

## **FACTORS OF REGIONAL SPILLOVER EFFECTS ON HOUSING PRICES: A LITERATURE REVIEW**

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**ABSTRACT:** With the development of the metropolitan real estate market in recent years, there has been a trend of residents spilling out of the metropolis, especially in the wake of COVID-19. Housing prices in the regional areas have increased. The factors that cause the spillover are unclear. This paper aimed to excavate the potential factors that make households move away from metropolitan areas to regional areas through a literature review. Literature was searched in Google Scholar using selected keywords. The spillover effect was assessed by considering the economic, geographic, demographic and social characteristics. Understanding the factors of the spillover effect is conducive to real estate valuation, provides informed information for governments formulating regional planning and land policies, advises developers to compose commercial strategy, and helps buyers to make choices.

**KEYWORDS:** Spillover effect; regional market; housing prices; literature review.

### **1. INTRODUCTION**

As an essential part of the national economy, the real estate industry occupies a pillar position in the national economy of many countries. It not only promotes economic growth through national investment and consumption but also promotes the process of urbanisation and the harmonious and healthy development of the whole social economy. The real estate industry has long been centred on the development of developed urban agglomeration, focusing on the exploration and expansion of the real estate market in the metropolis. This is because this development mode is very efficient in the early development of the real estate industry, which can quickly establish the real estate market in developed cities. Moreover,

the demand for real estate in regional and rural areas is too low to support the initial development of the real estate market.

However, with the gradual development of the real estate market, too much attention to the development model of developed urban agglomeration shows bottlenecks. First, the land in the city is limited, and the supply of new commercial housing is increasingly difficult. Second, it is difficult for real estate development to introduce new concepts to promote housing demand by enriching its attributes. Third, due to long-term development, the ratio of housing price to income in developed cities has been pushed up, making it more challenging to buy a house. Fourth, concerning the quality of life, housing comfort, and even the natural environment, especially after COVID-19, for preventing and controlling disease transmission, people tend to flee from high-population cities.

Due to the above reasons, coupled with the development of transportation (such as high-speed railway, intercity rail transit, etc.), residents have been pouring out of metropolitan areas. With this trend emerging, the spillover effect has become one of the critical factors affecting housing prices in the regions surrounding the metropolis. In the past research on the influencing factors of housing prices, due to the previous development model, most focused on large and medium-sized cities in countries and regions and did not care about regional areas. Therefore, this study reviewed recent literature to explore the potential factors leading to the migration of families from metropolitan areas to regional areas. This evidence is crucial for real estate valuation, providing valuable insights for the government to develop regional planning and land policies, offering recommendations for developers to formulate business strategies, and assisting buyers in making informed choices.

The following section will describe the research methodology used for the literature review. Findings from the literature review will be discussed in section 3, and the conclusion follows.

## **2. LITERATURE REVIEW PROCESS**

A qualitative study using a systematic literature review has been adopted to understand the factors of the regional spillover effects on house prices. The review began with searching literature in Google Scholar, one of the largest databases with an estimated 100 million articles, or approximately 79-90% coverage of all articles published in English (Wikipedia, 2023). The first step of conducting the literature review was establishing keywords and screening and scanning the titles and abstracts of the relevant articles. The keywords were related to the topic, such as “housing”, “price”,

“spillover”, and “effect”. The search focuses on the articles within the last ten years, i.e., from 2012 to 2022. The research papers include peer review journal articles and conference papers from some of the top journals in the real estate field, such as *Housing Studies*, *Regional Studies*, *Journal of Regional Science*, *Regional Science*, *Urban Economics*, and so on. As the topic to be studied in this paper is relatively unique, there are few systematic studies on this aspect, and the required information will be distributed in many pieces of literature. Therefore, the literature screening is relatively loose, and any literature related to the “spillover effect on housing price” was considered.

In addition, in the process of comprehensive reading, the literature was expanded according to the needs. Relevant articles before this period were also reviewed. Some literature was cited earlier than 2012 but still of significant significance, although not highly related to the research topic but closely related to a specific factor, and some non-English literature was selected. There were 1,420 results in 0.06 seconds that appeared in the initial search. It was highly likely that the literature selected could not be searched by the chosen keywords in the first step but was still worthy of reference and research. Therefore, such expansion can make up for the limitations of the literature obtained from a single keyword to a certain extent. As a result, 62 articles relevant to the studied topic were selected from 38 journals. It was found that 25 articles (40.3%) were from 2018 to 2022, and 18 (29%) came from 2012 or prior. This implies that the topics of housing price spillover effects have attracted more and more attention from researchers in recent years. Table 1 summarises the chronological distribution of the identified articles.

The second step involved a thorough reading of the selected articles and identifying the relevant information being sought. The main factors of regional spillover effects on housing prices were then identified and classified into seven themes according to the literature review, being: 1) theory of housing price spillover effect, 2) population and population structure, 3) land, 4) economic fundamental elements such as price, income and unemployment, 5) society and government factors, 6) information, and 7) other factors. Some articles discussed more than one theme. For example, Costello *et al.* (2011) investigated the extent of interstate spillover of house prices in capital cities of Australia by studying the relationships between age structure and household disposal income.

