

Article

How Can Public Spaces Contribute to Increased Incomes for Urban Residents—A Social Capital Perspective

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Abstract: The recovery of the global economy in the aftermath of COVID-19 faces enormous challenges. Ensuring stable income growth of the population has become an important means for developing countries to ensure sustained economic development. Raising the overall income of the population is a public initiative that benefits all citizens; therefore, governments of developing countries should promote the implementation of relevant public policies and the provision of public goods to ensure that existing economic instruments can benefit the entire population. In this regard, public space, as a typical form of public good, may play an important role in promoting the benefits of existing economic policies for all residents. This paper examines how residents' use of public space contributes to their income growth through social capital. Hypotheses are tested based on an econometric analysis of 1565 questionnaires received from Chinese workers. The results show that residents' use of public space can indeed be an important way to increase their income, which is realized through the enhancement of social capital. The research presented in this paper provides a new influence variable of public space to improve residents' income. Further, it improves people's understanding of the three classical concepts—public space, social capital, and income—by establishing the logical connection and theoretical explanation of physical space, emotional space, and value space in human society. The conclusions of this paper highlight the important role of public space in urban and rural development planning.

Keywords: urban public space; social capital; income increase; China



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1. Introduction

The recovery of the global economy is facing enormous challenges as a result of COVID-19. Under these circumstances, ensuring that the population has stable income growth has become an important way for many countries around the world, especially developing countries, to ensure the sustained development of their economies. However, for most developing countries, efforts to increase residents' income often encounter challenges such as economic recession, regional differences, diseases, natural disasters, and environmental pollution [1–5]. To address the question of how to enhance the income of residents in developing countries, most existing policy options focus on the effects of economic factors. These include the promotion of the upgrading of the consumption structure and industrial structure, the optimization of human capital, and the transformation of the economic development mode [6–8]. However, judging from the currently available theoretical and practical results, promoting the increase in residents' income is a systematic project. Excessive reliance on economic instruments will likely render economic policies ineffective, which further widens the income gap [9–11]. Therefore, how to combine economic policies with other means to avoid falling into the trap of increasing residents' income deserves further attention.

From a public goods governance perspective, raising the overall income of the population is a public initiative that benefits all citizens. Therefore, governments in developing countries need to ensure that the effects of already established economic instruments indeed reach the entire population by promoting the implementation of public policies and the provision of public goods [12]. In this regard, public space—a typical public good—may play a key role in facilitating existing economic policies to reach all residents and promote their income growth. Further, this paper finds that public spaces are important places for the cultivation of social capital, which can promote the formation of residents' relationship networks, interpersonal trust, and reciprocal support. These three dimensions of social capital positively impact the increase in residents' income. Based on the above background analysis, this paper explores how public space can be a new way to promote the growth of residents' income in developing countries. By analyzing the relationship between public space and social capital, new perspectives and strategies for increasing residents' income can be provided.

Existing research on public space has focused on urban planning and governance, urban green space and residents' well-being, as well as urban climate. For example, the use of artificial light sources in public spaces can meet the needs of pedestrians with various forms of visual impairments who are walking at night [13], the expansion of the area of urban public green spaces and the improvement of outdoor connectivity can help to improve local residents' sense of security [14], and the establishment of shelters surrounded by trees and climbing plants can improve the comfort levels of residents during summer and effectively mitigate the urban heat island effect by reducing temperature differences in the surrounding environment [15]. Among the many studies on public space, the relationship between public space and social capital has received particular attention. Related studies have shown that urban streets can provide physical connectivity for social interactions, while the perceptual attributes of urban green space are conducive to facilitating communication among residents, thereby fostering higher levels of social capital [16–18]. Thus, through the layout and design of physical space, public space can provide a place where residents can interact socially, thereby promoting the cultivation of social capital.

With regard to the factors influencing the income of residents, relevant studies have emphasized the importance of factors such as educational attainment, family background, and professional skills. For example, the higher the level of education of the people, the more their incomes increase, and the income effect of receiving a higher level of education is more pronounced [19–21]; through their familial social connections, children from affluent families are more competitive in the labor market and are therefore more likely to enter the elite class [22]; plus, individuals with professional certificates and proficiency in their specific industry are more likely to be invited to job interviews and are more likely to obtain high-income positions [23]. Moreover, the relationship between social capital and residents' income has also gradually received increasing scholarly attention. Research showed that residents can obtain effective information and resources and can promote income increase by expanding the size of their relationship network and strengthening social ties with others [24]. By building trusting relationships with friends, conflicts can be reduced, and thus, improvements in household poverty can be realized [25]. The positive role of social capital as a resource and support individual residents obtain in the social network to improve their income should not be ignored.

Further, a review of the literature showed that certain scholars have already conducted preliminary discussions on the effects of public spaces on income. For example, people can economize by growing their own produce in community gardens, thus lowering personal spending on household groceries and expanding their budgets [26]. Improvement and construction of sidewalks and roads provide opportunities for local residents to set up stores or stalls, thus generating and increasing their economic income [27]. Finally, residents can reduce the financial burden imposed by chronic diseases by using community green spaces to fulfill their recreational needs and achieve a longer and healthier life [28].

Despite the substantial progress of previous research in the areas of public space and social capital as well as social capital and residents' income (several studies have also suggested that public space can increase residents' income), there are still shortcomings in the existing research: Firstly, although existing research has found a possible relationship between public space and residents' income, the specific mechanisms involved have rarely been explored. Secondly, although existing studies have found a possible relationship between social capital and residents' income, how social capital is generated is rarely explored. This lack of exploration makes it impossible for people to find a concrete way to increase their income by promoting social capital in practice. Considering the important role of public space in promoting social interactions among residents and their accumulation of social capital, as well as the positive impact of social capital on residents' income, based on the above analysis, this paper poses the following research questions: (1) Can public space contribute to increasing residents' income? (2) Will residents realize an increase in personal income through the enhancement of social capital in the process of their use of public space? This paper provides systematic answers to these two questions by theoretically integrating public space, social capital, and residents' income based on a web-based questionnaire survey conducted in China.

The possible contributions of this paper are as follows: Firstly, the new influencing variable of public space for raising residents' income is identified, and a new perspective on how to raise residents' income is provided. Secondly, this paper discusses the issue of how people's use of public space can promote their increase in income, identifies the income effect of public space, and expands the available understanding of the importance of public space for human society. Thirdly, this paper systematically discusses the relationship between public space, social capital, and income increase, thus establishing a logical connection and theoretical explanation of physical space, emotional space, and value space in human society. This connection can improve people's understanding of these three classical concepts.

2. Theoretical Analysis and Research Hypotheses

A glance at various types of literature and scholars' views clearly shows that there are many definitions of public space. For example, Arendt (2013) [29] argued that public space is a place where citizens can freely express their opinions and participate in both political activities and social decision-making. However, Jacobs (2010) [30] argued that public space is a central place for people's daily life and social interactions in the city, and it should be diverse and vibrant. In his theory of public sphere, Habermas (1991) [31] defined public space as the place where public opinion can form and where the public can freely discuss and communicate through media such as newspapers, periodicals, radio, and television. Although the definitions for public space vary among different scholars, they all share common features. This paper focuses on these common features of public space and specifically defines public space as a place where residents can engage in socialization, leisure, recreation, and political participation, including streets, squares, and parks.

Based on the research of Putnam (1994) [32], this paper uses the three dimensions of social capital—interpersonal trust, relational networks, and norms of reciprocity—to analyze how the use of urban public space contributes to the increase in residents' income through the cultivation of social capital. Among these three dimensions, interpersonal trust forms the core of social capital, reflecting the relational attribute of mutual trust between people. This mutual trust is the prerequisite for the formation of social capital and the basis for enhancing interactions among residents. The relationship network is the carrier of social capital, which can connect different residents, promote communication among residents in public spaces, and provide the necessary conditions for residents to cultivate trust and mutual assistance. Reciprocal norms are a vital form of social capital, as these norms not only direct more available resources to residents to broaden their opportunities for upward mobility but also help residents obtain timely and effective economic information to reduce transaction costs. In this way, residents cultivate social capital through activities in public

spaces, gain interpersonal trust, broaden their relationship networks, and collaborate for mutual benefit and mutual assistance, thereby increasing their income and improving their overall economic situation. Therefore, based on the above three dimensions of social capital, this paper proposes the analytical framework as shown in Figure 1.

