Does the transfer of state-owned land-use rights promote or restrict urban development?

Jintao Li[a,b], Zongfeng Sun[b,*]

[a] *Institute of Governance, Shandong University, Qingdao, 266200, China*
[b] *School of Political Science and Public Administration, Shandong University, Qingdao, 266200, China*

ABSTRACT

Urbanisation has significantly influenced socioeconomic development while land transfer, as a carrier, has played an important role in the process of urbanisation. However, urbanisation has led to an unbalanced development of regional cities and a widening gap between rich and poor. We explored the influence mechanism of land transfer on urban development by quantitative and qualitative investigations of land benefits. Firstly, we employed game theory to analyse the relationships among the government, developers, and consumers. Developers have been the greatest beneficiaries of land transfers, whereas the consumers' interests have mostly been affected negatively. Then, we applied a coupling coordination model to 21 cities located along the Beijing–Hangzhou Grand Canal to verify the theoretical mechanism and analyse the relationship between land transfers and urban socioeconomic benefits. The results show that government-led and market-led land transfers could promote urban development. The latter could be more sustainable than the former. For the sustainable development of land transfers and urban–rural integration, the government should control land prices and regulate the relationships between developers and consumers by formulating laws and reforming land systems.

1. Introduction

Land use is the core issue of sustainable development and reveals the attributes, characteristics, mechanisms, evolution, regional differentiation, and contradictions of human and land relationships (Zhou et al., 2019). As one of the significant types of land-use that converts land from its natural state, land urbanisation[a] promotes urban economic development and improves education, medical care, and social infrastructures (Zienkiewicz et al., 2014; Liu, 2018). The state-owned land transfers (LTs) are important ways of promoting land urbanisation, as well as increasing revenue for the government and the country's gross domestic product (GDP). However, the high housing prices caused by the state-owned LTs have put tremendous pressure on people's lives and encourages a large number of young people to abandon agricultural production for high incomes in the cities, thereby accelerating the loss of young rural labourers, increasing the area of idle arable land, and leaving a substantial number of "hollow villages" (Liu et al., 2013, 2017). As a result, urban-rural differences have gradually increased. Thus, it is of great theoretical and practical significance to explore the

effects of LTs on socio-economic development and to study those policies and strategies of state-owned land that would encourage urban-rural integrated development.

In the United States, urbanisation follows the laissez-faire mode alongside economic development. Land urbanisation is promoted by industry and each city has its leading industry (Cho et al., 2003; Sealey et al., 2018), such as the cultural and entertainment industry in New York and the electronic information industry in Seattle (Hemphill, 2010). The country has a sound land trading market, and all land is used for fees. Faced with the high housing prices of land urbanisation, the government has issued a series of policies to regulate it (Gabbe, 2019). In most developed countries in Europe, such as Germany and the United Kingdom, urbanisation is regulated by the governments (Kamphorst et al., 2017), which first develop sound infrastructure and management systems, then form the urban characteristics according to the natural resources and environment of the land (Salvati et al., 2018). Industrialisation and urbanisation, such as in Cannes, France, and Liverpool, England, also promote each other (Salvati and Zambon, 2019). Some countries in Latin America suffer from malformed urbanisation.

---

* Corresponding author.
  E-mail addresses: lijt2018@sdu.edu.cn (J. Li), sunzongfeng2017@163.com (Z. Sun).
[a] Land urbanisation is the process by which land transitions, including agricultural and rural construction land, from non-urban to urban statuses occur. Population urbanisation, which coexists with land urbanisation, is the process of transforming rural populations into urban populations and agricultural populations into non-agricultural populations.

Rio de Janeiro in Brazil is one example wherein the government excessively pursued land urbanisation while neglecting the implementation of public services and other social infrastructures (Angotti, 2013; Chauvin et al., 2017). As a result, population urbanisation lagged far behind land urbanisation and many low-income living areas (slums) began to appear in the urban built-up areas (Marchetti et al., 2019). Some Asian countries, such as South Korea and Singapore, followed urbanisation modes relying on economic development (Jusuf et al., 2007; Haeran and Sangwon, 2018). Labour-intensive processing industries attracted much rural labour to work in the cities (Needham, 2016), i.e., population urbanisation promoted land urbanisation. The rapid development of urbanisation was particularly evident in coastal and riverside cities. State-owned land is transferred mainly by lease in Singapore, and the government pays more attention to infrastructure construction and environmental greening inland urbanisation (Murakami, 2018). The land urbanisation development models provide an essential foundation for the healthy and stable urbanisation of cities around the world.