The factors studied on the housing price spillover effects were coded and added into NVIVO (a software package used for qualitative analysis). The NVIVO software helps to organise, analyse, and find insights by classifying, sorting, arranging information, and examining the data

relationships. In the process of comprehensive reading, the classification themes would be gradually improved according to the new information added to NVIVO. The theme, subtheme, and corresponding literature number and reference points are established and shown in Table 2.

**Table 1.** Chronological Distribution of Regional Spillover on Housing Price Articles. Source: the Authors.

| No | Journal   | Prior 2012 | 2013     | 2014     | 2015     | 2016     | 2017     | 2018     | 2019     | 2020     | 2021     | 2022     | Total     |
|----|---|------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
| 1  | Applied Economy   | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 2  | Applied Geography   |            |          |          |          | 1        |          |          |          |          |          |          | 1         |
| 3  | Cities & Health   |            |          |          |          |          |          |          |          |          | 1        |          | 1         |
| 4  | Economic Computation & Economic Cybernetics Studies & Research    |            |          |          |          |          |          |          |          |          | 1        |          | 1         |
| 5  | Economic Modelling  |            | 1        | 1        |          |          |          |          |          |          |          |          | 2         |
| 6  | Empirical Economics   |            |          |          |          |          |          |          |          |          | 1        |          | 1         |
| 7  | European Real Estate Society                                      |            |          |          |          |          |          | 1        |          |          |          |          | 1         |
| 8  | Finance Trade Econ  |            |          |          | 1        |          |          |          |          |          |          |          | 1         |
| 9  | Growth and Change   |            |          |          |          |          |          |          |          |          |          | 1        | 1         |
| 10 | Habitat International   |            |          | 1        |          |          |          |          |          |          | 1        |          | 2         |
| 11 | Housing Studies   | 1          |          |          |          |          |          |          |          |          |          | 1        | 2         |
| 12 | International Journal of Environmental Research and Public Health |            |          |          |          |          |          |          |          | 1        | 1        |          | 2         |
| 13 | International Journal for Housing Science and Its Applications    | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 14 | International Journal of Strategic Property Management            | 2          |          |          |          |          | 1        |          |          |          |          |          | 3         |
| 15 | Journal of Applied Statistics and Management                      |            |          |          |          |          |          | 1        |          |          |          |          | 1         |
| 16 | Journal of Asian Economics  |            |          |          |          |          |          |          |          |          | 1        |          | 1         |
| 17 | Journal of the Asia Pacific Economy                               |            |          |          | 1        |          |          |          |          | 1        |          |          | 2         |
| 18 | Journal of Banking & Finance                                      | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 19 | Journal of Business Research                                      |            |          |          |          |          |          |          | 1        |          |          |          | 1         |
| 20 | Journal of Empirical Finance                                      |            |          |          |          |          |          |          |          |          | 1        |          | 1         |
| 21 | Journal of Planning Literature                                    | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 22 | Journal of European Real Estate Research                          |            |          |          |          |          |          |          |          |          | 1        |          | 1         |
| 23 | Journal of Housing Economics                                      |            |          | 2        |          |          | 1        |          |          |          |          |          | 3         |
| 24 | Journal of Housing Research                                       | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 25 | Journal of Political Economy                                      |            |          | 1        |          |          |          |          |          |          |          |          | 1         |
| 26 | Journal of Regional Science                                       | 1          |          |          |          |          |          |          |          | 1        |          |          | 2         |
| 27 | Journal of Urban Economics  | 1          |          |          |          |          |          | 1        |          |          |          |          | 2         |
| 28 | Journal of Urban Affairs  |            |          |          | 1        |          |          |          |          |          |          |          | 1         |
| 29 | Real Estate Economics   | 1          | 2        |          |          |          |          |          |          |          |          |          | 3         |
| 30 | Regional Science and Urban Economics                              | 1          | 1        | 1        |          | 1        | 1        | 2        |          |          |          | 1        | 8         |
| 31 | Regional Studies  |            |          |          | 1        |          |          |          | 1        |          |          |          | 2         |
| 32 | Research on Financial and Economic Issues                         | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 33 | Review of Economics and Statistics                                | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 34 | Scottish Journal of Political Economy                             | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 35 | The Annals of Regional Science                                    | 1          |          |          |          |          |          |          |          |          |          |          | 1         |
| 36 | The Review of Financial Studies                                   |            |          |          | 1        |          |          |          |          |          |          |          | 1         |
| 37 | Tourism Economics   |            |          |          |          |          |          |          |          |          |          | 1        | 1         |
| 38 | Urban Studies   | 1          |          |          |          |          |          |          |          | 1        |          | 2        | 4         |
|    | <b>Total</b>  | <b>17</b>  | <b>4</b> | <b>6</b> | <b>5</b> | <b>2</b> | <b>3</b> | <b>5</b> | <b>2</b> | <b>4</b> | <b>8</b> | <b>6</b> | <b>62</b> |