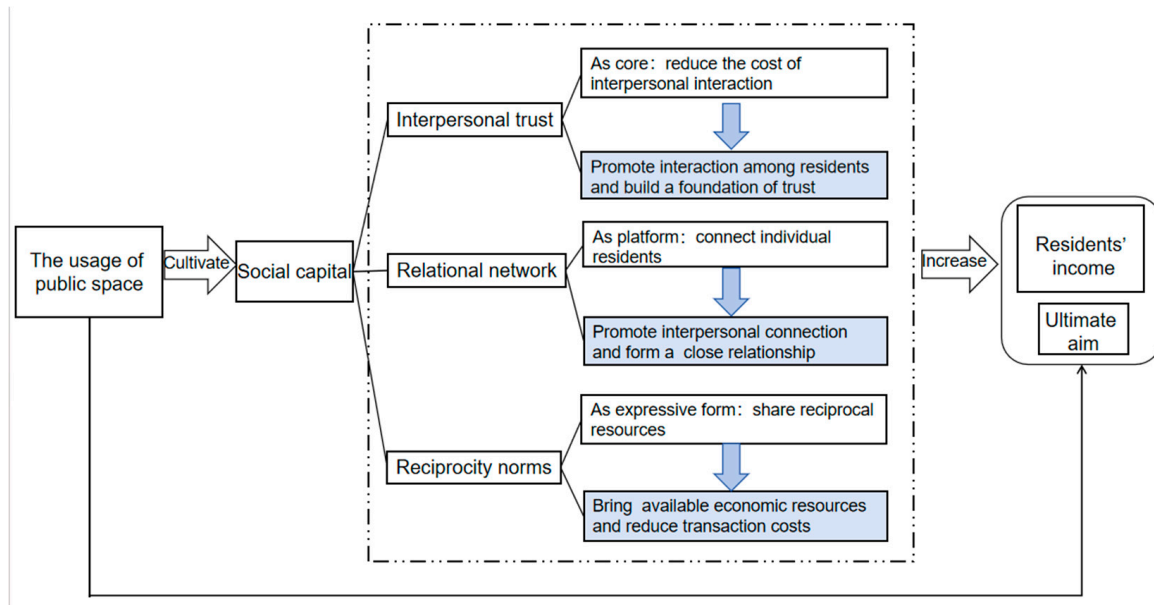


Figure 1. Theoretical framework diagram.

2.1. Impact of the Use of Public Space on Residents' Income

As an important part of urban space, public space provides an open place for urban and rural residents to carry out social activities associated with daily life, social interaction, leisure and recreation, and physical exercise. This paper argues that public space can also promote residents' incomes for the following reasons: First, by moving around in public spaces, residents can get to know people of different economic statuses, obtain valuable resources from them, and learn about the economic effects of the space they live in; further, the housing costs and economic pressures of low-income people can be reduced [33]. Secondly, public space can provide residents with places for business exchange and production transactions. For example, in neighborhood parks, certain residents take advantage of the opportunities provided by public space and set up stalls in front of parks to improve their income [27]. Third, the amenities and types of facilities offered by public spaces also impact residents' incomes. One study found that residents living in affordable housing neighborhoods with low accessibility to external public space amenities can reduce their economic costs associated with the use of external public space amenities by upgrading amenities such as pedestrian systems, commercial services, and parking lots [34]. Finally, during the empirical survey conducted for this study, some of the respondents' answers also reflected the fact that the use of public space promotes an increase in income. Examples of this are the following: "I go to the side of the nearby square to set up a stall on weekends, mainly to sell some fruits to subsidize my family". "I met a neighbor in the community when I was playing with my kids in the park, and later he introduced me to work in an organization, and the salary is still higher than what I had". Therefore, based on the analysis of the above theoretical and practical surveys, this paper proposes Hypothesis (H1):

Hypothesis 1 (H1): *The use of public space will contribute to the promotion of residents' incomes.*

2.2. Relationship between Public Space and Social Capital

As an important place for social interaction, public space is the carrier of both the activities and social relations of residents. Relevant studies clearly show that public space plays an important role in the cultivation of social capital. First, the use of public space can promote interpersonal trust among residents. In practice, public space carries people's exchanges and interactions, promotes their relationships and trust, and thus has a clear effect on the overall enhancement of community social capital. At the same time, the structure of public space also affects the level of trust between residents. Shared housing in cities can rebuild local social capital and establish interpersonal trust by designing structures that encourage high levels of social interaction among the members of the community [35]. Second, as a typical social space in urban life, public space is an important place for people to interact and expand their social networks. People are more willing to interact in public spaces with better facilities (e.g., laundry rooms, childcare centers, and public parking lots). As a result, in these public spaces with better amenities, people also develop a richer and closer network of relationships [36]. Third, engaging in socialization through the use of public spaces can promote the development of reciprocal norms among residents. It is precisely in public spaces that reciprocal norms among residents often emerge from their engagement in multiple reciprocal activities, which tend to be reciprocal and informal in nature. Related studies have also confirmed that the activity space factor in urban communities is significantly positively related to reciprocal trust in neighborhood social capital [37]. Finally, during the empirical survey for this study, some of the respondents' answers also reflected that their use of public space could lead to the cultivation of social capital. Examples of this are "Like inside our neighborhood, the hygiene level is relatively good, because everyone abides by the norms in the neighborhood, and when they see anyone indiscriminately disposing garbage, they basically go to stop him". "I usually like to sing and dance, and I have met many friends with whom to sing and dance together in the park, and we always help each other". Therefore, based on the analysis of the above theories and actual survey responses, this paper proposes Hypothesis (H2):

Hypothesis 2 (H2): *The use of public space will enhance the social capital of residents.*

2.3. Impact of Social Capital on Residents' Income

The relationship between social capital and residents' income has been confirmed by many studies. Individual residents can broaden their opportunities for advancement in the workplace by accumulating social capital, which positively affects their income. The concentration of social capital by residents of low-income neighborhoods has a significant impact on their income [24]. Therefore, based on relevant studies, this paper considers that social capital has a significant impact on the growth of residents' individual incomes, which is mainly manifested in the following three points: Firstly, interpersonal trust in social capital—the basis of residents' interpersonal interactions—can improve individuals' access to social resources and reduce the economic cost imposed by information gaps. For example, by building cohesive interpersonal trust relationships outside the neighborhoods in which they live, families in low-income neighborhoods can unlock more social resources, satisfy their own daily needs, and reduce family poverty to a certain extent [38,39]. Secondly, the relationship network in social capital also has a positive impact on the increase in residents' income. Relevant studies showed that the network size and network level in the relationship network positively affect the income growth of the urban low-income class. As urbanization continues to accelerate, more and more farmers are entering cities in pursuit of work; for them, the use of "human resources" in their social capital network can help to expand their channels of income sources. Thirdly, the norm of reciprocity in social capital plays an important role in increasing residents' income. When residents interact with their neighbors in the urban community, they can help each other with resources, thus alleviating their economic pressure to a certain extent [25]. In terms of improving the income increase in the low-income class, the norms of mutual aid are clearly effective in improving the

current status quo of the low-income class in the city. Fourthly, during the empirical survey of this paper, some respondents' answers also reflected the positive impact of social capital on residents' income. Examples of this are "I remember when I was small, basically every family would grow rice, at that time everyone was poor, when rice harvesting could not afford to hire machines to harvest, it was all relatives and friends in the village who helped together". "I had stayed in the countryside before, it was only in the past few years that I went to the city to work, and during the New Year I heard a friend of mine say that their factories were well-paid, and that as long as I was down-to-earth and willing to work, he would find a way to help me get into the factories, and I was very thankful to him, ah". Therefore, based on the analysis of the above theoretical and practical deliberations, this paper proposes Hypothesis (H3):