In comparison to land ownership transfer and leasehold land in developed countries, the Chinese government, as a land-owner, grants land-use rights to land-users, who pay the fees for the transfers of the land-use rights (Cai et al., 2016). The real estate industry has been the primary driver of rapid land urbanisation and land transaction fees have become an important source of government revenue since the beginning of the 21 st century (Ye, 2015). However, most cities experience faster land urbanisation than population urbanisation and housing prices have continued to increase with the increase in land prices (Li and Chand, 2013). These high housing prices place tremendous pressure on young people and migrant workers, who have no property of their own (Hu et al., 2019; Peng and Tsai, 2019). Unplanned land urbanisation in combination with little to no infrastructure or service facilities results in idle land and a significant number of unfinished buildings (Tian et al., 2017; Li et al., 2019). Rapid land urbanisation has also produced a substantial real estate economic bubble in China (Hui and Shen, 2006; Zhao et al., 2017). Considering these varied challenges, we proposed a fresh framework for explaining human–land relationship theory by quantitative and qualitative analyses. This study applied game theory to determine the mechanism by which LTs affect urban development and investigated the influences of LTs on urban socioeconomic benefits by using a coupling coordination model for an empirical analysis of cities along the Beijing–Hangzhou Grand Canal in China. We provide a new idea for the influence mechanism of land use on urban development and the decision-making support for regional urban coordination and sustainable development.

2. Methods and models

2.1. Game theory

Game theory explains how players (multiple individuals or teams) in a game implement relevant strategies under the constraints of specific conditions (Tisdell and Harrison, 1990). In a game, one player may establish a strategy by analysing their strengths and weaknesses, as well as those of their rivals, and, if the strategy is formulated correctly, may win the game. Game theory includes players, strategies, and returns, which are the essential elements, as well as actions, information, balances, and outcomes. (Roth, 2010; Tan et al., 2015).

This paper presents a three-dimensional equalisation game model that includes the government (G), a developer (D), and a consumer (C) (Table 1). The government is the subject of LTs and provides enough land to develop and uses the income to build public facilities and infrastructure. The government's income and expenditures (IAE) consist of land transaction fees (G1) and infrastructure construction and management fees (G2). The developer is the recipient of LTs, develops the land, and provides spaces to residents and industries. The developer's IAE are housing profits (D1), land transaction fees (D2), and

Table 1
The components of the game model.

Players	Income	Expenditure
Government	land transaction fees (G1)	infrastructure construction and management fees (G2)
Developer	house profits (D1)	land transaction fees (D2) construction materials fees (D3)
Consumer	wages (C1)	home purchase fees (C2)

construction materials fees (D3). The consumer is the recipient of housing, for which they need to pay, whereas they use the public facilities for free. The consumer's IAE are wages (C1) and home purchase fees (C2). Each of the three players adopt different strategies to increase their revenues or reduce their expenses whenever their expenditures exceed their incomes. The goal is to achieve a Nash equilibrium. This paper discusses the mechanism of the game among the government, the developer, and the consumer so that the reader may understand the stable state for the promotion of sustainable urban development.

2.2. Coupling coordination model

The coupling coordination model can be used to describe the degree of dependency between systems. The coupling coordination degree (D (t)) is composed of the coupling degree (G(t)) and the coordination degree (H(t)) through two subsystems (Guo et al., 2015). We used the coupling coordination degree in an empirical analysis to measure the relationship between LTs and urban development. The higher the coupling coordination degree, the greater is the dependence of urban development on LTs. Thus, the relationship between the two subsystems can be divided into four types of coordination: low-level coupling coordination (0–0.4), which means that LTs and urban development are extremely uncoordinated and there is no obvious correlation between them; middle-level coupling coordination (0.4–0.6), which means that there is a certain relationship between LTs and urban development while the mutual influence is low; run-in coupling coordination (0.6–0.8), which means that there is a coordinated relationship between LTs and urban development and urban socioeconomic development is caused by LTs to a certain extent; high-level coupling coordination(0.8–1.0), which means that there is a very harmonious relationship between LTs and urban development and that the higher the LTs, the higher is the level of urban development.