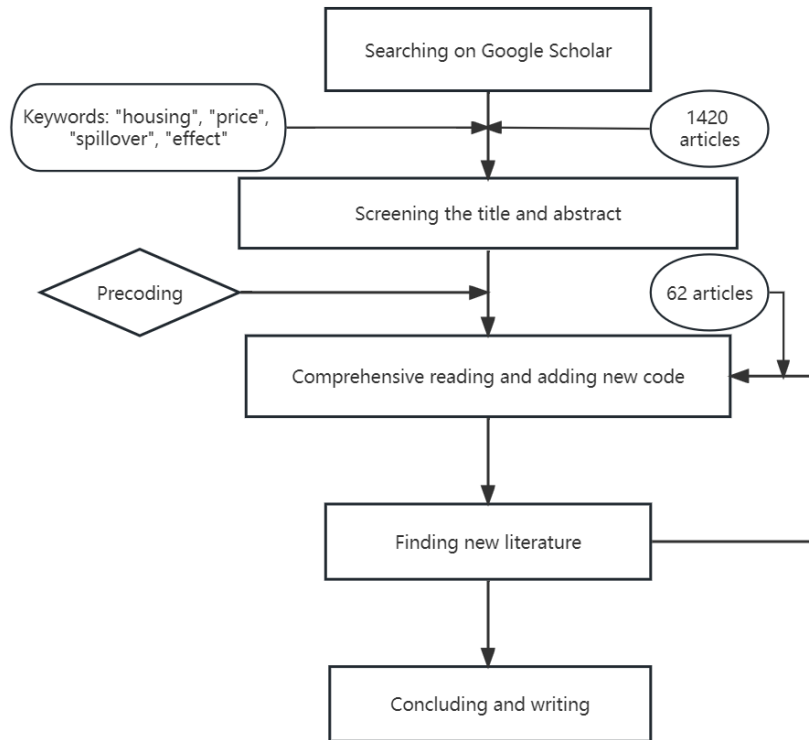
The first column is the main theme in the process of literature processing, such as "The phenomenon, evidence and theory of the housing price spillover effect". "Population", "Land", and so on. The second column is the sub-theme attached to the main theme that should be listed separately, such as "Population structure", which belongs to the "Population" main theme. The third column is the number of articles involved in each theme (including the main theme and the sub-theme), that is, how many articles mentioned the information of this theme. For example, the main theme of "Economic Fundamentals" involved 37 articles. The fourth column is the total reference point: how many places of content are included in the paper. This reference point may be one paragraph or several paragraphs of content; they may be continuous or discrete, so there may be more than one reference point in the articles. In a general example, in the sub-theme of "Price" under the main theme of "Economic Fundamentals", 12 papers mentioned this influencing factor, and 21 reference points are included in this paper.

**Table 2.** Reviewing Literature and Reference Points for Each Code. Source: the Authors.

| <b>Main theme</b>  | <b>Sub-theme</b>                  | <b>Literature</b> | <b>Reference point</b> |
|--|-----------------------------------|-------------------|------------------------|
| The phenomenon, evidence, and theory of the housing price spillover effect |                                   | 36                | 86                     |
| Population   |                                   | 16                | 33                     |
|  | Population structure              | 4                 | 12                     |
| Land   |                                   | 5                 | 9                      |
| Economic fundamentals  |                                   | 37                | 58                     |
|  | Price                             | 12                | 21                     |
|  | Income                            | 12                | 18                     |
|  | Unemployment                      | 6                 | 9                      |
| Influence from society and government                                      |                                   | 10                | 22                     |
|  | Government adjustment and control | 7                 | 11                     |
| Information  |                                   | 10                | 38                     |
| Other factors  |                                   | 6                 | 13                     |

Finally, the coding content of each theme in NVIVO was reviewed, and the content of the same theme was comprehensively sorted out and analysed in combination with the original article. Figure 1 shows the

literature review process. The following section explains the findings from the literature review.



**Figure 1.** The Flow Chart of the Review Process. Source: the Authors.

### 3. DISCUSSIONS OF THE LITERATURE REVIEW FINDINGS

This section discusses the literature review findings on the housing price spillover effect theory and the main drivers of the spillover effects.

#### *The Phenomenon, Evidence and Theory of the Housing Price Spillover Effect*

Regional economic development is often uneven; even in developed countries. Essential factors such as income, employment, infrastructure, and local amenities can significantly affect housing prices and cause

significant regional differences (Zhang and Fan, 2019). However, changes in house prices in one region can be spatially transmitted to other areas, leading to a long-term convergence in house prices. This is known as a "spillover effect", in which house prices in one area spread to neighbouring regions and beyond until they become the same (Meen, 1999).