Hypothesis 3 (H3): *An increase in social capital will contribute to boosting the income of the population.*

The possible mechanisms by which the use of public space affects the income of residents is summarized as Hypothesis (H4):

Hypothesis 4 (H4): *The use of public space will contribute to an increase in the income of residents through the enhancement of social capital.*

3. Data, Variable Selection, and Empirical Methods

3.1. Data Sources, Survey Methods, and Descriptive Statistical Analysis

The data used in this study originate from the online survey project "Survey on the Current Situation of Social Capital and Income of Chinese Residents" conducted by the School of Public Administration of Guangxi University in October 2023. Drawing on the survey methodology of Wang and Han (2021) [40] and Wang and Lu (2021) [41], the project team conducted an anonymous online cross-sectional survey using Questionnaire Star (China Co., Ltd., Shanghai, China). The survey lasted from 7 October 2023 to 7 December 2023 and followed the international methodology of recruiting respondents based on the principles of voluntary participation and reimbursement. Sample information was obtained through stratified random sampling. Questionnaire Star is equivalent to Qualtrics Seattle, WA, USA), SurveyMonkey (San Mateo, CA, USA), or CloudResearch (New York, NY, USA); it provides online questionnaire design and survey functions for research organizations, enterprises, and individuals. The target population of this study is working adults living in mainland China. A random sampling procedure stratified by age and location was used to match relevant Chinese adults in the QuestionStar sample database. The survey covered four aspects: respondents' basic characteristics, basic income level, use of urban public space, and social capital.

It should be noted that when respondents filled out the questionnaire online, they were influenced by subjective motives and personal emotions, making them prone to answer irrationally, which may bias the source data. To control and reduce the generation of the above problems, this study selected two methods in the process of data collection: On the one hand, by filling out the questionnaire anonymously, the respondents' personal privacy was strictly protected, and their resistance towards the research project was reduced. On the other hand, drawing on the relevant studies of Gao et al., (2016) [42,43] and Jones et al., (2015) [44], this questionnaire set up several "trap questions" to determine whether the respondents replied truthfully and accurately when filling out the questionnaire. Samples that did not pass the trap questions were eventually screened out to improve the reliability and credibility of the data source.

A total of 1857 questionnaires were retrieved from this survey, and non-compliant samples were excluded according to the following principles: (1) wrong answers to trap questions; (2) apparent regularity in the selection of questions (e.g., consecutively filling in obliquely); (3) abnormal answering time, either too short or too long (the normal response

time is usually four to six minutes); and (4) incoherence in the answers to questions before and after the questions, as well as apparent logical errors. Ultimately, this survey obtained 1565 valid questionnaires, representing a validity rate of 84.28%. A breakdown of the regional distribution of respondents in this survey is shown in Figure 2.

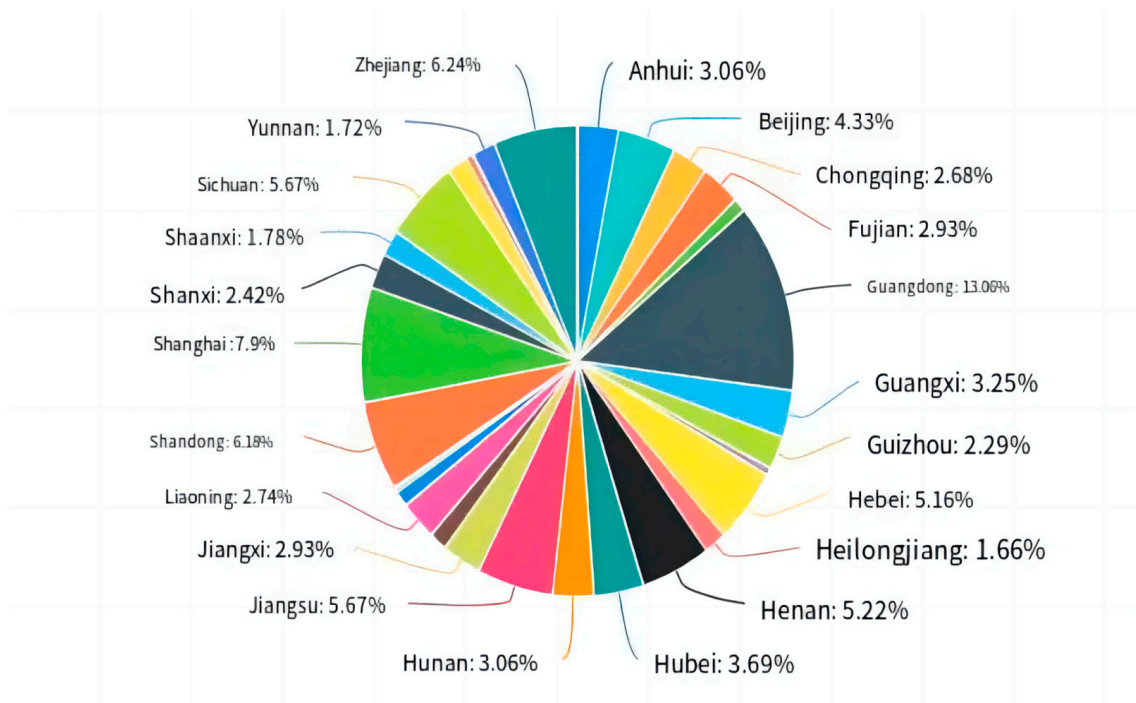


Figure 2. Regional distribution of respondents.

The organization and statistics of valid questionnaires indicated that this sample has the following characteristics: From the perspective of the gender of respondents, the proportion of men is 46.24%, and the proportion of women is 53.76%. In terms of age composition, nearly 90% of respondents were aged between 25 and 45 years, with an average age of about 33 years. This age distribution is roughly in line with the average age of 38 years of working staff in China, according to the Ninth National Survey on the Status of the Workforce conducted by the All-China Federation of Trade Unions from January to September 2022. Young and middle-aged people predominate in this sample overall. In terms of the education level of the respondents, more than 90% of respondents in the sample have a high school education or above, which is roughly in line with the results of the Ninth National Survey on the Status of the Workforce. The education level of China's working people is relatively high, with more than 85% having a high school education or above. In terms of the respondents' occupations, 81.21% were employed by enterprises, and 10.45% were civil servants working for public organizations. This is generally consistent with the results of the Ninth National Survey on the Status of the Workforce, showing that there were more employees in enterprises than in state-owned units. In terms of the respondents' vocational skills, 81.1% of respondents possessed skill certificates for their occupations, indicating that the majority of the working people in the sample possessed basic vocational literacy. In terms of the distribution of public spaces where respondents live, parks, squares, and community activity centers account for the majority within 1 km of their neighborhoods, as shown in Table 1.

Table 1. Distribution of public space within 1 km of residential neighborhoods.

Distribution of Public Space	Sample Size	Percentage of Distribution
Parks (for public recreation)	1248	79.49%
Squares	1126	71.72%
Public playgrounds	885	56.37%
Community center	1150	73.25%
Other types of public space	209	13.31%
No public space in the vicinity of the place of residence	33	2.1%

3.2. Selection of Variables

3.2.1. Dependent Variables

This paper focuses on the impact of residents' use of public space on their income; therefore, residents' income is the dependent variable. According to Li et al., (2023) [45] and Zhao et al., (2023) [3] regarding residents' income, this paper specifically adopts the respondents' annual income in 2022 (INCOME) as a measure of the income level of residents.

3.2.2. Core Independent Variables

Through in-depth research on public space, scholars have found that public squares concentrate both economic resources and cultural details. Public space has been identified as the place where material culture and social behavior intersect [46], acting as places for commerce and community [47]. Through rational community design and an increase in the thermal comfort of community squares provided in different seasons, residents can be encouraged to visit public squares for social activities [48,49], thus providing an important place for the accumulation of social capital. Based on this, this paper uses the question "Do you visit public squares frequently?" (WTS) to measure residents' use of public space.

