714	53.599*	-187.721**	-25.545
	(66.425)	(29.609)	(83.744)	(70.584)
Income	-3.176	0.133	-4.218	-1.792
	(3.558)	(1.982)	(4.083)	(2.519)
Seats	0.344	1.788***	0.054	1.890***
	(0.262)	(0.177)	(0.281)	(0.179)
Theater Quality	-7.640	13.208***	4.608	11.584**
	(5.607)	(2.610)	(8.485)	(4.684)
Rchange	-124.691***		-91.649***	
	(22.107)		(26.753)	
Constant	11,878.659	-11,000.622**	14,757.239	-1,574.592
	(11,824.599)	(4,396.625)	(13,769.355)	(8,064.351)
Fixed effects				
Chain	Yes		Yes	
Year	Yes		Yes	
DWH Test	2.17		5.18	
p-value	0.14		0.03	
Observations	362		175	

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. The endogenous regressor, *Cseats*, is instrumented by the instrumental variable, *Rchange*. Standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

TABLE A-11. BROADER LOCAL MARKET DEFINITIONS

Variable	Two mile radius		Five mile radius	
	All cities	3 largest cities	All cities	3 largest cities
Cseats	-0.176***	-0.520***	-0.079**	-0.158***
	(0.062)	(0.133)	(0.037)	(0.053)
Rpop	1.293***	0.531	0.375**	0.648***
	(0.450)	(0.737)	(0.187)	(0.250)
Fpop	1.366**	5.573***	0.777**	1.603***
	(0.687)	(1.496)	(0.362)	(0.560)
Seats	1.748***	1.851***	1.730***	1.842***
	(0.190)	(0.202)	(0.194)	(0.217)
Theater quality	16.943***	17.038***	15.336***	8.756**
	(2.540)	(4.873)	(2.449)	(3.771)
Constant	-694.267***	-6.523	-446.970*	-246.267
	(244.149)	(434.037)	(247.979)	(447.312)
Fixed effects				
Chain	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	362	175	362	175

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. The endogenous regressor, *Cseats*, is instrumented by the instrumental variable, *Rchange*. Robust standard errors (clustered by theaters) are in parentheses. A two mile radius (a five mile radius) around a theater is defined as its local market in the first two columns (in the last two columns, respectively). The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

TABLE A-12. ADMISSION PRICE AS A REGRESSOR

Variable	All cities			Three largest cities		
	First		Second	First		Second
	Price	Cseats		Price	Cseats	
Price			-2.013 (2.071)			-0.577 (1.081)
Cseats			-0.603 (0.429)			-0.652*** (0.252)
Rpop	1.407** (0.562)	-5.355*** (1.754)	3.411* (2.055)	0.856 (0.521)	-7.724*** (2.204)	-2.645 (1.998)
Fpop	0.803* (0.420)	19.971*** (1.905)	11.478 (8.897)	0.785 (0.516)	17.844*** (2.083)	8.783** (4.266)
Seats	0.234*** (0.056)	0.101 (0.263)	2.363*** (0.641)	0.181*** (0.051)	-0.094 (0.307)	2.029*** (0.291)
Theater Quality	4.872*** (1.596)	-5.611 (5.836)	22.489*** (8.646)	2.032 (1.441)	8.016 (7.705)	16.239*** (6.170)
Landval	3.412 (4.356)	-51.526** (21.151)		-0.778 (4.045)	-50.928** (24.664)	
Rchange	26.917*** (4.533)	-124.190*** (22.895)		32.504*** (5.796)	-117.025*** (26.334)	
Constant	7,307.105*** (164.278)	4,224.250*** (787.971)	15,628.065 (16,784.918)	7,558.883*** (184.464)	4,079.087*** (902.176)	4,878.111 (9,123.433)
Fixed effects						
Chain		Yes			Yes	
Year		Yes			Yes	
F test for joint significance	18.08	15.11		15.96	10.70	
	0.00	0.00		0.00	0.00	
DWH Test			1.23			8.20
p-value			0.29			0.00
Observations		346			166	

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. Two endogenous regressors, *Price* and *Cseats*, are instrumented by two instrumental variables, *Landval* and *Rchange*. Robust standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

