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Original Paper

Exploring the Association between Job Attributes and Housing Rents: A Case Study of Guangzhou

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Abstract

The association between jobs and housing rents has garnered significant attention from scholars. However, the current body of literature only examines a limited number of job-related characteristics when investigating the link between jobs and housing rents, without delving into more comprehensive job attributes. This study utilizes job data sourced from the job search website Zhilian to conduct a comprehensive analysis of how housing rents are associated with job attributes (specifically, job position features, employer features, and distant job accessibility) at various spatial scales. The analysis is based on a sample of 3,850 communities in Guangzhou, China. This study reveals that housing rents are associated with job attributes at varying spatial scales, with the magnitude of impact generally diminishing as the spatial scale expands. When considering job attributes, it is found that employer features hold the highest level of significance, followed by job position features, while distant job accessibility is deemed to be of lesser importance. The aforementioned findings contribute novel insights into the association between specific job characteristics and housing rents. This information can prove valuable for policymakers as they strive to formulate affordable housing strategies that align with prevailing employment conditions.

Keywords

job attributes, job position features, employer features, distant job accessibility, housing rents

1. Introduction

The phenomenon of a city's economic growth is typically accompanied by a plethora of job opportunities, an expanding working-age population, as well as increased affluence and inflation within the housing market. The rental housing market plays a significant role within the housing market of megacities due

to the financial constraints faced by a considerable number of individuals, particularly migrant workers and those in the early stages of their careers, who are unable to purchase a home (Hu et al., 2019). Therefore, maintaining rental prices at an affordable level can alleviate the financial burden experienced by individuals. Previous studies have demonstrated that various factors contribute to the determination of housing rents or prices. These factors encompass dwelling-level attributes, neighborhood characteristics, and locational attributes (Gao et al., 2022; Li et al., 2022; Liang et al., 2018; Wang et al., 2017). Among all the associational factors, the job market plays an important role. Therefore, understanding the association between jobs and housing rents can assist policymakers in tackling the issue of housing affordability problems for the working population.

In China's planned economy era during the 20th century, housing was considered a fundamental facility that was publicly owned and allocated to individuals based on their work units (Wu, 1996). As China started its housing reform and comprehensive housing commodification in 1998, the private rental market was gradually formed. According to the National Bureau of Statistics (2012), a significant proportion of the population residing in megacities such as Beijing and Shanghai consists of individuals who occupy rental housing, amounting to more than one-third of the total population. Nevertheless, the escalating costs of housing rentals have compelled individuals with middle- and low-income occupations to relocate to more remote regions, resulting in the spatial stratification of labor and housing, alongside an increasing burden on quality of life. There exists a strong correlation between rental markets and the employment market. According to Hu et al. (2019), it is possible that there could be a rise in rental prices within the vicinity of large corporations. The escalation of housing rental prices has prompted governments to acknowledge the necessity of formulating policies aimed at the development of affordable housing (Miao, 2017). In order to enhance the alignment of these policies with real-world circumstances, it is crucial to acquire an understanding of the mechanism by which housing rental prices are associated with job attributes.

There have been numerous studies on the relationship between employment and housing (Li et al., 2019; Li et al., 2022; Osland & Thorsen, 2008). However, most of them consider job locations or accessibility without thoroughly exploring other job attributes. One potential explanation for this phenomenon could be attributed to the limited availability of comprehensive job-related data within the sources utilized by the researchers. The socio-economic characteristics of jobs, such as the industry type of the company and the experience requirements for workers, are frequently overlooked or not thoroughly examined. This study aims to address the existing research gap by utilizing job data obtained from a prominent job search website. The primary objective is to examine the potential relationship between job characteristics and housing rents in the city of Guangzhou. Furthermore, the analysis incorporates various spatial scales to demonstrate the varying effects of job associations across different spatial scales. The primary contribution of this study lies in its elucidation of the correlation between job characteristics and housing rents. This finding offers valuable insights for local governments in addressing the issue of housing affordability among the working class.

The remainder of this paper is structured in five parts. Section 2 reviews existing literature about how housing rents/prices are associated with jobs and the spatial scale issues. Section 3 introduces the methodology. Section 4 is the result, showing the association between job-related characteristics and housing rents and the variations along with spatial scales. Section 5 discusses the key findings and draws out some policy implications accordingly. Finally, this study is concluded in Section 6.

2. Literature Review

2.1 The Association between Jobs and Housing

A substantial body of literature has demonstrated that employment is a significant factor influencing urban housing prices (Li et al., 2022). The effect of job accessibility has been extensively examined in academic research. According to Osland and Thorsen (2008), the accessibility of the labor market is a contributing factor to the variation in housing prices within a region. Alonso (1964, as cited in Osland & Thorsen, 2008)'s 'access-space-trade-off' model suggests that labor-market accessibility is represented by the distance to the central business district (CBD) and housing prices decrease with increased distance from the city center. The employer type also serves as a potential associational factor on housing prices. Becker et al. (2021) pointed out that public-sector employment can affect private-sector employment through its impact on income and housing prices. Housing rents/prices can also be associated with industries. Empirical evidence indicates a positive correlation between the expansion of employment prospects and the escalating unaffordability of housing in Silicon Valley (Anthony, 2022). The rapid growth of tech companies such as Apple, Facebook, and Google has resulted in an increase in housing prices and the emergence of real estate speculation (Chapple & Jeon, 2021). Kishor et al. (2022) uncovered that there is a larger response of non-tradable sector employment to house price changes compared with tradable sector employment. Hu et al. (2019) uncovered that company diversity is significantly associated with rental prices by using company-level POI data. Li et al.(2022)'s work incorporates job classifications as a factor and demonstrates that the prices of both owner-occupied and rental housing in both inner and outer districts are impacted by blue-collar occupations, whereas pink- and white-collar occupations only exert influence in certain housing sub-markets. Salary is also an explanatory factor of housing prices (Taltavull Paz, 2003). Well-paid jobs can potentially result in an increase in regional housing prices through the operation of market forces. Although numerous scholarly works have examined the relationship between jobs and housing, there is still a lack of in-depth studies in consideration of more detailed job attributes (like industries, education requirements, etc.). The major potential explanation is the data sources utilized by previous scholars lack comprehensive job information. Currently, there exists a considerable number of job attributes that possess the potential to impact housing prices and rents; however, these attributes have received limited attention in scholarly research. Scholars are currently exploring the utilization of fine-scale online big data in urban studies, leveraging the advancements in big data technology. For example, Han et al. (2019) used online big data from the job search website 51.job to investigate how housing prices are associated with employment