3.2.3. Mediating Variables

Based on the hypotheses (H2–H4), social capital is the mediating variable in this paper, which is used to explore how the use of public space affects residents' income. Social capital is a latent variable that cannot be directly observed, and further observational variables are therefore needed to measure it. This paper uses exploratory factor analysis to determine the specific dimensions of measuring social capital and the corresponding observational variables.

Based on the classic dimensions of social capital proposed by Putnam (1994) [32] as well as the exploratory analysis conducted in the data processing for this paper, two dimensions are finally chosen to measure the social capital of residents after their use of public spaces. Specifically, on the one hand, this paper chooses the three dimensions of "People you meet in public space are trustworthy" (T1), "You are willing to give more help to people you meet in public space when they are in trouble" (T2), and "Would you be willing to lend money to a person you met in a public space activity who asks you to borrow money and promises to return it within a certain period of time?" (T3). These three dimensions are used to measure the degree of trust between residents and people they met in public spaces and the degree of compliance with behavioral norms among each other. On the other hand, this paper chooses three questions, namely, "In public space activities, you can meet people with higher incomes than you" (N1), "In public space activities, you can meet people with higher education than you" (N2), and "In public space activities, you can meet people who may help you to achieve promotion" (N3), to measure the level of trust between residents and the people they meet in public space as well as their compliance with behavioral norms. Three questions were asked to measure the network of relationships residents have built through their activities in public spaces.

In the questionnaire of this paper, the data were collected through the use of a five-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree) to measure

the level of trust and the relationship network. The test of combined reliability and mean extracted value variance for the above two sets of observed variables are shown in Table 2.

Table 2. Observed variables: composite reliability and average variance extracted values.

Latent Variable	Observed Variable	Standardization Factor Loading	Composite Reliability	Average Value Extracted	Standardization Cronbach's α
Trust and behavioral norms	T1	0.760	0.762	0.517	0.725
	T2	0.722			
	T3	0.672			
Network	N1	0.778	0.741	0.489	0.808
	N2	0.669			
	N3	0.644			

3.2.4. Control Variables

The control variables in this paper encompass the five main categories of factors affecting residents' income, which have also been summarized by existing research: age, gender, education level, work occupation, and health status. This enables this paper to analyze the impact of public space use on residents' income while controlling all conditions to be constant. First, Yang et al., (2022) [50] found that age and gender have a moderating effect on personal income by affecting self-control, where men and relatively older individuals are more likely to increase their own income. Therefore, age (AGE) and gender (GENDER)—the most basic characteristics of resident status—need to be controlled for. Second, according to Turner et al., (2020) [19], educational attainment is also an important variable that affects residents' income. Therefore, in this paper, the respondents' educational attainment (EDU) has been used as a control for the educational level variable. This variable has options that include common educational levels such as elementary school, junior high school, senior high school, bachelor's degree, graduate school, and above. As pointed out above, different occupational backgrounds have an important impact on residents' income. According to Liang et al., (2014) [51], Gao et al., (2015) [52], and Kifle et al., (2019) [53], whether the respondent is a civil servant (PC) and whether the respondent is an employee of an enterprise (EE) are used as a measure of the occupational background of residents. Fourth, health status is an important indicator of a person's physical condition; if their physical function is impaired, their ability to work will be greatly affected, which in turn will also affect their access to income. According to Wei et al., (2020) [54] and Mair et al., (2020) [55], to measure the respondent's health status, this paper selects whether the respondent suffers from chronic diseases (ILL), whether the respondent smokes cigarettes regularly (SMOKE), and whether the respondent drinks alcohol regularly (DRINK). In addition, this paper includes control variables such as province of residence, personal residency status, and household size in the model to control for possible regional differences as well as the effects of differences in other demographic factors on the estimation results. Table 3 shows the variable descriptions and descriptive statistics of this study.

Table 3. Description of variables and descriptive statistics.

Variable Name	Descriptive	Sample Size	Mean	Std. Dev.	Min.	Max.
Dependent variable						
INCOME (ln)	Annual income of residents (Unit: 10,000 yuan)	1565	2.652	0.686	−1.609	6.908
Core independent variable						
WTS	Whether to go to the square (Yes = 1, No = 0)	1565	0.702	0.458	0	1
Control variables						
GENDER	Gender (M = 1, F = 0)	1565	0.463	0.4499	0	1

Table 3. Cont.

Variable Name		Descriptive	Sample Size	Mean	Std. Dev.	Min.	Max.
AGE		A person's age	1565	32.748	6.633	17	73
EDU		Below elementary school = 1, elementary school = 2, middle school = 3, high school = 4, bachelor's degree = 5, master's degree = 6, doctorate = 7	1565	5.063	0.411	1	7
PC		Occupation is civil servant (Yes = 1, No = 0)	1565	0.104	0.306	0	1
EE		Occupation is enterprise employee (Yes = 1, No = 0)	1565	0.813	0.390	0	1
SMOKE		Tobacco use (1 = Never to 5 = Frequently)	1565	1.751	1.182	1	5
DRINK		Alcohol consumption (1 = Never to 5 = Frequently)	1565	2.376	0.954	1	5
ILL		Presence of a chronic disease (Yes = 1, No = 0)	1565	0.475	0.500	0	1
FAMILYNUM		Number of persons in the household	1565	3.817	1.182	1	9
LIVETIME		Length of residence in current location (Unit: year)	1565	19.350	12.858	1	70
WITHME		Whether respondents are living alone (Yes = 1, No = 0)	1565	0.049	0.215	0	1
TRUST	T1	Do you think that people you meet in public spaces are trustworthy (1 = Completely disagree to 5 = Completely agree)	1565	3.113	1.121	1	5
	T2	Are you willing to raise help for people you meet at public space events when they are in trouble (1 = Completely disagree to 5 = Completely agree)	1565	3.322	0.992	1	5
	T3	When someone you met at a public space event asks you to borrow money, are you willing to lend it to them (1 = Completely disagree to 5 = Completely agree)	1565	2.745	1.246	1	5
	N1	Are you able to meet people with higher incomes than you by moving around in public spaces (1 = Totally disagree to 5 = Totally agree)	1565	3.468	1.058	1	5
	N2	Are you able to meet people with more education than you by moving around in public spaces (1 = Completely disagree to 5 = Completely agree)	1565	3.449	1.090	1	5
NET (Internet)	N3	Are you able to meet people who may help you to achieve promotion at events in public spaces (1 = Completely disagree to 5 = Completely agree)	1565	3.383	1.107	1	5

3.3. Model

3.3.1. Instrumental Variables Regression

The dependent variable in this study is a continuous real number; therefore, this paper first tests whether a boost of income originates from residents' use of public space through ordinary least squares (OLS). However, OLS regression may be biased because of endogeneity problems such as omitted variables. For example, climate change affects people's income, and according to Xie et al., (2023) [56] and Synnefa et al., (2020) [57], hot

weather increases their health risks, which in turn also affects their income. However, climate change factors are not included in the control variables of this paper; therefore, the OLS estimation results may be affected by these unobserved omitted variables. At the same time, in reality, housing near public spaces tends to be overpriced; therefore, it is possible that only those with higher incomes are able to live near public spaces and thus have easier access to them. This increases the potential influence of the reverse causation problem in the causal judgment of this paper.

To control the impact of the above endogeneity problem on the regression results, instrumental variables are introduced. According to Wooldridge (2016) [58], a valid instrumental variable must satisfy the following two necessary conditions: (1) Correlation, which means that the selected instrumental variable should be highly correlated with the core independent variable of the study; in this paper, the selected instrumental variable should be highly correlated with the core independent variable (WTS). (2) Exogeneity, which means that the selected instrumental variable should be uncorrelated with the random error term. Based on the above principles, whether there is a square (SQUARE) near the respondents' residence was chosen as the instrumental variable for the core independent variable WTS. The following two reasons are provided: On the one hand, if there is a public square near the respondent's place of residence, the respondent is more likely to go to that square for activities; therefore, there is a high degree of correlation between whether there is a square or not (SQUARE) and the core independent variable WTS. On the other hand, in China, most public spaces represented by squares are provided by the government through city planning, i.e., the construction of public squares is decided by local governments [59]. Therefore, the proximity of public squares to residential areas is not directly related to individual residents, and thus, the instrumental variable can also be theoretically independent of factors that may affect individual residents' income but are not observed, i.e., it is exogenous.