The "spillover effect" can be explained by the concept of growth pole theory, developed by French economist François Perroux (1955) with the joint effort of the French economist Jacques-Raoul Boudeville in the 1950s. The basic idea of the growth pole theory is that the development of one or several of the leading industrial sectors with economic and technological links with other economic production will be driven by the corresponding development of other sectors. The growth pole extends into all directions in the surrounding area. Diffusion tends to be the dominant process of the growth pole theory. Tsai and Chiang (2019) applied the growth pole theory to explain the causal relationship between the spillover effect of the real estate market; that is, capital is initially concentrated in first-tier cities, but the boom in housing prices leads to spillover to second-tier cities. Using monthly price and rental data, they showed that the source of spillover effects is in first-tier cities, particularly Beijing, China.

The earliest systematic studies of this spillover effect date back to the 1990s in the United Kingdom. Using UK data, MacDonald and Taylor (1993) and Alexander and Barrow (1994) identified a chain reaction of house prices originating in southeast England or greater London and transmitted through central England to the northwest. For the theory of this channel of transmission of effects, the study of Meen (1999) has played a significant role in the literature because it provides a convincing economic explanation for ripple effects. Meen (1999) proposes four possible reasons for the interactions that lead to the observed spillover pattern to provide a plausible economic rationale for the ripple effect. The first is population migration; if house prices in one area are higher relative to other areas, buyers may migrate to other areas, resulting in house price equalisation, which causes a ripple effect on regional house prices. The second is the transfer of equity, which means that buyers in areas with high housing prices will have greater purchasing power, pushing up housing prices in other areas. The third is spatial arbitrage, carried out through space to eliminate the difference in housing price returns. The fourth is the spatial pattern of the determinants of house prices, which proposes that if the determinants of house prices follow a similar pattern, even if there is no spatial linkage between housing markets, there may be a pattern of house prices similar to the observed ripple effect. By breaking down the reasons for these four parts, it is not difficult to draw out the explanations of several

factors about the spillover effect of housing prices, namely, population, economic fundamentals (housing price model), social and government influences (arbitrage feasibility), information and other factors, which constitute the main factors in this paper.

Costello *et al.* (2011) used the dynamic present value model within the VAR framework to construct the time series of house prices, investigated the extent of inter-state spillover income of house prices in capital cities of Australia's states, and confirmed that New South Wales was more susceptible to spillover effects transmitted by other states. The cause of this spillover effect had not been investigated in the paper. However, Bangura and Lee (2020) examined one of Australia's most diverse housing markets, showing that low and high-price sub-markets in Greater Sydney were not segmented but converged into a single market over time. It means there is a spillover effect within a single housing market. Based on the cointegration test and error correction model, Luo *et al.* (2007) studied the dispersion in regional housing prices by applying data for the period from the December quarter of 1989 to the June quarter of 2005 and suggested cointegration relationships were occurring in house prices in the eight capital cities of Australia; there is a 1-1-2-4 diffusion pattern with Sydney at the top level of the list, Melbourne at the second level, Perth and Adelaide at the third level, and the other four cities at the bottom. They concluded that Australian regional housing markets share common trends in the long run. Liu *et al.* (2008) further used the vector autoregressive model and impulse response function to investigate the housing price diffusion among the capital cities of Australian states from the December quarter of 1989 to the June quarter of 2007. They found a lagged effect of regional house price diffusion, and Sydney and Melbourne's housing markets were safer than other capital cities. The Markets of Adelaide, Brisbane, and Perth were more sensitive to the change in external markets, whereas the Perth market was more sensitive to itself than changes in external markets.

Some literature discussed spillovers, which refer to a unique spatial pattern: house prices change over time. It rises periodically in a city and then spreads out with increasing distance (Pollakowski and Ray, 1997). The spillover effect is a unique cooperative motion mechanism of regional housing prices, characterised by the spatial continuous transmission effect of regional housing prices. By investigating the data of 94 metropolitan areas with information on over 23 million individual transactions from the 1st of 1993 to the 4th of 2011, DeFusco *et al.* (2018) studied the existence of spillover effects of a real estate boom from one place to neighbouring places by taking advantage of the fact that one of the notable features of



the last real estate boom in the United States was the time difference of its occurrence in local markets. They discovered that the timing of local housing booms was highly spatially correlated. If a central market's neighbouring markets started to boom recently, its probability of entering a housing boom in a given quarter roughly doubles. Their empirical results further supported the growth pole theory. Gupta and Miller (2012) estimated the spillover effects among three western cities—Los Angeles, Las Vegas, and Phoenix. They found that Los Angeles housing prices directly spilled over to Las Vegas and indirectly to Phoenix housing prices. Yunus and Swanson (2013) used nine housing markets to study the convergence of a regional housing index with a lead-lag relationship. Long-run results indicated that the extent of convergence among the regional housing markets substantially increased over time, affected by regional per capita income and regional GDP. Brady (2014) confirmed the existence of spillover effects among counties and took the lead in studying how spatial diffusion of states in the United States interacts with monetary policy shocks to influence the spillover effect. In addition, he plotted the molecular sample period to show structural changes and found that spillovers were more substantial after the late 1990s.