opportunities and salaries. Another limitation observed in previous research is the tendency to examine the job-housing relationship solely at a specific spatial scale, such as 1 kilometer. This approach fails to consider the comparison of job-housing relationships across multiple scales, thereby hindering the ability to elucidate the scale dependence of this relationship.

2.2 The Spatial Scale Issues

In the field of housing studies, Lee et al. (2016) have highlighted the potential impact of spatial scale and spatial configuration on the coefficients obtained when employing aggregated geographic data in hedonic models. This is due to the fact that the spatial distribution of urban amenities or features exhibits variation across different scales (Hu et al., 2019; Jun & Kim, 2017). The relationship between jobs and housing exhibits a notable dependence on spatial scale (Niedzielski et al., 2013). For example, numerous scholars have demonstrated that the relationship between jobs and housing exhibits fluctuations in accordance with changes in spatial scales (Niedzielski et al., 2013; Yao & Kim, 2022; Zhou & Yeh, 2021). Hu et al. (2019) demonstrates that the diversities of companies at the subdistrict level and within a 15-minute walking distance exhibit distinct effects on housing rental prices. These studies demonstrate that policymakers can develop more suitable and customized strategies by comprehending the factors and spatial scales that contribute to specific outcomes (Reisig et al., 2021). Therefore, it is imperative to take into account spatial scales when undertaking comprehensive investigations into the association between employment and housing rental prices.

3. Methodology

3.1 Research Area

Guangzhou is the central city within the strategically planned Greater Bay Area (GBA) (Figure 1). Over the recent years, the rapid expansion of its economy has resulted in a substantial increase in both employment prospects and a thriving market for private housing rentals. According to the Guangzhou Bureau of Statistics (2022), there was a notable rise of 335,500 individuals in the urban employment population during the year 2021. Given that a significant portion of its population consists of renters, making it an appropriate choice for conducting studies on employment and rental housing (Wang et al., 2021), we have selected Guangzhou as the case city for our research.

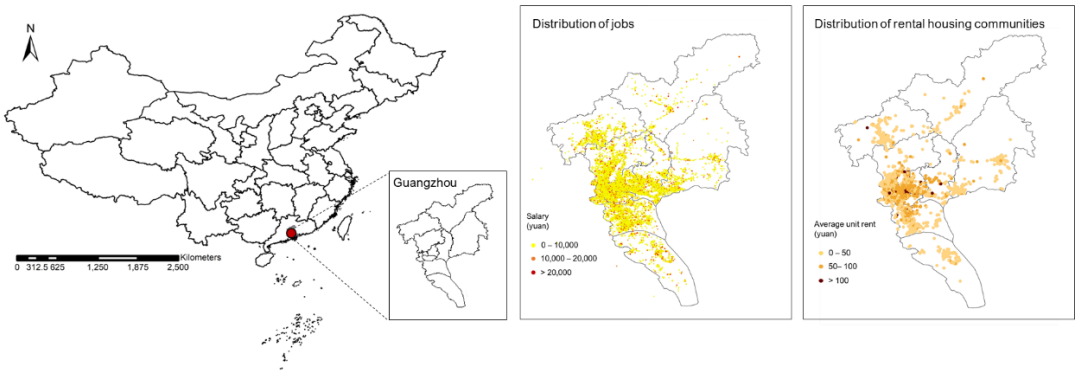

Figure 1. The Location, and the Distribution of Jobs and Rental Communities of Guangzhou

3.2 Methodology

Figure 2 illustrates the overall methodological flow. First, we collect online job and rental housing data (distributions of housing and jobs are shown in Figure 1) and preprocess the data. Second, we create buffer zones with different radii centered on the location of each community. Finally, we employ Lasso regression analyses at various spatial scales to investigate the association between job characteristics and housing rents.