3.3.2. Propensity Score Matching

As the dependent variable in this study is a continuous real number, this paper first tests whether a boost of income originates from residents' use of public space through ordinary least squares (OLS) regression. However, because of the presence of sample selectivity bias, this may lead to endogeneity problems. Specifically, in the OLS regression, respondents who often go to the square and respondents who rarely go to the square are different individuals. Different individuals are inherently different from each other because of many differences between them, and these inherent individual differences may be the cause of the different incomes among respondents. Thus, according to the OLS regression model, going to the public space is not the necessary reason why people can obtain a relatively high income.

Based on the above analysis, this paper excludes the endogeneity problem caused by the possible sample selectivity bias mentioned above by using propensity score matching. The concept of the propensity score was introduced by Rosenbaum and Rubin (1983) [60]. They defined the propensity score as the conditional probability that an individual is influenced by an independent variable after controlling for observable "confounding" variables. In this paper, the effects of sample selection bias are overcome by using propensity scores and matching these scores using a variety of methods to test whether residents' use of public space is indeed the cause of their increased income. The statistical principles of propensity score matching are detailed in Appendix A.

3.3.3. Models of Mediating Effects

According to the research hypotheses and data screening, whether residents' frequenting the square (WTS) affects their income needs to be tested through two mediating mechanisms, namely interpersonal trust (TRUST) and network of relationships (NET). These represent social capital, meaning that the analysis presented in this paper needs to involve the estimation of two sets of mediating effects. Therefore, this paper is based on

the basic principles of the simple mediated effects model and utilizes structural equation modeling to achieve the systematic estimation of multiple mediated effects. The principle of the simple mediated effects model is provided in Appendix B. The main paths involved in the path analysis of this paper are depicted in Figure 3.

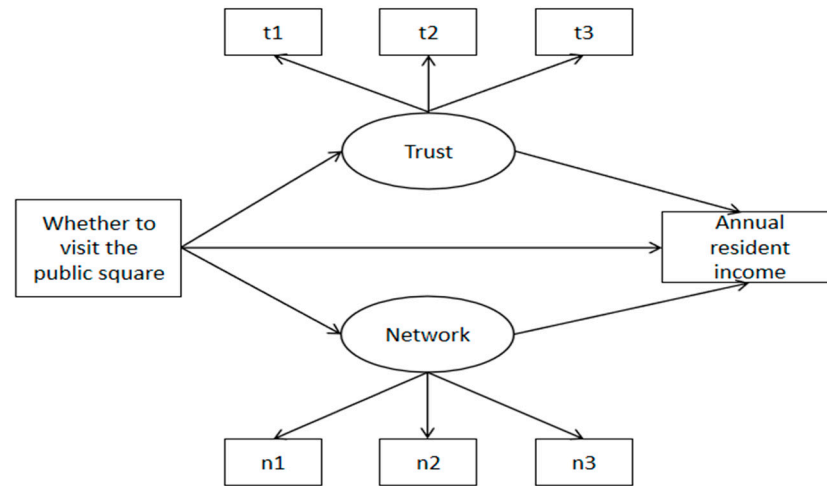


Figure 3. Mediated effect pathway.

3.4. Findings

3.4.1. Base Regression Results

Table 4 shows the results of the OLS regression using Stata 17.0. Model 1 shows a separate regression of residents' use of public space on income. This analysis identified a significant positive effect of residents' use of public space on income, suggesting that residents who go to public spaces frequently are able to obtain higher incomes. After separate regressions, groups of control variables were gradually added in Models 2–5. The results showed that residents' use of public space had a positive effect on their income, indicating that residents who go to the public space frequently are indeed able to obtain higher incomes.

Table 4. Baseline regression and instrumental variable regression results.

Variables	Model 1 OLS	Model 2 OLS	Model 3 OLS	Model 4 OLS	Model 5 OLS	Model 6 IV-OLS
WTS	0.087 * (2.23)	0.081 * (2.20)	0.079 * (2.15)	0.074 * (2.04)	0.084 * (2.29)	0.064 * (1.71)
GENDER		0.189 *** (5.44)	0.190 *** (5.48)	0.137 *** (3.51)	0.138 *** (3.55)	0.137 *** (3.63)
AGE		0.007 (1.80)	0.007 (1.92)	0.007 (1.82)	0.006 (1.54)	0.006 ** (2.06)
EDU		0.341 *** (3.78)	0.346 *** (3.81)	0.351 *** (3.82)	0.346 *** (3.74)	0.346 *** (8.35)
DANGYUAN		0.174 *** (4.46)	0.190 *** (4.85)	0.184 *** (4.66)	0.181 *** (4.62)	0.182 *** (4.55)
FAMILYNUM		0.003 (0.19)	0.003 (0.19)	−0.001 (−0.05)	0.003 (0.22)	0.003 (0.24)
WITHME		−0.109 (−1.37)	−0.104 (−1.33)	−0.107 (−1.35)	−0.123 (−1.51)	−0.122 (−1.55)
LIVETIME		−0.001 (−0.65)	−0.001 (−0.63)	−0.001 (−0.57)	−0.002 (−1.10)	−0.002 (−1.27)
PC			−0.045 (−0.55)	−0.042 (−0.53)	−0.039 (−0.49)	−0.038 (−0.52)
EE			0.073 (1.08)	0.072 (1.07)	0.058 (0.87)	0.060 (1.07)

Table 4. Cont.

Variables	Model 1 OLS	Model 2 OLS	Model 3 OLS	Model 4 OLS	Model 5 OLS	Model 6 IV-OLS
SMOKE				0.048 ** (2.81)	0.048 ** (2.81)	0.049 *** (3.01)
SLEEP				−0.005 (−0.23)	−0.000 (−0.01)	−0.001 (−0.04)
ILL				−0.020 (−0.60)	−0.014 (−0.44)	−0.014 (−0.41)
Province	Uncontrolled	Uncontrolled	Uncontrolled	Uncontrolled	Controlled	Controlled
_cons	2.591 *** (78.17)	0.527 (1.10)	0.430 (0.90)	0.400 (0.81)	0.447 (0.89)	0.460 * (1.80)
N	1565	1565	1565	1565	1565	1565
R2	0.003	0.092	0.095	0.101	0.113	0.113
F	4.994	14.397	12.488	9.942	7.428	8.43
p	0.026	0.000	0.000	0.000	0.000	0.000

t statistics in parentheses; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Instrumental variables are added in Model 6, and the statistic of Crag Donald Wald F exceeds 18,000, indicating that there is a good correlation between the instrumental variables selected and the core independent variables. In reference to Wang et al., (2022) [61], the instrumental variables used in this paper are tested for over-identification. After outputting the estimation results of instrumental variables OLS regression, the residual predictions of Model 6 are regressed against instrumental variables. The results show that the fitted curve of the regression is close to a horizontal line, indicating that the chosen instrumental variables are almost independent of the error term. This near independence suggests that the instrumental variables chosen in this paper are reasonable. The results of Model 6 show that the coefficient of the effect of WTS use on lnINCOME is 0.064, which is significant at the 10% statistical level. Therefore, Hypothesis (H1) is confirmed.