TABLE A-13. DROPPING OUTLIERS

Variable	Excluding revenue outliers				Excluding resident population outliers				Excluding floating population outliers			
	All cities		Three largest cities		All cities		Three largest cities		All cities		Three largest cities	
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Cseats	-0.153**	-0.245*	-0.502***	-0.967*	-0.145*	-0.230*	-0.522***	-0.849*	-0.161**	-0.272*	-0.523***	-0.833*
	(0.073)	(0.130)	(0.150)	(0.517)	(0.074)	(0.133)	(0.164)	(0.477)	(0.078)	(0.147)	(0.164)	(0.426)
Rpop	2.748***	2.558**	-2.778	-5.086	2.759***	2.567**	-3.150	-4.910	2.112*	1.581	-3.178	-4.878
	(1.013)	(1.019)	(2.056)	(3.798)	(1.027)	(1.066)	(2.427)	(4.089)	(1.271)	(1.486)	(2.495)	(3.875)
Fpop	1.866	2.098	6.270***	11.385*	1.716	1.981	6.237***	9.407*	1.801	2.116	6.264***	9.215*
	(1.313)	(1.564)	(2.085)	(6.305)	(1.301)	(1.535)	(2.187)	(5.428)	(1.300)	(1.617)	(2.163)	(4.916)
Seats	1.787***	1.827***	1.961***	2.006***	1.802***	1.836***	1.891***	1.895***	1.797***	1.835***	1.889***	1.892***
	(0.201)	(0.203)	(0.178)	(0.211)	(0.200)	(0.200)	(0.177)	(0.185)	(0.209)	(0.204)	(0.177)	(0.183)
Theater Quality	15.400***	15.007***	11.450	11.408	15.728***	15.495***	11.301**	11.697*	16.240***	15.828***	11.228**	11.495*
	(2.620)	(2.658)	(5.050)	(7.802)	(2.568)	(2.583)	(4.783)	(6.391)	(2.771)	(2.858)	(4.879)	(6.388)
% Commercial		20.627		34.548		18.546		28.728		22.821		27.669
		(19.288)		(36.746)		(19.295)		(34.377)		(20.276)		(31.912)
% Unemployment		-7.994		-546.591		-17.372		-313.178		-10.247		-292.112
		(73.585)		(588.926)		(72.591)		(487.221)		(84.769)		(471.261)
Constant	-827.774***	-786.052**	47.011	2,940.062	-867.669***	-788.550**	258.444	2,026.775	-748.615**	-619.738	269.246	1,943.552
	(242.115)	(362.219)	(438.508)	(3,145.604)	(266.978)	(370.244)	(542.748)	(2,702.000)	(356.160)	(536.647)	(585.643)	(2,508.102)
Fixed effects												
Chain	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	360	360	173	173	355	355	172	172	300	300	169	169

Note: The table presents 2SLS estimates using *Daily audience* as the dependent variable. Movie theaters with less than 20 daily audience size, no resident population, and no floating population are excluded from the analysis one after another. The endogenous regressor, *Cseats*, is instrumented by the instrumental variable, *Rchange*. Standard errors (clustered by theaters) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