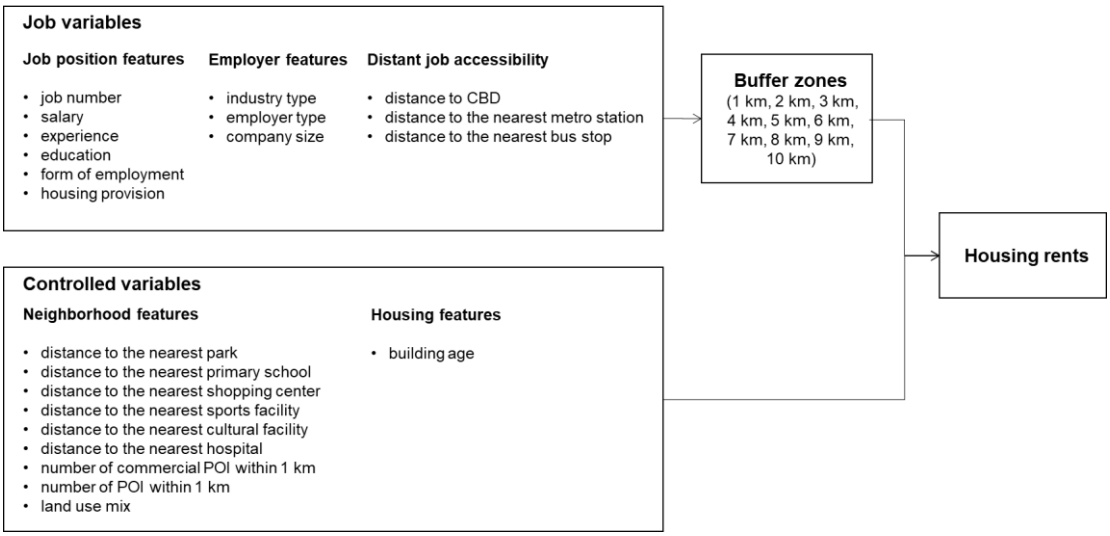

Figure 2. Overall Methodological Flow

3.2.1 Data Collection and Preprocessing

Table 1 presents the variables and their corresponding descriptions within the context of this research investigation. The study's dependent variable is represented by the natural logarithm of the average unit housing rents within each community. The primary independent variables encompass various job characteristics, such as features related to job position, employer attributes, and the accessibility of remote job opportunities. In addition, a set of nine variables related to the characteristics of the

neighborhood and one variable related to housing are considered as controlled variables. The calculated attributes of the controlled neighborhood were determined within a 1 km radius, representing the distance that can be covered by walking.

Online property website is an important and reliable data source for the collection of detailed housing rental data (Chen et al., 2016). The housing data utilized in this study was obtained from Lianjia.com, a prominent online platform for housing listings (www.lianjia.com). Initially, we obtained the rental lists and the xiaoqu (community) lists through self-written Python crawlers. Second, we conducted a matching process between the rental data and xiaoqu data, which consists of community information including the year of construction. This allowed us to obtain the construction years of the rental units, enabling us to calculate the ages of the buildings. Next, we eliminated the rental housing records that lacked data regarding the year of construction. In the fourth step of our analysis, we computed the natural logarithm of the mean unit rental price for each community. This variable serves as the independent variable in our research. Finally, the average unit rental price data of 3,850 communities in Guangzhou was obtained (Figure 1).

The job data (Figure 1) was collected from Zhilian (https://sou.zhaopin.com), a widely used online platform for job searching. The dataset pertaining to employment encompasses various attributes related to employers, such as industry classifications, employer categorizations (e.g., state-owned, foreign), company sizes, as well as job-specific details including salary ranges, educational prerequisites, experience prerequisites, and employment arrangements (e.g., full-time, part-time). Besides, we could also extract the information of whether a job provides accommodation by searching with the keywords—'accommodation' (*Zhusu*), 'accommodation included' (*Baozhu*) and 'food and accommodation included' (*Baochizhu*). The records containing incomplete information were eliminated, resulting in a final dataset comprising more than 140,000 job data entries. In addition, we have chosen certain characteristics pertaining to transportation (such as distances to the nearest metro station and bus stop) as well as the distance to the central business district (CBD) to serve as variables for measuring job accessibility from a remote location.

Previous research has indicated that housing rents are associated with neighborhood attributes and housing attributes (Hu et al., 2019; Wang et al., 2022). Therefore, we chose nine variables related to the neighborhood and one variable related to the dwelling as the controlled variables. The geographical data pertaining to points of interest (POI) within the neighborhood were obtained from Amap, a popular online mapping service (https://ditu.amap.com/).

Table 1. Description of Variables

Variables		Variable codes & Descriptions
Dependent variable	Housing rents (*y*)	Natural algorithm of average unit rental price of each residential community
Job position features	Job numbers (job_Num)	The number of jobs within the buffer zone
	Average salary (job_Salary)	The average salary within the buffer zone
	Experience	Percentage of each level of experience requirement within the buffer zone, including less than 1 year or no requirements (exp_<1), 1-3 years (exp_1-3), 3-5 years (exp_3-5), and 5 years and above (exp_>=5).
	Education	Percentage of each level of educational requirement within the buffer zone, including below vocational school or no requirements (edu_< Vocational), vocational school (edu_Vocaltional), bachelor (edu_Bachelor), master and above (edu_>=Master)
	Form of employment	Percentage of each form of employment within the buffer zone, including full time (form_F/T), part time (form_P/T)
	Housing provision (Housing)	Percentage of job positions within the buffer zone that provide housing
Employer features	Industry type	Percentage of each industry type within the buffer zone, including IT (type_IT), real estate & architecture (type_Estate), finance (type_Fin), education (type_Edu), media (type_Media), biomedical (type_Bio), retail (type_Retail), manufacturing (type_Manufacture), automobile (type_Automobile), transport (type_Transport), professional service (type_Prof), living service (type_Life), energy & environment (type_Energy), government & non-proft (type_Gov), agriculture (type_Agri)
	Company type	Percentage of each type of employer within the buffer zone, including state-owned enterprises (type_SOE), foreign companies (type_Foreign), joint ventures (type_Joint), private companies (type_private), joint

		stock companies (type_stock), listed companies (type_Listed), public institutions (type_Public), and other employers (type_Other).
	Company size	Percentage of each category of company size within the buffer zone, including less than 100 (size_<100), 100-500 (size_100-500), 500-1000 (size_500-1000), 1000-10000 (size_1000-10000), 10000 and above (size_>10000)
Distant job accessibility	Distance to CBD (dist_CBD)	Euclidean distance from the rental housing to CBD (Zhujiang New Town)
	Distance to the nearest metro station (dist_Metro)	Euclidean distance to the nearest metro station
	Distance to the nearest bus stop (dist_Bus)	Euclidean distance to the nearest bus stop
(Controlled) Neighborhood features	Distance to the nearest park (dist_Park)	Euclidean distance to the nearest park
	Distance to the nearest primary school (dist_School)	Euclidean distance to the nearest primary school
	Distance to the nearest shop	Euclidean distance to the nearest shop
	Distance to the nearest sports facility (dist_Sports)	Euclidean distance to the nearest sports facility
	Distance to the nearest cultural facility (dist_Culture)	Euclidean distance to the nearest cultural facility
	Distance to the nearest hospital (dist_Hospital)	Euclidean distance to the nearest hospital
	POI number (POI_Num)	The number of POI within 1 km buffer
	Commercial POI	The number of commercial POI within 1 km buffer

	number (commPOI_Num)	
	Land use mix (MIX)	Land use mix within 1 km buffer, calculated by Shannon formula: $$MIX = -\sum_{i=1}^{n}[p_i \times \log(p_i)]$$ Where n represents the number of POI types within the buffer zone; p_i represents the percentage of POI type i within 1 km buffer zone
(Controlled) Housing feature	Building age (build_Age)	The age of the building