3.4.2. Propensity Score Matching Results

As the individual difference between urban residents who go to a public space for activities and those who do not are large, the difference in their incomes may be due to other reasons. To rule out sample selection bias in this study, the reliability of the findings is improved by using controlled propensity scores. Drawing on Lechner (1999) [62], Sianesi (2004) [63], and Caliendo and Kopeinig (2008) [64], in this paper, one-to-one matching, radius matching, and kernel matching are used to estimate the average treatment effect of going to a public space for activities on residents' income. Specifically, by calculating the standard deviation of all matching variables and conducting t-tests for both individual variables and the entire sample, the overall sample balance test for each matching method is shown in Table 5. Judging from the test results, under all matching methods, the absolute value of the standard deviation of all matching variables is almost within 10%, and the statistical difference after matching is not significant. This result indicates that all variables are well balanced after matching, making the results of propensity score matching reliable.

In addition to the above tests, histograms of the propensity score common support domains are also plotted. The degree of overlap between the propensity score intervals of the treatment and control groups, as well as the magnitude of the sample loss during the matching process, is compared and analyzed. As shown in Figure 4, under all three matching methods, the propensity scores of the treatment and control groups overlap largely in the intervals with an appropriate range of common values. This indicates that both the control and treatment groups have passed the common support test.

Table 5. Overall sample balance test for each matching method.

Matching Method	Sample Situation	Ps R2	LR Chi2	$p > \text{Chi2}$	Mean Bias
Neighbor matching	Unmatched	0.015	28.73	0.121	5.2
	Matched	0.004	11.24	0.985	2.6
Radius matching	Unmatched	0.015	28.73	0.121	5.2
	Matched	0.001	3.36	1.000	1.4
Kernel matching	Unmatched	0.015	28.73	0.121	5.2
	Matched	0.002	6.87	0.998	2.0

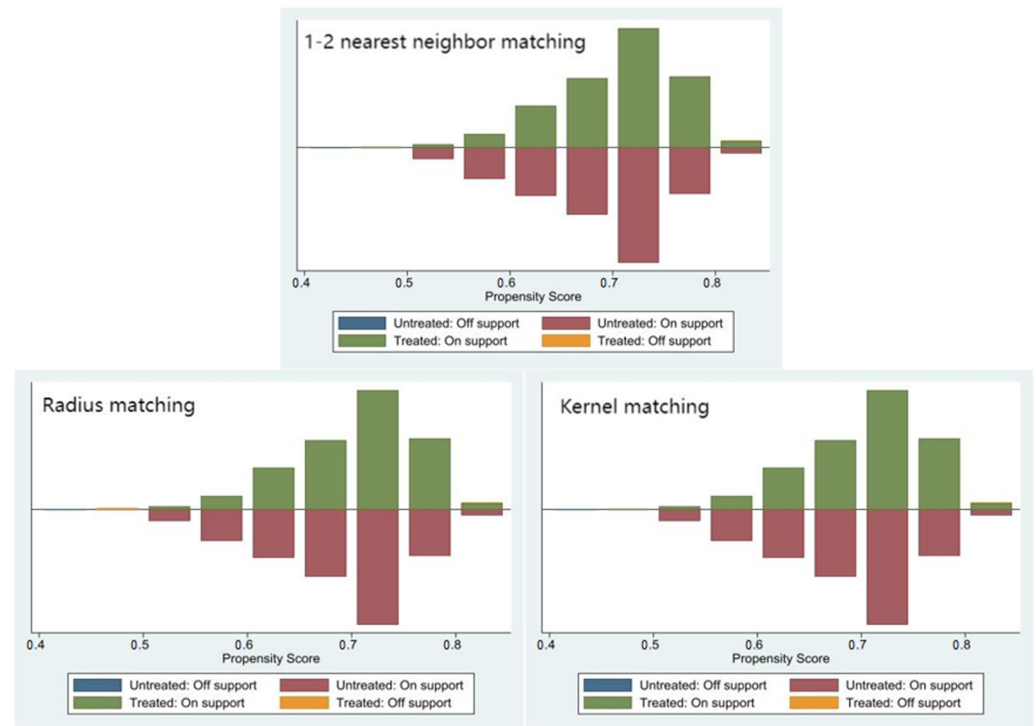
**Figure 4.** Overlap in testing results.

Table 6 presents the treatment effects of the impact of WTS on income. Under the three matching methods, WTS has a significant positive impact on income growth. Therefore, after resolving the interference of the endogeneity problem, this paper hypothesizes that residents who often go to the square can indeed increase their income. Hypothesis (H1) is proved.

Table 6. Treatment effects of the impact of whether residents go to the public space on income.

Matching Method	Treated	Controls	ATT Diff	T-Stat	Sig
1:2 nearest neighbor matching	2.678	2.591	0.122	2.64	***
Radius matching	2.678	2.591	0.096	2.38	***
Kernel matching	2.678	2.591	0.100	2.51	***

Note: 1. *** represents significance at the 1% level. 2. Samples' $0.25\hat{\sigma} \approx 0.063$, the chosen caliper range = 0.06, which represents one-to-two matching and radius matching among the observed values with a 6% difference in the tendency score.

3.4.3. Robustness Tests Results

To test the robustness of the base regression and instrumental variable results, the core independent variable is replaced to test whether residents' use of public space will boost their income. The regression results of the robustness test in this paper are provided in Table 7. Specifically, Model 7 shows the regression results after replacing "whether

residents often go to the public space” (WTS) with “frequency of residents going to the public space” (FREQS). According to the results of Model 7, there is a significant positive correlation between the frequency of residents going to the public space and their income, indicating that the higher the frequency of residents going to a public space, the higher their income. This can also prove the theoretical logic underlying this paper, namely that residents’ use of public space can increase their income.

Table 7. Results of robustness tests.

	Model 7 OLS		Model 8 Heckman Selection Model
Frequency of residents going to the public space	0.054 *** (4.13)	Length of time residents spend in the public space	0.118 *** (4.16)
Control variables	Controlled	Control variables	Controlled
Province	Controlled	Province	Controlled
N	1123	N	1565
R2	0.127	R2	-
p	0.000	p	0.000

Notes: *** $p < 0.001$.

Model 8 shows the regression results after replacing “whether residents frequent the public space” (WTS) with “length of time residents spend in the public space” (TIS). Because residents’ activity in the public space depends mainly on whether they go to the public space, the two-stage Heckman model is chosen in Model 8 to filter out the sample of residents who frequently go to a public space; then, their incomes are regressed on their length of time spent in the public space. The coefficient of the two-stage Heckman model’s regression model’s α is statistically significant at the 1% level ($p = 0.008$), thus justifying the choice of the two-stage Heckman model to screen the sample. The estimation results of Model 8 show that the length of time residents spend in the public space is significantly and positively correlated with their income, indicating that the longer residents spend in a public space, the higher their income level. This likewise proves the theoretical logic of this paper, namely that residents’ use of public space can increase their income.

3.4.4. Mediating Effects Results

Because the mediating variable of social capital is a latent variable that is not directly observable, the reliability and validity of the observed variables used to measure social capital need to be tested. First, this study follows the general practice in the existing literature to evaluate the reliability by calculating Cronbach’s alpha coefficient using SPSS 26.0, where the larger the Cronbach alpha coefficient, the higher the level of reliability. The results of the reliability analysis of the mediating variables of social capital are shown in Table 2. According to the results, the Cronbach α values of all variables lie between 0.7 and 0.9, indicating that the internal consistency of the selected observed variables is high. Second, based on the high reliability of each latent variable, the validity of each latent variable was further tested. In this paper, the research scale was the first factor analyzed using SPSS 26.0 to derive the loading coefficients of the principal components in which each question item is located. The output of MPLUS 8.0 was then used to calculate the mean variance extracted and the combined reliability to test both the convergent and discriminant validity of each variable. Table 2 shows that the mean variance extracted value of each latent variable ranges between 0.4 and 0.6, and the combined reliability ranges between 0.7 and 0.8. The above test results indicate that the variable measurement items have good reliability and validity.