$$G(t) = \left[4x(t)y(t) \Big/ (x(t) + y(t))^2 \right]^{1/2} \quad x(t), y(t) \in [0,1] \tag{1}$$

$$H(t) = \alpha\, x(t) + \beta y(t) \tag{2}$$

$$D(t) = \sqrt{H(t)G(t)} \tag{3}$$

where $x(t)$ and $y(t)$ are the respective values of the land transfer and socio-economic effects subsystems while α and β are their respective coefficients ($\alpha + \beta = 1$). Both subsystems are synchronously changing and interacting, so we believe that their effects on the coupling degree are equivalent; thus $\alpha = 0.5$, $\beta = 0.5$. $G(t)$, $H(t)$, and $D(t)$ are less than 1.

2.3. Mechanism of LTs' influence on urban development

Land is the carrier of urban development and LTs have made an essential contribution to people's lives and economic growth. The government, the developer, and the consumer are critical players in the LT game model (Fig. 1). In order to better analyse the mechanism between LTs and urban development, we propose three hypotheses. Firstly, we consider that all three players are participants and their benefits are primarily related to LTs. Secondly, the three players are rational and each aims to serve their self-interest. Finally, the game
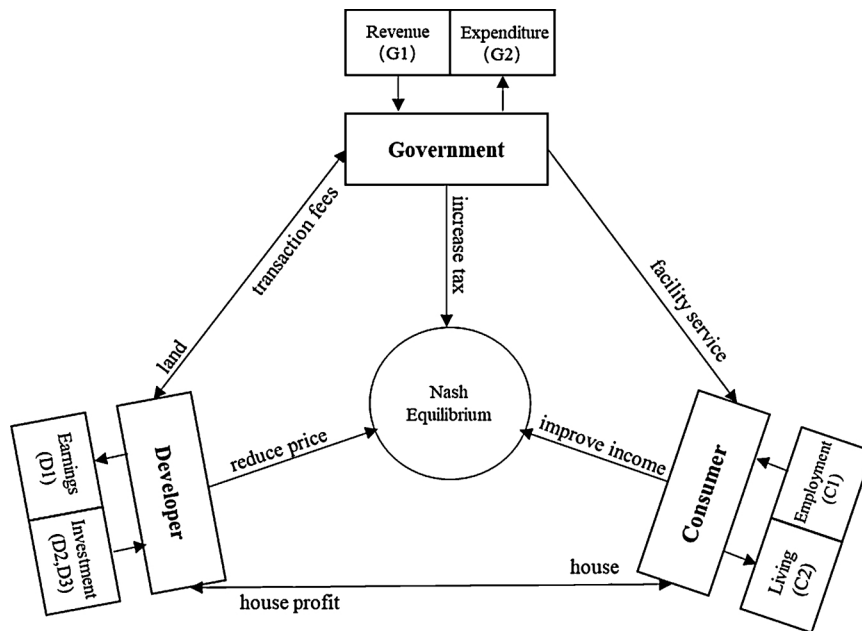
Fig. 1. Game model of LTs.

model is a closed system, and the players' strategies are correctly formulated.

According to regional development plans, the government provides state-owned land to the developer through agreements, tenders, auctions, and/or listings in exchange for G1 from the developer. The land is used to build residential buildings, factories, and commercial establishments, while the fees are used to build and maintain the necessary public service facilities, such as transportation and water conservancy. Thus, the gap in the government's IAE is G2 – G1. When that gap is much lower than zero, the government needs to increase LT fees to meet the demand for fiscal revenues for urban development. The developer must develop the real estate as soon as they obtain the land-use rights. Because of the significant expenses of D2, land-use rights need to be converted into income, which is mainly sourced from the house profits (D1) received from the consumer. Thus, the gap in the developer's IAE is D2 – D1. When that gap is lower than zero, the developer will increase the price of housing. The consumer needs to buy affordable real estate as dictated by C1. There are two choices in real estate consumption: when the deposit is far higher than the price of the real estate, the consumer is more likely to buy; otherwise, they are less likely to buy.

According to the game mechanism of the three players, if a city lacks industry, then the government must provide a substantial quantity of state-owned land to increase the revenues for socio-economic development. Because of limited land, land prices will continue to increase over time, and the prices of land closer to the city will be higher. Thus, the developer will increase real estate prices to improve efficiency. However, when the housing prices exceed the consumers' purchasing power, they will fail to purchase. As a result, much real estate will remain vacant, and the developers will decrease the prices and reduce construction. Urban development is limited, and the government must take measures to keep housing prices stable. For example, the government could provide adequate bank loans to citizens for one to thirty years and those consumers with stable jobs could also obtain housing provident funds. Thus, consumers could increase their purchasing power for real estate. The developers would gain the most benefits and promote urban socio-economic development.