3.2.2 The Spatial Scale

The relationships between jobs and housing may vary across different spatial scales (Yao & Kim, 2022). In this study, we employ ten buffer zones with the radius ranging from 1 to 10 kilometers with a 1 km interval based on Yao and Kim (2022)'s work. The ArcGIS software was utilized to aggregate job attributes within each buffer zone.

3.2.3 Lasso Regression Analysis

OLS (Ordinary Least Regression) is a widely used model in housing price prediction. However, it has poor performance when there are multicollinearity problems, causing low reliability and high variance in the coefficient estimates of the model. Comparatively, the Lasso (Least absolute shrinkage and selection operator) regression model has better prediction accuracy and interpretability as it performs both variable selection and regularization at the same time. Thus, it is applied by scholars in property evaluation (Gao et al., 2022). In this study, we apply the Lasso regression model to examine the association between the independent variables and the dependent variable. The original hedonic price function can be expressed as:

$$y = \beta X + \beta_0 \quad (1)$$

Where y is the natural logarithm of the rental price; X represents the matrix of the job characteristics and the controlled variables, β is the coefficient matrix and β_0 is the random error term.

The target function of Lasso is:

$$J(\beta) = \sum(y - X\beta)^2 + \lambda\|\beta\|_1 = \sum(y - X\beta)^2 + \sum\lambda|\beta| \quad (2)$$

The value of λ is optimal when $J(\beta)$ is minimized.

RMSE (root mean square error) shows the deviation between the real value (Y_i) and the predicted value (y_i). For each model, we computed its RMSE value. The performance of the model is better when the RMSE value is smaller:

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{n}(Y_i - y_i)^2} \quad (3)$$

4. Result

Figures 3 and 4 depict the retained job variables that are associated with housing rents subsequent to the elimination of insignificant variables through an automated process. Figure 3 also illustrates the direction of a variable's effect on housing rents, indicating whether it is positive or negative. In a broad sense, the quantity of significant job factors tends to diminish as the spatial magnitude expands. Figure 4 illustrates a significant decline in the quantity of job-related variables associated with housing rental rates at the 8km level. Figure 3 also demonstrates that the coefficients of variables exhibit a transition from positive to negative values as spatial scales vary. The RMSE values presented in Table 2 demonstrate that the models operating at spatial scales of 2 km, 3 km, and 4 km exhibit superior performance. This observation suggests that job attributes are more effective in elucidating the variations in housing rents at medium spatial scales. Figure 5 presents an illustration of the five most significant positive and negative associational factors affecting housing rents. On the other hand, Figure 6 displays the frequencies of variables that appear in the diagrams representing the top five positive and negative factors. Employer attributes, as a whole, exert a substantial associational effect on rental prices. The job accessibility variables exhibit certain effects, albeit relatively less pronounced, whereas the distant job accessibility variables are found to be of lesser significance.

Figure 3. Positivity/negativity of Job-related Variables

Table 2. RMSE Value of the Lasso Regression Models at Different Spatial Scales

1 km	2 km	3 km	4 km	5 km	6 km	7 km	8 km	9 km	10 km
0.347	0.339	0.338	0.337	0.341	0.343	0.342	0.343	0.344	0.353