Based on the premise that Hypothesis (H1) is proved, the mediation effect model is further applied to disclose the internal mechanism of how the use of public space increases residents' income. Table 8 shows the fully standardized estimation results of the mediating effect output in this paper according to MPLUS 8.0. Model path a represents the use of public space affecting the supply of social capital. The standardized path coefficient between the use of public space and interpersonal trust is 0.065, which is significant within the bootstrap bias-corrected 95% confidence interval. This significant result indicates that residents' use of public space positively affects the level of interpersonal trust between interactions, i.e., residents who frequently visit a public space experience stronger interpersonal trust between their internal groups. The standardized path coefficient between the use of public space and relational networks is 0.099, which is significant within the bootstrap bias-corrected 95% confidence interval. This result suggests that residents' use of public space positively affects their relational networks, i.e., the higher the number of friends residents who frequently visit a public space have access to, the larger the relational networks they build. Therefore, it can be argued that the coefficients of the two paths of social capital are statistically significant, indicating that the use of public space both supplies and nurtures social capital in both dimensions. Thus, Hypothesis (H2) is proven.

Table 8. Mediating effect path coefficients.

Form	Ratio	Bootstrap Bias-Corrected 95% Confidence Interval (Math.)
Model path: a		
Use of public space → Interpersonal trust	0.065	(0.019, 0.113)
Use of public space → Network of relationships	0.099	(0.051, 0.145)
Model path: b		
Interpersonal trust → Residents' income	0.056	(−0.003, 0.117)
Networks of relationships → Residents' income	0.181	(0.117, 0.237)
Mediating effects: $a \times b$		
Use of public space → Interpersonal trust → Residents' income	0.006	(0.001, 0.014)
Use of public space → Network of relationships → Residents' income	0.012	(0.004, 0.023)
Direct effect: c'		
Use of public space → Residents' income	0.039	(0.001, 0.080)

Model path b represents social capital for residents' income. The standardized path coefficient between interpersonal trust in social capital and residents' income is 0.056, which is significant within the bootstrap bias-corrected 95% confidence interval. This result indicates that the level of interpersonal trust among residents positively affects their income, i.e., the higher the level of trust among residents, the more it contributes to the increase in their income. The standardized path coefficient between the relationship network in social capital and residents' income is 0.181, which is significant within the bootstrap bias-corrected 95% confidence interval. This result indicates that residents' relationship network positively acts on their income, i.e., the friendlier relationships between residents and their neighbors are, the more their income increases. Thus, Hypothesis (H3) is proved.

The mediating effects of the two dimensions of social capital in public space use and residents' income are tested by taking public space use as the independent variable and interpersonal trust and relational networks as mediating variables. Relevant control variables are also included. The results are presented in the mediating effect $a \times b$ path in Table 8. According to the results, the standardized path coefficient for interpersonal trust as a mediating variable is 0.006, which is significant within the bootstrap bias-corrected 95% confidence interval. The standardized path coefficient with the relational network as the mediating variable is 0.012, which is significant within the bootstrap bias-corrected 95% confidence interval. This result indicates a significant mediating effect of social capital, measured by interpersonal trust and relational networks, between the use of public space and residents' income. Therefore, Hypothesis (H4) is proved.

Finally, judging from the c' estimation of the direct effect, the standardized path coefficient between the use of public space and residents' income is 0.039, which is significant within the bootstrap bias-corrected 95% confidence interval. This result indicates that interpersonal trust and relational networks partially mediate the use of public space and residents' income. This suggests that in addition to social capital, other mediating mechanisms that are not considered in this paper also affect the income of residents. For example, relevant studies have pointed out that the construction and improvement of residential green spaces, including the improvement of green coverage, green landscape satisfaction, and other indicators, have a positive impact on residents' health [65]. Furthermore, health, which is an important part of human capital, can make individual residents more energetic and capable by investing in their health, thus increasing both their productivity and income [66]. Therefore, such mediating mechanisms, which are not explored in this paper, could be a plausible explanation for the direct effect that exists between public space use and the income of residents.

4. Discussion

According to existing studies, the theoretical framework of social capital was mainly established by three famous scholars: Bourdieu, Coleman, and Putnam. Overall, the definition of social capital dimensions by relevant scholars today can mainly be divided into two types: cognitive social capital and structural social capital. The measurement of social capital dimensions chosen in this paper belongs to the category of cognitive social capital. Structural social capital is usually measured by the three dimensions of bonding social capital, bridging social capital, and linking social capital. Based on the existing research findings, clues can be obtained to explain the increase in residents' income from the three dimensions of structural social capital. For example, regarding the aspect of linking social capital, residents reduce conflicts and improve family poverty by building trusting relationships with friends [25]. The aspect of bridging social capital influences the increase in residents' income by enhancing interpersonal interactions, for example, by making friends in sports clubs and participating in social services, among other activities [67]. In terms of linking social capital, residents of low-income neighborhoods can climb the social ladder by strengthening social ties with higher-income neighborhoods, which in turn can help to increase their income [24]. For example, the strengthening of social ties through the exchange of gifts between family and friends increases household income from multiple sources, such as promotion to better-paying jobs, introduction of acquaintances to government departments, and better access to loan financing [68]. Accordingly, the contribution of social capital to income can actually be articulated in terms of structural social capital. In this paper, the dimension of cognitive social capital is used to measure the social capital of residents after their use of a public space, but this does not prevent the understanding of the conclusions of this paper from a structural social capital perspective. Specifically, among the dimensions of social capital chosen in this paper, a network is actually a connection, and trust is the combination of bridging and bonding. A further extended understanding of the conclusions presented in this paper is that the contribution of social capital to income is, in fact, based on the economic and social resources that the multidimensional character of society offers to people.

At the same time, new perspectives on observing social capital and economic income have also been presented in recent studies. For example, Chetty et al., (2022) [69] linked how to measure social capital with economic mobility; they generalized three new dimensions for measuring social capital: cross-type ties, network cohesion, and civic engagement. Based on this, they analyzed the relevant mechanisms of action between social capital and economic mobility, arguing that economic ties between people of different socioeconomic statuses are strongly associated with upward income mobility. Therefore, they concluded that social ties with resourceful individuals can significantly impact economic and labor market outcomes. The findings of this paper actually validate the traditional social capital perspective by examining the relationship between "public space-social capital-residents'

income". At the same time, based on traditional social capital, this paper further answers the prerequisite questions of where social capital originates from and how social capital can be enhanced. The answers provide a new understanding for people to further think about the relationship between social capital and income.

The public space, social capital, and residents' income mentioned in this paper actually correspond to the physical space, emotional space, and value space in which humans live. Existing research has provided useful discussions on the interrelationship between these three kinds of spaces. First, regarding the relationship between physical space and emotional space, relevant studies have found that common behaviors (such as walking and sitting) in urban green spaces induce emotional changes, which are conducive to stress relief [70]. Moreover, compared with traditional open-plan offices, activity-based workspaces enhance employees' positive sense of belonging [71] and creativity [72]. As a result, scholars have proposed to integrate people's emotional connection with the physical urban environment in future urban planning [73]. Second, regarding the relationship between emotional space and value space, it has been found that the improvement of individual value, such as by learning a foreign language, will satisfy people's achievement emotions such as enjoyment, pride, and hope [74]. Moreover, increased income reduces people's negative emotions and predicts more positive self-esteem emotions and less negative self-esteem emotions [75,76]. Again, regarding the relationship between physical space, emotional space, and value space, relevant scholars found that individuals with different income levels have different frequencies of going to green space for sports activities, and the happiness and well-being of residents brought by activities in space are also different [77]. Moreover, the positive role of public space has also been demonstrated in rural areas [78]. Analysis of the above studies shows that, on the one hand, these studies present the links between physical space and emotional space, as well as between emotional space and value space; however, they do not systematically explore the interrelationships among these three in a unified framework; on the other hand, the few existing studies that discussed the relationship between physical space and emotional space, as well as between emotional space and value space did not conduct a rigorous empirical test of the relationship among the three. In contrast to these studies, the discussion of the relationship between public space, social capital, and residents' income presented in this paper actually realizes the empirical test of the relationship between physical space, emotional space, and value space. The logical connection and analytical framework of the physical space, emotional space, and value space in human society are established using social capital as a bridge. This approach further complements the knowledge of related studies on the relationship between these three.