Unfortunately, high bank loans can trigger a subprime mortgage crisis that could destroy the government's financial system. If the government does not implement adequate measures, a large number of

abandoned houses may cause developers to go bankrupt, and a real estate bubble crisis could arise. If the government excessively transfers state-owned land for revenue, then there will be two severe crises that will have detrimental effects on urban socio-economic development. Thus, the government needs to explore other ways to promote urban development. On the one hand, the government should regulate the scale of LTs according to population and industry. On the other hand, the government should develop other industries to increase sources of government revenue and control the prices of real estate, regulate the market by purchase restriction policies to avoid overbuilding and collect real estate taxes.

3. Empirical analysis

3.1. Study area and data source

The Beijing–Hangzhou Grand Canal is the oldest and largest ancient canal in the world. Its value is comparable to that of the Great Wall. Flowing through six provinces and 21 cities from north to south and joining five major river systems, including the Haihe River, the Yellow River, the Huaihe River, the Yangtze River, and the Qiantang River, the Grand Canal is 1,794 km long and is the country's second "golden waterway" after the Yangtze River (Fig. 2).

The Beijing–Hangzhou Grand Canal is also one of the most affluent agricultural regions in China and has several developed industries. The region has a high population density and agricultural intensification while its production potential is substantial. The area around the river has played an enormous role in economic, especially industrial and agricultural, development and cultural development, as well as in exchanges between China's northern and southern regions. There are considerable differences among cities in social and economic development because of different influencing factors. Thus, the cities in the region have significant differences in LTs. We verified the game mechanism between LTs and urban development by a coupling coordination analysis of the LTs and socioeconomic benefits in the 21 cities along the Beijing–Hangzhou Grand Canal.

This study selected the proportion of state-owned LTs to represent the land transfer system. In accordance with the mechanism between LTs and urban development, we selected social and economic factors, such as the GDP index, the industrial output value index, and the
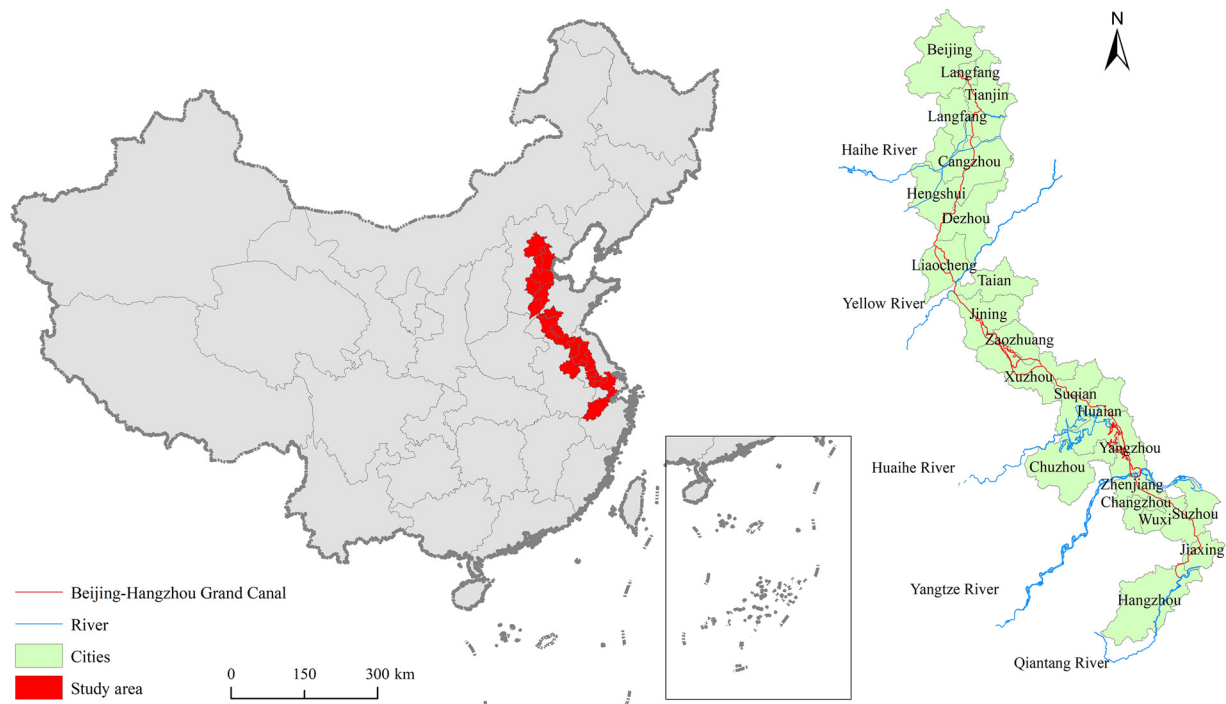
Fig. 2. Study area.