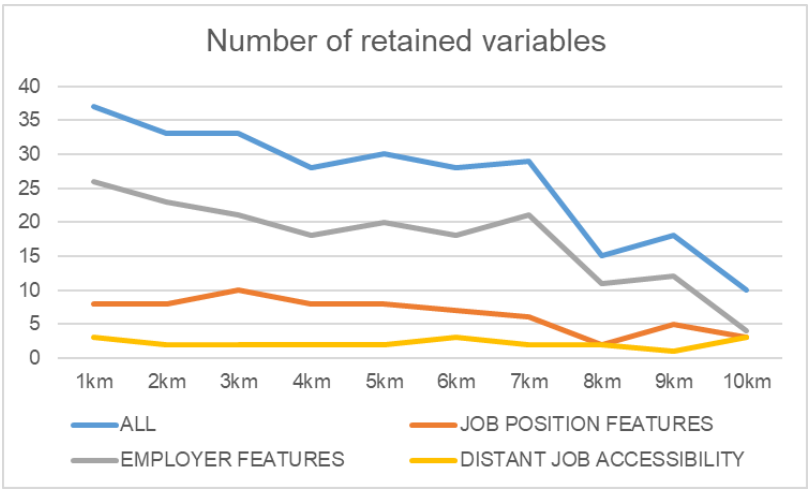

Figure 4. Number of Retained Variables

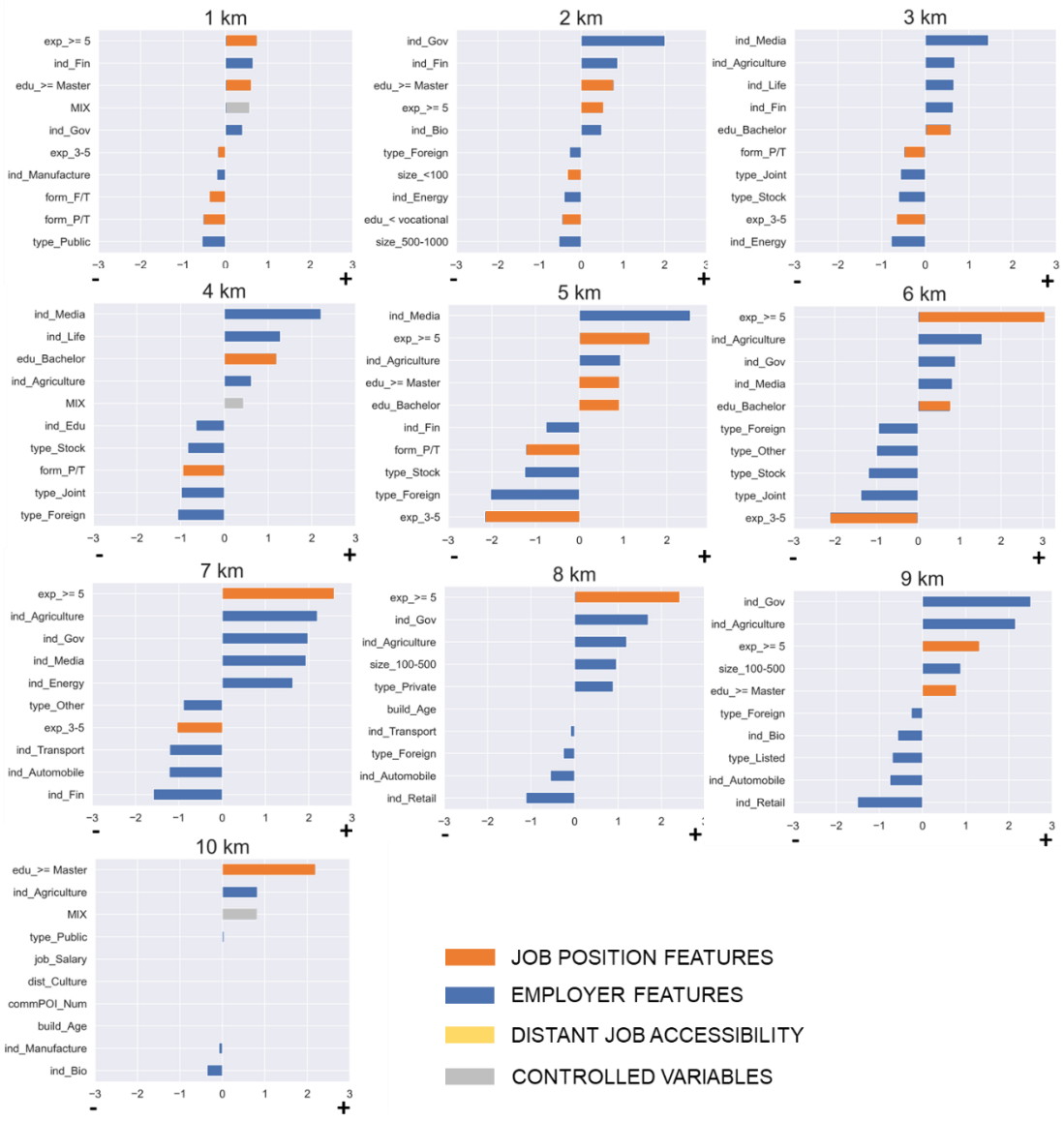

Figure 5. The Top 5 Positive/Negative Job-related Attributes Associated with Housing Rents

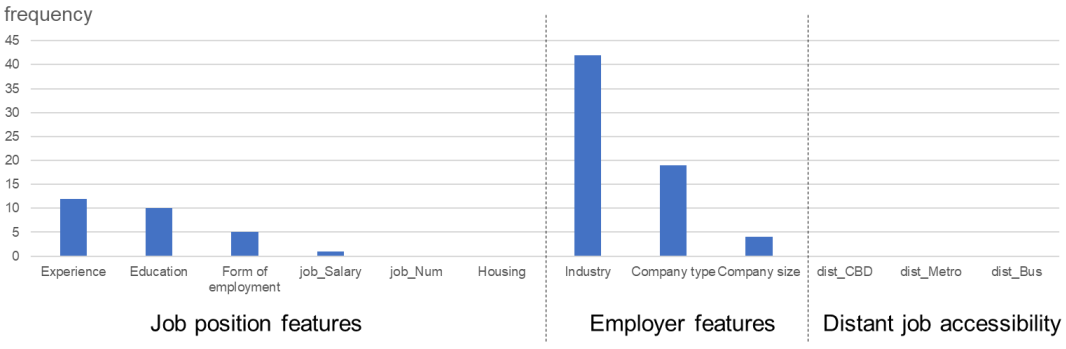

Figure 6. Frequencies of the Variable's Appearance in the Top 5 Positive/Negative Variables

4.1 Job Position Attributes

Upon examining the characteristics of the job position, it becomes evident that there is a positive correlation between the quantity of jobs and the rental prices of housing across all spatial scales that were investigated. The presence of numerous job prospects within a given region engenders an increased need for rental accommodations, ultimately resulting in elevated housing rental prices. This observation aligns with the outcomes reported in a prior study conducted by Jun and Kim (2017). However, unlike the result indicated in other scholars' work that salaries are positively correlated with housing rents (Jun & Kim, 2017), this study reveals a noteworthy observation that salaries have limited significance across various spatial scales in relation to housing rents. One possible explanation for this phenomenon is that individuals with higher incomes are more inclined to invest in homeownership rather than relying on rental properties within the housing market. The provision of housing by employers is a prevalent practice in China, serving as a means to accommodate a significant number of migrant workers (Li & Duda, 2010). There exists a positive association between the percentage of job postings offering accommodation and housing rents at scales of 2 km, 4 km, 6 km, and 7 km. One possible explanation for this phenomenon is that the employers who offer accommodations tend to be prominent and established organizations, thereby contributing to the economic growth of the local rental market.