Yu (2015) explored 35 large cities in China with the method of GVAR analysis and concluded that there are significant spillover effects in 35 major cities in China. He pointed out that the housing price spillover effect of first-tier cities is higher than that of eastern cities, and the housing price spillover effect of eastern cities is higher than that of central and western cities. By analysing data between 2003 and 2012, Yang *et al.* (2021) studied the housing boom transmitted from one local market to another. They discovered the unique dynamic and easy touch mode in China: metropolitan areas first experience prosperity, which then transfer to geographically adjacent cities.

In addition, the specific causes of spillover effects were also explored in other countries and regions. Vizek *et al.* (2023) studied the spatial spillover effects of tourism on housing prices in Croatian towns and their neighbouring regions. Their findings supported the spatial spillover effects in rental properties from 2012 to 2019. Ooi and Le (2013) focused on the spillover effect of the infill development model in Singapore. Their empirical analysis of 55,887 resale transactions between 1997 and 2011 in the city-state concluded that an infill housing development positively impacted local housing prices, and the spillover effect was the overpricing of new homes by developers.

### **Population**

The population's spillover effect on housing prices can be outlined as follows: the rapid development of metropolitan areas leads to the influx of people looking for employment opportunities, which will push up the housing price and the ratio of housing price to income, resulting in the population spillover to the surrounding areas and then push up the surrounding housing price to realise the spillover effect of housing price. From the perspective of supply and demand, Mankiw and Weil (1989) pointed out that population would significantly impact the demand for the housing market. As a commodity, housing is the fundamental attribute of use, so the population is one of the fundamental determinants of housing demand and price. The role of demographic factors is not like the influence of the local population on local housing prices in the traditional real estate pricing model, but the influence of the population of neighbouring areas (predominately metropolitan areas) on the housing prices of surrounding areas. Generally speaking, the larger a city's population, the stronger the spillover effect on housing prices.

Yang *et al.* (2018) pointed out that population is an important determinant of the net spillover effect, and population redistribution through intercity migration realises housing price spillover. They argued that population is one of only two factors that has a positive impact on net spillovers and their systemically important cities, reflecting the importance of population factors in China's housing price spillovers and confirming the importance of labour transfer from rural to urban areas in driving China's recent housing boom. Lu *et al.* (2021) studied the time-varying spillover effect of housing prices in 70 major and central regions of China from 2006 to 2019. They advised that the degree of population migration positively correlated with the spillover effect of housing prices and calculated that the unilateral spillover effect increased by 18.45% of a standard deviation for every standard deviation increase in population migration. The empirical results aligned with the findings of Yang *et al.* (2018) and had policy implications in urban planning and development. Inter-regional labour mobility and trades were the two main factors that caused the spatial spillover, and different regions showed heterogeneous variations over time. The development of a metropolis would lead to an increase in the inflow population, which would not only increase the population in the inflow area but also squeeze out the original residents to overflow into the surrounding areas (Chen *et al.*, 2021). High population density drives up house prices and only affects incomes slowly because there is a limit to how many people a city can accommodate.

However, the root causes of the growing people-to-people ties in the regional housing market may be more complex. Some domestic policies, cross-regional or even transnational migration, and other spillover effects are more difficult to understand. In some countries, there will be inter-city and inter-provincial migration barriers, which will also significantly impact population migration. Mussa *et al.* (2017) investigated the effect of inflow immigration on the US housing market for 275 Metropolitan Statistical Areas (MSAs) for rents and 282 MSAs for home prices from 2002 to 2012 and found that inflow immigration drove up rent and purchase prices in neighbouring MSAs. A one per cent increase in an MSA's population could raise approximately 80% of rents, implying a more significant spillover effect in the housing markets.

Implicit restrictions on migration and conditions on purchases by non-locals, such as China's hukou system, have raised questions about the role of migration. Yang *et al.* (2018) pointed out that the Chinese government's determination of core cities in regional development planning helps core cities have a noticeable impact on the changes in housing prices in other cities, so they are more likely to be identified as systemically important cities. There was further evidence that the administrative status of Chinese cities also significantly impacted the spillover effect of housing prices in China, and the literature on this was insufficient.