5. Conclusions, Implications, and Limitations

How to further increase the income of residents in developing countries and thus narrow the global and regional economic gap is a topic of widespread concern. Using 1565 survey data from China, this paper analyzes the relationship between the use of public space and residents' income by taking the annual income of Chinese residents in 2022 as a research object and using social capital as a mediating variable. The main conclusion of this paper is that the use of public space contributes to the increase in residents' income through the trust and network dimensions of social capital. Residents cultivate social capital through activities in public spaces and then increase their income with the help of that cultivated social capital. Based on this conclusion, this paper explores the mechanism and realization path of public space use $\rightarrow$ social capital $\rightarrow$ residents' annual income, which provides new perspectives and ways to increase the income of residents.

Therefore, this paper calls on the government to reserve a sufficient quantity and quality of public space for residents in urban planning, especially public spaces conducive to the cultivation of residents' social capital, as this helps to promote the increase in residents' income. In China, for example, as urbanization continues to expand, economic interests often drive urban planners to excessively convert public land into construction

land, thus encroaching on and squeezing out a large amount of community public space. Such a development is detrimental to the development of residents' leisure activities and their cultivation of social capital. Therefore, it is particularly important to rationally plan the layout and distribution of public space in Chinese cities based on this reality. This paper proposes the following suggestions: On the one hand, for public spaces closer to where people live, such as neighborhood communities, the comfort of sidewalks and resting chairs can be optimized, and fitness venues and parent–child recreational facilities can be increased. Consequently, a space for residents to communicate with one another is created, and cohesion between neighbors is increased, which achieves mutual benefit and trust. On the other hand, public spaces that are farther away from where people live, such as parks and squares, can be improved by increasing the density of green lawns, improving children's playground facilities and sports equipment, as well as improving the friendliness of park staff. These measures can encourage residents to visit public spaces for social interaction, enhance their well-being, and cultivate a wider range of social capital. At the same time, interventions in public spaces may also have a series of negative impacts. On the one hand, as a result of the beautification of public spaces, the number of public users will continue to increase, which may impose increased pressure on hygiene and cleanliness and increase the management costs of public spaces. On the other hand, this large number of people will lead to an increase in environmental noise, which may induce negative and even stressful feelings among residents, especially female visitors. In addition, public space interventions may also produce problems such as air pollution, ecological damage, and reduced biodiversity. Therefore, urban planners should give full consideration to the emergence of the problems mentioned above when renovating public spaces; they should strengthen the management of public spaces by promoting the rationalization and design of public spaces to better serve urban development.

The research in this paper also has several shortcomings. For example, the selected public space focuses on squares and parks, and therefore, the income effect of other types of public space has not been examined. The selection of public space focuses on the vicinity of the place of residence, and there is a lack of in-depth discussion on the income effect of public spaces near the place of work. Moreover, the type of income that is affected by the increase in residents' income via public space was also not examined closely. At the same time, because this paper mainly explores whether the use of public space has an income effect on residents, focusing on the presence or absence of an income effect, this paper lacks a detailed analysis of the geographic environment in which the public space is located. Also, different types of public spaces are not distinguished, and an in-depth exploration of the differences between the two external environments mentioned above and the resulting impact on the extent of residents' income is also missing. Future research needs to improve and supplement the above-mentioned aspects based on the conclusions of this paper, with the goal of obtaining a more complete theoretical elaboration on the relationship between public space and residents' income.

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Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors on request.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. The Statistical Principles of Propensity Score Matching

From a statistical perspective, let the dependent variable values for members of the experimental and control groups be represented by Y_1 and Y_0 , respectively, and let w be a binary variable, where $w = 1$ represents individuals in the experimental group, and $w = 0$ represents individuals in the control group. Therefore, when an individual belongs to the experimental group, the value of $E(Y_1|w = 1)$ is observable as a factual event, while the value of $E(Y_0|w = 1)$ is a counterfactual event that cannot be observed. For instance, the impact of a university education on an individual who has received it cannot be observed under a hypothetical scenario where he had not received a university education. Similarly, for the control group, the value of $E(Y_0|w = 0)$ is observable as a factual event, while the value of $E(Y_1|w = 0)$ is counterfactual and, therefore, unobservable. Thus, our objective is to determine the causal relationship between the differences in “fact” and “counterfactual” elements among individuals in the experimental group, which can be calculated as a weighted average.

$$T = \pi[E(Y_1|w = 1) - E(Y_0|w = 1)] + (1 - \pi)[E(Y_1|w = 0) - E(Y_0|w = 0)] \quad (A1)$$

The symbol π signifies the proportion of all individuals surveyed who belong to the experimental group.

Since counterfactuals are unobservable and the same group of people can only belong to either the experimental or control group, it is imperative to fulfill the following non-confounding assumption when making causal inferences:

$$E(Y_1|w = 0) = E(Y_1|w = 1) \quad (A2)$$

$$E(Y_0|w = 0) = E(Y_0|w = 1) \quad (A3)$$

The notion here is that a separate group of individuals in the control group can act as a representative for the counterfactual state of individuals in the experimental group. Therefore, it is possible to simplify Equation (A1) as follows:

$$T = E(Y_1|w = 1) - E(Y_0|w = 0) \quad (A4)$$

In the context of a randomized experiment, the assumptions presented in equations $E(Y_1|w = 0) = E(Y_1|w = 1)$ and $E(Y_0|w = 0) = E(Y_0|w = 1)$ hold since experimental individuals are assigned to the experimental and control groups in a random manner. However, it is worth noting that when relying on observational data, the fact of randomization cannot be guaranteed. Thus, it becomes imperative to control for confounding variables as much as possible to maintain the independence between variable w and variables Y_1 and Y_0 , i.e.,

$$E(Y_1|w = 0, x) = E(Y_1|w = 1, x) \quad (A5)$$

$$E(Y_0|w = 0, x) = E(Y_0|w = 1, x) \quad (A6)$$

The variable x represents a confounding variable. As long as the confounding variable can be identified and controlled, w can be approximated to be independent of Y_1 and Y_0 [60], i.e.,

$$(Y_0, Y_1) \perp w | x \quad (A7)$$

At this stage, a specific propensity score of P for the confounding variable x is obtained through logistic regression, leading to the following relationship:

$$E(Y_1|w = 0, P) = E(Y_1|w = 1, P) \quad (A8)$$

$$E(Y_0|w = 0, P) = E(Y_0|w = 1, P) \quad (A9)$$

In summary, it is possible to obtain an “approximate” fulfillment of the non-confounding assumption, thereby obtaining the desired causal inference.

Appendix B. The Principle of Mediation Effect Model

We hypothesize that WTS affects INCOME through possible mediating mechanisms. Following Baron and Kenny (1986) [79], we use the following econometric model:

$$\text{INCOME} = \beta_0 + \beta_1 \text{WTS} + \sum_k \theta_k X_k + \varepsilon \quad (\text{A10})$$

$$M = a_0 + a_1 \text{WTS} + \mu \quad (\text{A11})$$

$$\text{INCOME} = c_0 + c_1 \text{WTS} + b_1 M + \sum_k \lambda_k X_k + \eta \quad (\text{A12})$$

$$\text{INCOME} = c_0 + b_1 a_0 + c_1 \text{WTS} + (a b_1) \text{WTS} + \sum_k \lambda_k X_k + b_1 \mu + \eta \quad (\text{A13})$$

In Equations (A10)–(A12), INCOME is the annual income of residents, WTS is the core independent variable measured by whether to go to the square, M_i is the set of mediating variables, and X_i represents the control variables. Equation (A10) gives the total effect of WTS on INCOME, with magnitude β_1 . Equations (A11) and (A12) show how the effect of WTS is mediated by other variables; the coefficient a_1 measures the effect of WTS on the mediator, and b_1 measures the effect of the mediator on INCOME. Substituting Equation (A11) into Equation (A12) gives Equation (A13), where c_1 measures the direct effect of WTS on INCOME, and $a_1 b_1$ measures how much WTS affects INCOME through the mediating mechanisms.

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