4.1.1 Experience

Experience is the most important job-position-related variable associated with housing rents. Job posts requiring less than one year experience show no influence. Job postings that specify a requirement of less than one year of experience demonstrate negligible effect. The relationship between job requirements and rental prices at various spatial scales indicates that a higher proportion of jobs demanding 1-3 years or 5 years and above of work experience is associated with an increase in rents. Conversely, the proportion of jobs requiring 3-5 years of experience is negatively associated with rental prices. Based on our analysis, it can be inferred that the recruitment practices of companies tend to favor highly skilled individuals, particularly in the case of large corporations situated in strategically advantageous regions. Consequently, the cost of housing rentals in the neighboring regions is exorbitant. Individuals who possess a professional background of 1-3 years typically find themselves in the initial phases of their career trajectories. Typically, individuals of this demographic do not possess residential property, yet they may harbor more optimistic aspirations regarding their prospective professional advancement. Consequently, individuals exhibit a greater inclination to fulfill their rental obligations within specific spatial ranges, namely 3 km, 4 km, 5 km, and 7 km. The potential reason for the inability to afford rental prices near one's workplace could be attributed to their high cost. Additionally, individuals with 1-3 years of professional experience may still experience financial strain. Consequently, these factors may not exert a substantial effect on rental rates at a smaller geographical level. Individuals may opt to lease properties in locations that are moderately distant, yet still within reasonable proximity.

4.1.2 Education

The second most significant job position factor associated with housing rents is education. There is a negative association between rental prices and jobs with low educational qualifications. At the 1 km, 2 km, and 3 km spatial scales, job posts requiring less than a vocational school education have a considerable negative effect, but the negative effect of the proportion of occupations requiring a vocational school education is mostly focused at the medium spatial scales (5 km, 6 km, and 7 km). At various spatial scales, the percentage of occupations requiring a bachelor's, master's, or higher degree has a considerably positive effect on rent. Jobs with low educational requirements are typically low-paying, whereas persons with higher levels of education are more likely to have competitive jobs (e.g., lucrative incomes, numerous prospects for promotion), which enable them to afford more expensive rent.

4.1.3 The Form of Employment

Only at the 3km scale does the percentage of full-time jobs have a positive association with housing rents, while at the 1km, 3km, 4km, and 5km scales the number of part-time jobs has a negative effect. Perhaps there are more persons working low-paying odd jobs with variable wages in locations with greater rates of part-time employment. Rents may therefore be lower. There are still additional types of employment outside full- and part-time jobs (such internships and informal employment). We conclude that the diversity of employment can be positively associated with housing rents.

4.2 Employer Features

4.2.1 Industry

Different types of industries may be associated with housing rents at different spatial scales. Companies in the fields of IT, real estate, banking, and media serve as the 'symbol' of contemporary economic progress and provide many high-end white-collar employment. Other researchers have also demonstrated that these businesses' employment are more likely to cause rents in the area to rise (Anthony, 2022). Additionally, a bigger proportion of businesses in the living services sector has a stimulating effect on rent increase. Rents are positively associated with government employers at lower spatial scales (1 km, 2 km). This sort of employment is typically found in urban centers or subcenters, and their high prevalence suggests both a high level of neighborhood convenience and high rents. However, some sectors have a negative association with the rental prices in the area. For instance, industries like manufacturing, auto manufacture, transportation, agriculture, and education typically require larger land blocks and hence are more likely to be found in suburban areas with lower local rents. The occupations offered by the wholesale and retail sectors are frequently low-paying, and the residents can hardly afford expensive rent. The professional services sector has a detrimental impact on rents as well. Rents can be maintained low since there are fewer job applicants in this industry and an oversupply of rental properties nearby.

4.2.2 Employer Type

Out of all the employer characteristics, the type of employer has the second-largest associational effect on rent. State-owned firms and private companies are the two different employer categories positively associated with housing rents at various spatial scales. China's national economic development is significantly influenced by state-owned firms (Yu, 2014). The more steady and perhaps better-paying jobs provided by state-owned businesses can help to maintain the area's relatively high level of housing rents. Private businesses in Guangzhou have grown to play a significant role in the city's economic growth. They are the largest employers in Guangzhou's labor market, providing a large number of employment possibilities and raising the demand for rental property in the process. Within 1 km, there is a positive association between foreign businesses and joint ventures and rental prices, while at greater spatial scales, there is a negative effect or no correlation. This can mean that those who work for these companies are willing to rent in a close-by neighborhood but are not ready to put up with a lengthier commute. Within 5 kilometers, there is a positive association between listed firms and rent, while public institutions' associational effect is positive within 2 kilometers. We infer that those employed by large listed companies are willing to spend more time on commuting because being employed by a reputable employer will advance their professional careers.

4.2.3 Company Size

Companies with less than 100 employees or 500-1000 employees are negatively associated with housing rents in their neighborhoods and at the medium spatial scales, while the association between companies with 100-500 employees and rents is positive at all the studied spatial scales except 10km. We infer that the company size of 100-500 employees is suitable because companies of this size have some financial strength and no employee redundancy, which benefits the surrounding rental market. Large companies (1,000-9,999 people, 10,000 and more people) tend to be well-known and prestigious enterprises that contribute to the prosperity of the economic activities in the neighborhood areas. Thus, there can be a positive association between the proportion of large enterprises and rents.