Except for the population itself affecting the housing price according to the theory of supply and demand, the population structure will also affect the housing price more through housing characteristics and house buyers' preferences, reflected in the Hedonic pricing model. The hedonic price model, derived from Lancaster's (1966) Consumer Theory and Rosen's (1974) Theoretical Model, is proposed based on the persistence, heterogeneity, and spatial firmness of real estate, mainly focusing on the diverse and unique attributes of real estate, including land location, household type and other characteristic factors. It emphasises the utility of specific real estate features to buyers. People have preferences about the demographics of their neighbourhoods or cities, which directly affect housing prices. In addition, the different population structures will also have a particular impact on the region's economic fundamentals. For example, Costello *et al.* (2011) pointed out the strong correlation between age structure and real disposable income. The Organisation for Economic Co-operation and Development (2005) reported that demographic cohorts, particularly in the 30-40 age group, will significantly impact housing demand as this population segment is the most active in household formation. If the area is more elderly, it may lead to a decline in the ability to buy homes and thus affect prices. Zhou *et al.* (2022) showed that the

characteristics of older adults have a heterogeneous impact on housing prices based on location, housing prices, and building age and that housing prices decrease slightly as the total number of older adults in the community increases but spillover effects to the surrounding areas increase. Although this conclusion is based on the inter-community spillover effect of the same city as the research object, it still has strong reference significance. Population density can directly affect the land use of neighbouring areas, indirectly affecting the spatial spillover effect of housing prices (Peng *et al.*, 2021).

In addition, the racial or ethnic composition would also become one of the characteristics affecting regional housing prices, and people would tend to cluster in areas of the same race or ethnicity as themselves (Clapp *et al.*, 2008). Jun (2022) argued that demographic characteristics variables significantly impact the spillover effect; that is, they are more influenced by the racial/ethnic composition of surrounding communities, and according to his research, such demographic characteristics have a more significant impact than housing and socioeconomic factors. Ismail (2021) confirmed that residential segregation by ethnic, racial, age, and other population characteristics will affect nearby housing prices and that high-income and respected neighbourhoods will spill over to neighbouring areas and push up housing prices.

### ***Land***

As an attached construction on the land, housing is undoubtedly limited by the scarcity of land. The availability of land supply for residential development is an important influencing factor (Costello *et al.*, 2011). In metropolitan areas, available land is increasingly scarce and subject to many important competing uses, one of which is housing. This leads to a tight supply of new housing in large cities, which will naturally drive housing prices in large urban areas and lead to a spillover of housing prices to surrounding areas. However, the land development in the regional areas is not perfect, and there is still a large amount of land that can be used for housing to provide enough housing supply. With the rise of housing prices in neighbouring areas, the possibility of rezoning vacant land is expected to increase (Cho *et al.*, 2012). Rising house prices in nearby areas mean more pressure on housing demand. Increased housing demand pressure may lead to an increased need for residential and commercial development to complement residential use.

However, as the land supply of real estate is influenced by the administrative level and government planning, building a relatively perfect

urban network or urban agglomeration is necessary to make the spillover effect determined by land more significant. Yang *et al.* (2018) found that the administrative level is an important determinant of net spillover from core cities by studying urban agglomerations in China. They demonstrated this by comparing the results of tests on whether a city's administrative rank was included in the model.

With the support of other cities, a city can develop functions larger than its size; at the same time, supported cities can use these features and perform better than isolated cities (Gong *et al.*, 2016). This network externality on productivity and comfort will eventually be capitalised into house prices, leading to housing market spillovers between cities. Shih *et al.* (2014) found that for cities developed around Shanghai—such as Suzhou and Wuxi—the spillover effect of Shanghai on these cities is very significant, while it is not significant for cities in Zhejiang Province that do not develop around Shanghai. This further supports the argument (Yang *et al.*, 2018) that a city's administrative level will affect the spillover effect's intensity. Camagni *et al.* (2017) revealed that housing prices in 136 large European urban areas are significantly affected by the density of external linkages and cooperative networks. This may suggest that the spillover effect is more pronounced in Europe than in China because of the greater feasibility of buying across regions; that is, there are fewer barriers to buying between regions.

Another factor that must be considered is the availability of developable land and the improvement of housing community planning. Gonzalez-Pampillon (2022) suggested that new housing will have higher community quality due to more open land in the surrounding areas. The improvement of surrounding facilities will attract more original metropolitan residents who pay attention to the quality of life, thereby driving up the housing price in the surrounding areas and realising the spatial spillover effect of housing prices.

In sum, the influence of land on the spillover effect of housing price is as follows: land supply cannot change flexibly; that is, the supply of original cities is tight, and the surrounding areas are rich in land, which makes the quality of new housing in regional areas high and the price low, thus attracting buyers to come to realise the spillover effect of housing price.

### ***Economic Fundamentals***

Indicators of economic fundamentals, such as per capita GDP and average wage, are closely related to the spillover effect of housing prices (Yang *et al.*, 2021). The spillover relationship between the housing sub-

markets in Sydney was found by Bangura and Lee (2020). They presented evidence of house prices spreading from less economically prosperous sub-markets (low price points) to high-end sub-markets. This supported the equity transfer hypothesis, which states that households shift to higher-priced sub-markets as market fundamentals change due to their increased equity. The finding also supported the residential mobility theory, which holds that families move to improve housing conditions and explore economic opportunities by moving closer to more economically prosperous city areas of the city. The low-price sub-market is the first to respond to changes in market fundamentals and thus dominates, further confirming the equity transfer hypothesis. Nneji, Brooks and Ward (2013) showed that although the real estate market seemed to be out of touch with the macroeconomic fundamentals during the real estate bubble burst, it was susceptible during the boom stage and pointed out that money supply and interest rate could be used as tools to force the real estate bubble to burst.