FIGURE A-1. THEATERS AND SUBWAY STATIONS IN THE SAMPLE DATA. SEOUL METROPOLITAN AREA

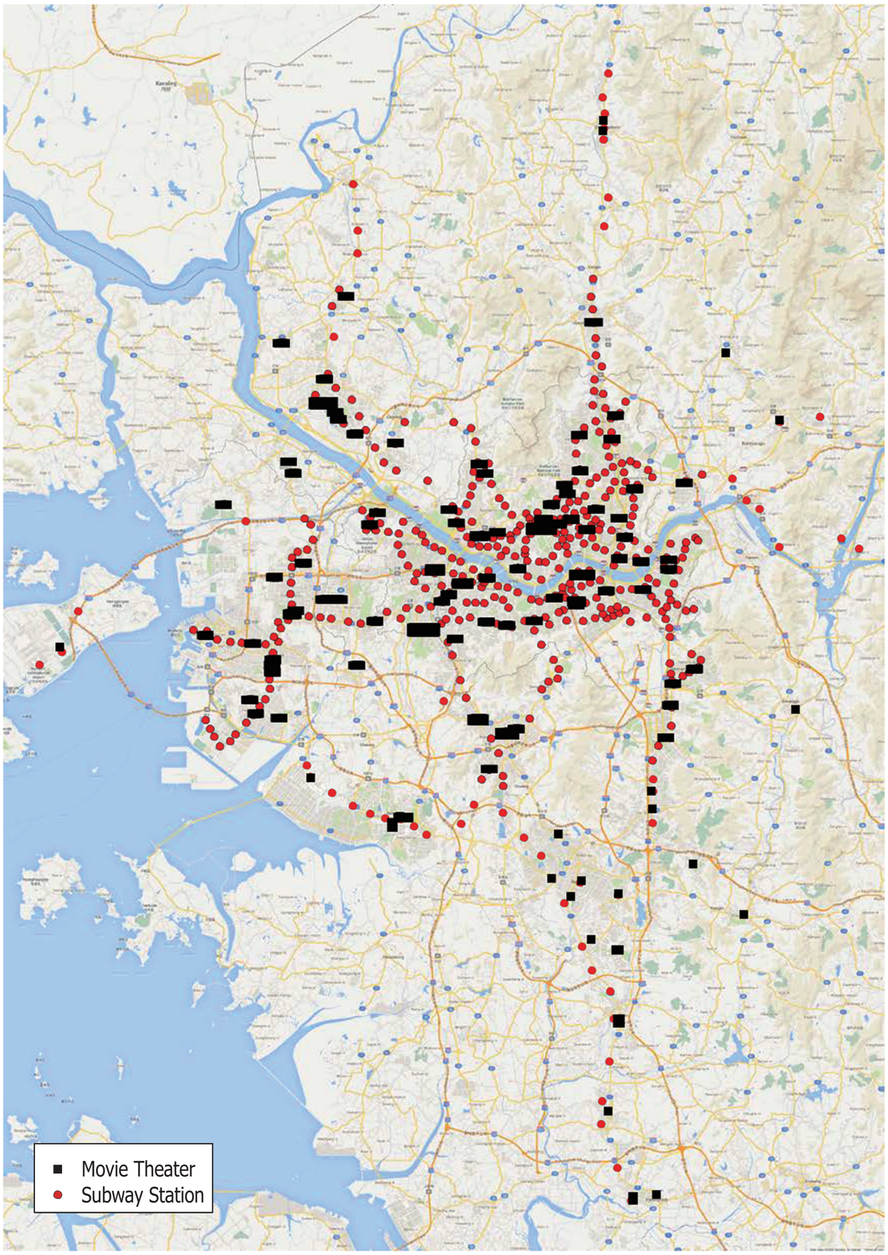
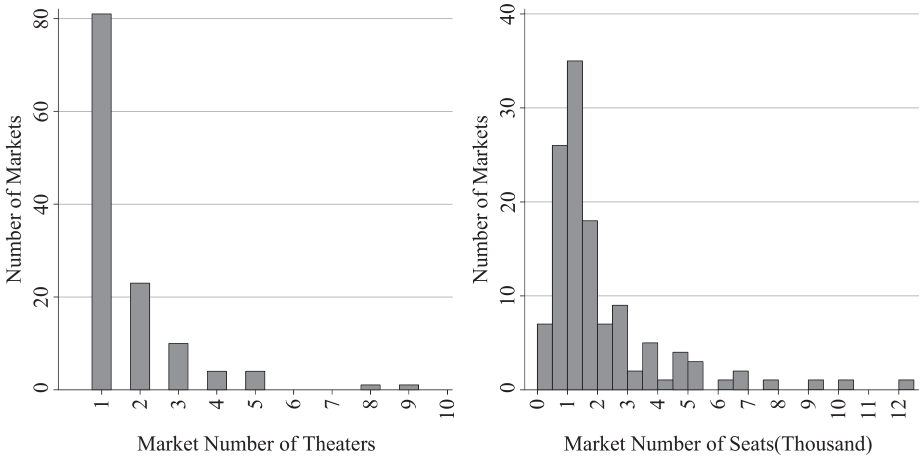


FIGURE A-2. LOCAL MARKET EXAMPLE

FIGURE A-3. THEATERS AND SEATS IN THE MARKET



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