4.3 Distant Job Accessibility

The associational effect of remote job accessibility is less substantial than the that of job position features and employer features. According to earlier researchers' findings (Wang et al., 2021), the distance to the CBD has a detrimental impact on housing rents. This is clear given that the majority of employment possibilities are concentrated in urban regions, making it difficult for people who reside distant from these locations to commute to work. It did not, however, rank among the top 5 variables that are significantly associated with our outcomes. To our surprise, the proximity to the nearest metro station does not always have an associational effect, which is at odds with earlier studies that found the metro station to be a significant home rents predictor (Hu et al., 2019). The distance to the closest bus stop is positively correlated with housing rents, contrary to what we would have expected. We conclude that the rental population tends not to use public transportation for commuting and that some unfavorable factors near bus stops (such as a chaotic urban environment) may be negatively associated with housing rents.

Li et al. (2022)'s study in Xiamen City also demonstrates that the number of bus stops within 1 km has no significant correlation with housing rents. We can deduce that the rental population may rent close to their jobs rather than renting close to a transportation hub and commuting to work in a more remote area from the findings of how distant job accessibility is associated with housing rents. Future research should explore this inference in more detail.

5. Discussion

This study demonstrates how various employment characteristics at various spatial scales are related to housing rentals in diverse ways. The employer features are the most significant associational factor. Job position features are less important while distant job accessibility is the least important.

Among the job position features, the experience requirement plays the most important role. Since a big percentage of entry-level workers typically have expensive housing rents, the government may want to think about offering them some rental subsidies or giving them preference when applying for public rental housing. Higher educational requirements for job jobs (such as bachelor's, master's, and above) may be associated with an increase in housing rents in the neighborhood. Since talent is the most valuable resource and the primary engine of socioeconomic development, we propose that there should be a greater supply of talent worker housing in the regions with a concentration of educated workers to ease the strain on their living standards.

The type of industry is the key factor among the employer characteristics. Particular attention should be paid to regions where high-end third-sector companies predominate (such as IT and finance), as they could be associated with higher rents. To preserve a balance between housing and employment in these locations, more affordable housing should be made available. Both state-owned and privately held businesses can think about offering housing aid to their employees. Additionally, it is crucial for local governments to encourage enterprises to address the housing needs of their employees by providing favorable policies (such as reduced tax rates).

At some scales, the availability of distant jobs is associated with housing rents, but this influence is relatively less strong. This shows us that it is not a good idea to build affordable housing in remote regions. To cut down on long commutes, affordable housing should be offered concurrently with the distribution of job possibilities.

In general, this study explains how occupational characteristics affect housing rents, which can help us better understand how to create policies for affordable housing. Guangzhou has implemented a number of initiatives over the past few years to create affordable housing. Nevertheless, there exist geographic mismatches between the supply and demand sides (Hu et al., 2019). This study demonstrates that occupational characteristics at smaller or medium scales are more likely to have an impact on housing rents. We suggest that the government construct public rental housing or convert existing buildings into public rental housing in accordance with the distributions of jobs to promote jobs-housing balance and

social equity, given that there is a lack of affordable housing and many affordable homes are built in unfavorable geographic locations (Ma et al., 2018).

6. Conclusion

This study employs Lasso regression analyses to examine the association between job attributes and housing rents in Guangzhou by utilizing online job big data sources. Given the multitude of factors related to housing rents, we propose employing the Lasso method to investigate the dynamics of housing rents across diverse urban contexts, owing to its commendable aptitude for variable selection. In addition, we also consider various spatial scales in order to investigate the spatial interdependence in the correlation between employment and housing.

This study reveals a notable spatial relationship between employment and residential rental prices. As the spatial scale increases, the association of job-related variables with housing rents diminishes. The variable can exhibit both positive and negative values across varying scales. Moreover, it is evident that the significance of various job variables may vary at a specific spatial scale. Of all the factors pertaining to employment, it is the characteristics of the employer that are most significantly associated with variations in housing rental prices. The associational effect of job position features in relation to housing rents is relatively low, while the variables pertaining to distant job accessibility exhibit the least significance. This study makes a valuable contribution to the existing body of research on jobs and housing by examining the specific mechanism through which jobs are associated with housing rents, taking into account spatial dependence. The findings of this study have important implications for local governments, as they can inform the development of effective affordable housing policies and contribute to the maintenance of social equity.

This study still has certain restrictions. Future studies are supposed to segment the rental market into several submarkets (e.g. urban center rental market, suburban rental market) and conduct comparisons across different cities to get deeper insights into the relationship between jobs and housing.

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References

Anthony, J. (2022). Housing Affordability and Economic Growth. *Housing Policy Debate*, 1-19. https://doi.org/10.1080/10511482.2022.2065328

Becker, S. O., Heblich, S., & Sturm, D. M. (2021). The impact of public employment: Evidence from Bonn. *Journal of Urban Economics*, *122*(July 2020). https://doi.org/10.1016/j.jue.2020.103291

Chapple, K., & Jeon, J. S. (2021). Big Tech on the Block: Examining the Impact of Tech Campuses on Local Housing Markets in the San Francisco Bay Area. *Economic Development Quarterly*, *35*(4), 351-369. https://doi.org/10.1177/08912424211036180

Chen, Y., Liu, X., Li, X., Liu, Y., & Xu, X. (2016). Mapping the fine-scale spatial pattern of housing rent in the metropolitan area by using online rental listings and ensemble learning. *Applied Geography*, *75*, 200-212. https://doi.org/10.1016/j.apgeog.2016.08.011

Gao, Q., Shi, V., Pettit, C., & Han, H. (2022). Property valuation using machine learning algorithms on statistical areas in Greater Sydney, Australia. *Land Use Policy*, *123*(August), 106409. https://doi.org/10.1016/j.landusepol.2022.106409

Guangzhou Bureau of Statistics. (2022). *Guangzhou National Economic and Social Development Statistical Bulletin for 2021*. Retrieved January 15, 2023, from https://www.gz.gov.cn/zwgk/sjfb/tjgb/content/post_8156569.html