Macroeconomic factors, such as employment and income fundamentals, may significantly promote the convergence of housing prices (Cotter *et al.*, 2015). Yang *et al.* (2018) studied the determinants of housing price spillovers in all major cities in China and suggested that GDP size was one of the critical determinants of net spillovers. However, it needs to be clear how economic fundamentals affect the spillover effect of housing prices. From the perspective of traditional supply and demand, if the economic fundamentals of the original city are promising, more people will be attracted to the city, and the housing demand will increase, leading to a more significant spillover effect of housing prices. However, if the economic fundamentals of the original city are poor, the heterogeneity of surrounding cities will be reduced. For home buyers, increasing substitution between cities will also urge people to rush to the surrounding areas to buy houses. This is a paradox, and the strength of the spillover effect has nothing to do with the fundamentals. DeFusco *et al.* (2018) found that the spillover effect of housing prices seems to have nothing to do with fundamentals when studying the spillover effect of the real estate boom in the United States, and they advised that the potential role of irrational factors interferes with this approach. Lu *et al.* (2021) also argued that GDP plays little role in explaining the dynamics of spatial spillovers between regions. Despite some different voices, scholars have yet to directly deny the impact of economic fundamentals on the spillover effect of housing prices, which is still one of the key influencing factors in future potential studies.

### ***Influence of Society and Government***

Some social factors also affect the size of the spillover effect. The most obvious are educational attainment and crime rates. For example, Zhou *et al.* (2022) explored the spillover effect of the aging population on housing prices, finding that well-educated older adults or those working in government institutions would increase the spillover effect. Hui and Liang (2016) claimed that more high-end CBDs planned by the government would lead to the inflow of highly educated professionals, the population would increase, and some low-income people would be squeezed out to the surrounding areas, realising the spillover of housing prices. According to Eichholtz and Lindenthal (2014), the demand for residential real estate largely depends on the human capital of families. The two main determinants of human capital are the education level and the health status of citizens. Yang *et al.* (2018) found that secondary education significantly negatively impacts the net spillover effect after studying education and health institutions, while the net spillover effect of higher education and health-related factors is positive.

Considering the sociocultural changes in recent years, Tyvimaa and Kamruzzaman (2018) believed that the number of young single households would also affect the strength of the spillover effect. Raleigh and Galster (2015) found that a high crime rate in a neighbourhood would spread to nearby communities, thus reducing housing values nearby. Gonzalez-Pampillon (2022) argued that new housing communities could improve the quality of the community, invest in more security measures to reduce crime and attract people to the area.

In addition, events such as COVID-19 have greatly affected the spillover effect. Chiang *et al.* (2022) argued that the pandemic effectively reduced investors' expectations with optimistic hopes for the future, thus reducing the spillover effect. However, some scholars believe that COVID-19 has discouraged people from living in metropolitan areas (because of the higher risk of infection) and from accepting mandatory lockdown orders and moving to surrounding areas. Amerio *et al.* (2020) explored the impact of the housing environment on mental health under the COVID-19 lockdown, pointing out that living in apartments less than 60 square meters with poor views and low indoor living environment quality significantly increases the risk of depression, highlighting the advantages of remote locations. Combined with the similarity of housing quality in urban regional planning, the housing in a given area seems to be of a narrow housing type (such as dilapidated or barren neighbourhoods), in which case residents will have a stronger willingness to flee such neighbourhoods.

However, as cities become increasingly crowded, it seems that residents in some highly developed urban areas must choose a narrow living environment (because of the high real estate unit price), so there will be a driving force for residents to flee in reverse. Jones *et al.* (2021) studied housing stability in the context of COVID-19. They noted that affordability stability is decreasing due to economic volatility and even unemployment caused by the pandemic, which also drives people to migrate to more remote areas with lower prices, resulting in housing price spillovers.

The impact of government adjustment and control on the spillover effect of housing prices is significant. Housing market intervention policies could change the intra-city spillover trend and indirectly affect the inter-city spillover effect (Zhang *et al.*, 2020). Autor *et al.* (2014) studied the situation after the end of rent control in Cambridge, Massachusetts, showing that deregulation could improve housing quality and attract buyers or renters, thus leading to the rise of housing prices. Yang *et al.* (2021) advised that implementing housing regulation policies in a city may cause changes in the housing market of neighbouring cities. Targeted regulation policies in cities ignore the spillover effect of housing prices between housing markets, which may lead to inadequate supervision of the housing market.