Hu, L., He, S., Han, Z., Xiao, H., Su, S., Weng, M., & Cai, Z. (2019). Monitoring housing rental prices based on social media: An integrated approach of machine-learning algorithms and hedonic modeling to inform equitable housing policies. *Land Use Policy*, *82*(129), 657-673. https://doi.org/10.1016/j.landusepol.2018.12.030

Jun, M. J., & Kim, H. J. (2017). Measuring the effect of greenbelt proximity on apartment rents in Seoul. *Cities*, *62*, 10-22. https://doi.org/10.1016/j.cities.2016.11.002

Kishor, N. K., Marfatia, H. A., Nam, G., & Rizi, M. H. (2022). The local employment effect of house prices: Evidence from U.S. States. *Journal of Housing Economics*, *55*(July 2020), 101805. https://doi.org/10.1016/j.jhe.2021.101805

Lee, G., Cho, D., & Kim, K. (2016). The modifiable areal unit problem in hedonic house-price models. *Urban Geography*, *37*(2), 223-245. https://doi.org/10.1080/02723638.2015.1057397

Li, B., & Duda, M. (2010). Employers as landlords for rural-to-urban migrants in Chinese cities. *Environment and Urbanization*, *22*(1), 13-31. https://doi.org/10.1177/0956247809358038

Li, H., Wei, Y. D., & Wu, Y. (2019). Analyzing the private rental housing market in Shanghai with open data. *Land Use Policy*, *85*(April 2018), 271-284. https://doi.org/10.1016/j.landusepol.2019.04.004

Li, Y., Lin, Y., Wang, J., Geertman, S., & Hooimeijer, P. (2022). The effects of jobs, amenities, and locations on housing submarkets in Xiamen City, China. *Journal of Housing and the Built Environment*, 1-19. https://doi.org/10.1007/s10901-022-09984-8

Liang, X., Liu, Y., Qiu, T., Jing, Y., & Fang, F. (2018). *The e ff ects of locational factors on the housing prices of residential communities : The case of Ningbo , China*, *81*(September), 1-11. https://doi.org/10.1016/j.habitatint.2018.09.004

Ma, Z., Li, C., & Zhang, J. (2018). Affordable housing brings about socio-spatial exclusion in Changchun, China: Explanation in various economic motivations of local governments. *Habitat International*, *76*(April), 40-47. https://doi.org/10.1016/j.habitatint.2018.05.003

Miao, J. T. (2017). Housing the knowledge economy in China: An examination of housing provision in support of science parks. *Urban Studies*, *54*(6), 1426-1445. https://doi.org/10.1177/0042098015627106

National Bureau of Statistics of China. (2012). *Tabulation on the 2010 population census of the people's Republic of China. China Statistical Press*. Retrieved January 15, 2023, from http://www.stats.gov.cn/tjsj/pcsj/rkpc/6rp/indexch.htm

Niedzielski, M. A., Horner, M. W., & Xiao, N. (2013). Analyzing scale independence in jobs-housing and commute efficiency metrics. *Transportation Research Part A: Policy and Practice*, *58*, 129-143. https://doi.org/10.1016/j.tra.2013.10.018

Osland, L., & Thorsen, I. (2008). Effects on housing prices of urban attraction and labor-market accessibility. *Environment and Planning A*, *40*(10), 2490-2509. https://doi.org/10.1068/a39305

Reisig, D., Mullan, K., Hansen, A., Powell, S., Theobald, D., & Ulrich, R. (2021). Natural amenities and low-density residential development: Magnitude and spatial scale of influences. *Land Use Policy*, *102*(July 2020), 105285. https://doi.org/10.1016/j.landusepol.2021.105285

Taltavull Paz, P. (2003). Determinants of housing prices in Spanish cities. *Journal of Property Investment & Finance*, *21*(2), 109-135. https://doi.org/10.1108/14635780310469102

Wang, L., He, S., Su, S., Li, Y., Hu, L., & Li, G. (2022). Urban neighborhood socioeconomic status (SES) inference: A machine learning approach based on semantic and sentimental analysis of online housing advertisements. *Habitat International*, *124*(129). https://doi.org/10.1016/j.habitatint.2022.102572

Wang, Y., Wang, S., Li, G., Zhang, H., Jin, L., Su, Y., & Wu, K. (2017). Identifying the determinants of housing prices in China using spatial regression and the geographical detector technique. *Applied Geography*, *79*, 26-36. https://doi.org/10.1016/j.apgeog.2016.12.003

Wang, Y., Wu, K., Jin, L., Huang, G., Zhang, Y., Su, Y., Zhang, H., & Qin, J. (2021). Identifying the Spatial Heterogeneity in the Effects of the Social Environment on Housing Rents in Guangzhou, China. *Applied Spatial Analysis and Policy*, *14*(4), 849-877. https://doi.org/10.1007/s12061-021-09383-6

Wu, F. (1996). Changes in the structure of public housing provision in urban China. *Urban Studies*, *33*(9), 1601-1627. https://doi.org/10.1080/0042098966529

Yao, Z., & Kim, C. (2022). Analyzing the multiscale patterns of jobs-housing balance and employment self-containment by different income groups using LEHD data: A case study in Cincinnati metropolitan area. *Computers, Environment and Urban Systems*, *96*(June), 101851. https://doi.org/10.1016/j.compenvurbsys.2022.101851

Yu, H. (2014). The Ascendency of State-owned Enterprises in China: Development, controversy and problems. In *Journal of Contemporary China* (Vol. 23, Issue 85, pp. 161–182). Taylor & Francis. https://doi.org/10.1080/10670564.2013.809990

Zhou, X., & Yeh, A. G. O. (2021). Understanding the modifiable areal unit problem and identifying appropriate spatial unit in jobs-housing balance and employment self-containment using big data. *Transportation*, *48*(3), 1267-1283. https://doi.org/10.1007/s11116-020-10094-z