### ***Information***

The spillover effect of most housing demand and prices discussed above were macro factors. Information focused on investment demand has yet to be addressed in the literature. The influence of information on the spillover effect of housing prices comes from Meen's (1999) spatial arbitrage theory, that is, the motivation to make profits by relying on different housing prices in different spaces and asymmetric information.

Meen (1999) suggested that the spatial spillover of housing prices is caused by information asymmetry. Inefficiencies characterise the housing market because of high search costs and few transactions in housing relative to other traded assets. This requires market participants to collect information across space. Namely, market participants must collect information from geographically adjacent or economically related areas. Thus, reliance on information from other geographically or economically connected regions creates the potential for spatial spillovers. Weng and Gong (2017) believed that the cooperative movement and volatility of housing prices were usually attributed to information spillovers caused by information links between regional housing markets and inter-regional trade. Miao *et al.* (2011) explained the transmission mechanism of price



fluctuations among housing markets in large cities in the United States from the perspective of information spillover. They argued that in an environment where homeowners and investors are acutely aware of the growth in real estate values, which is becoming more significant and frequent, information spillovers from one market to another are more simply related to expectations of dependency than to actual industry connections. This is a self-fulfilling prophecy brought on by the behaviour of investors and homeowners, who adjust their expectations based on information from other markets. Zhu *et al.* (2013) highlighted the importance of information spillovers or flows in the spatial linkages of price fluctuations in these housing markets. They found that housing markets can influence each other through returns, idiosyncratic risks, and fluctuations in conditions. Investors use information from their region and other regions to form market expectations, regardless of geographic distance. Yang *et al.* (2021) studied urban housing prices of 266 prefecture-level cities in China from 2005 to 2017 to measure the global and local correlations of urban housing prices. They compared the regional differences of spillover effects, finding that fundamental economic indicators such as per capita GDP and average wage realised the housing price spillover effect through the mode of information transmission.

It is widely accepted that housing investor sentiment may play a key role in overheating the housing market through the diffusion of housing information between cities; that is, spillover effects are more significant in the case of booms or even bubbles. The information spillover mechanism might help explain the links between regional housing markets and their short-term spillover effects (Zhang and Fan, 2019). When housing demand is more attributable to the investment, market participants (including investors and regulators) are more likely to be influenced by information flows, which may come from geographically adjacent or economically connected areas. In particular, information from large/capital cities can spill over to regional housing markets. Information should play a more significant role when housing prices are high and speculative buying demand is high. Tsai and Chiang (2019) also agreed that spillover effects are more potent in prosperous states. However, Chiang *et al.* (2022) argued that investors' pessimistic outlook is key to the information transmission process (which may explain the rapid decline in house prices in certain areas and the tendency of home buyers, especially investors, to be risk-averse). Chiang *et al.* (2022) found evidence that negative perceptions, such as extreme fear of loss, often play a dominant role in disseminating information and that the COVID-19 pandemic subsequently dampened the solid response to good news in 2019. Moreover, it is suggested that the

housing price regulation policy will effectively restrain investors' enthusiasm and reduce the role of information.

#### **4. CONCLUSION**

Since the spillover effect on housing prices was proposed at the end of the last century, scholars have conducted abundant studies on various countries and regions around the world, suggesting the universality of the spillover effect on housing prices and exploring the spillover factors behind it to a certain extent. This article, through the literature review, has studied the population (including population, age structure, population migration barriers, etc.), land (or land supply, urban land development network, etc.), economic fundamentals (GDP, per capita income, employment, etc.), society and government (education, crime, the government controls, etc.), information (mainly by investor sentiment, etc.) that effect on housing prices. Among them, the population is the most critical factor. Many scholars believe that all kinds of potential factors will eventually cause housing price spillover through the population. Information, as a factor that affects investors' preferences and judgments and thus the investment demand for property, is also the focus of scholars in recent years. Although the development of the real estate market in the past paid more attention to the market of big cities, the previous studies on the spillover effect on housing prices mainly focused on the spillover between large and medium-sized cities, and there were few studies on the less developed areas. However, the above factors can still provide research directions for studying the spillover effect of metropolitan regions on regional areas. The results from the literature review provide evidence to stakeholders such as governments, developers, and investors to consider the spillover effect when making decisions in urban planning, infrastructure development, and investment. For example, the spillover effect can be used to drive the development of the real estate industry in regional areas, reduce the ratio of house price to income in metropolitan areas without directly adopting price restrictions, and reconsider and formulate a more perfect and reasonable real estate regulation system.

Developers and investors can also look for potential appreciation regarding the spillover effect. Future studies on this topic may uncover some difficult and problematic situations in the research on big cities. Issues that should be further considered include the natural environment, tourism, and other factors affecting the housing price through the hedonic price model. These may have further implications for the strength of spillovers. One limitation of this study is that the articles were sourced only

from Google Scholar, and some relevant and essential information may need to be included. Further research is required to search articles from other powerful search engines such as Scopus.

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