Table 2
Land transfers and socioeconomic benefit index system.

Target layer	Indicator layer	Explanation
Land transfers (LTs)	Land transfer rate (x_1)	The ratio of the state-owned LTs area to the total urban area
Economic benefits (EBs)	GDP index (y_1)	The ratio of the total output value of gross domestic product to the total population
	Industrial output value index (y_2)	The ratio of the industrial output value to the total population
	Tertiary industry structure index (y_3)	The ratio of the output value of tertiary industry to the total output value of gross domestic product
	Fiscal revenue index (y_4)	The ratio of the fiscal revenue to the total population
	Average employee wage index (y_5)	The ratio of the total annual salary to the number of employees
Social benefits (SBs)	Urbanisation rate (z_1)	The ratio of the permanent population in cities and towns to the total population
	Employee rate (z_2)	The ratio of employees in public institutions to the total population
	University teacher–student index (z_3)	The ratio of the number of teachers in schools to the number of university students
	Number of beds in medical institutions index (z_4)	The ratio of the number of hospital beds to the total population
	Green coverage rate in urban built-up areas index (z_5)	The ratio of urban green spaces to built-up areas

urbanisation rate, to describe the economic benefits (EBs) and the social benefits (SBs) of LTs. (Table 2). The data in this study were drawn primarily from the China City Statistical Yearbook from 2000 to 2015 and includes population, social, and economic data. The land-use data were drawn from the Resource and Environmental Science Data Center of the Chinese Academy of Sciences.

In order to analyse the differences among cities, this study used the min-max normalisation method to set the values of all the socioeconomic data and land transfer rates from "0" to "1". All indicators are of equal weight ($w_i = 0.2$) while the values of EBs and SBs were obtained by comprehensive weighting (Eqs. (4),(5)). The coupling coordination degree (D(t)) was calculated by Eqs. (1),(2), and (3). LT is the subsystem of x(t) and EBs or SBs are the subsystem of y(t).

$$EBs = \sum_{i=1}^{5} y_i w_i \tag{4}$$

$$SBs = \sum_{j=1}^{5} z_j w_j \tag{5}$$

3.2. Analysis of LT coupling effect

Along the Beijing–Hangzhou Grand Canal, there were great

differences in state-owned LTs that occurred in 2000–2015 (Fig. 3). In 2000, the city with the most LTs was Cangzhou (0.71 %), and, in 2015, it was Changzhou (0.55 %). In 2000, the city with the least LTs was Xuzhou (0.003 %), and, in 2015, it was Beijing (0.05 %). In 2000, there were seven cities with LTs more than 0.2 % concentrated in the northern region. Most cities had LTs less than 0.05 % and accounted for 55 % of the total number of cities. In 2015, there were also seven cities with LTs more than 0.2 % but concentrated in the southern region and only the LTs of Beijing were less than 0.05 %. These figures indicate that the LTs of most cities had improved during 2000–2015. Moreover, the centre of the gravity of LTs had moved from the north to the south. In particular, the southern cities alongside the Beijing–Hangzhou Grand Canal developed rapidly with higher levels of socioeconomic development and urbanisation than did the northern cities.

To further explore the impacts of LTs on urban socioeconomic effects, this study used a coupling coordination analysis of LTs and socioeconomic benefits. As seen in Fig. 4, most cities had low-level coupling coordination degrees in EBs, SBs, and LTs in 2000, accounting for 40 % of the total number of cities. Only Beijing showed a high-level coupling coordination degree with a high number of LTs. Other cities, such as Dezhou, Jining, and Suqian, with a high number of LTs, had middle-level coupling coordination degrees. In 2015, most cities
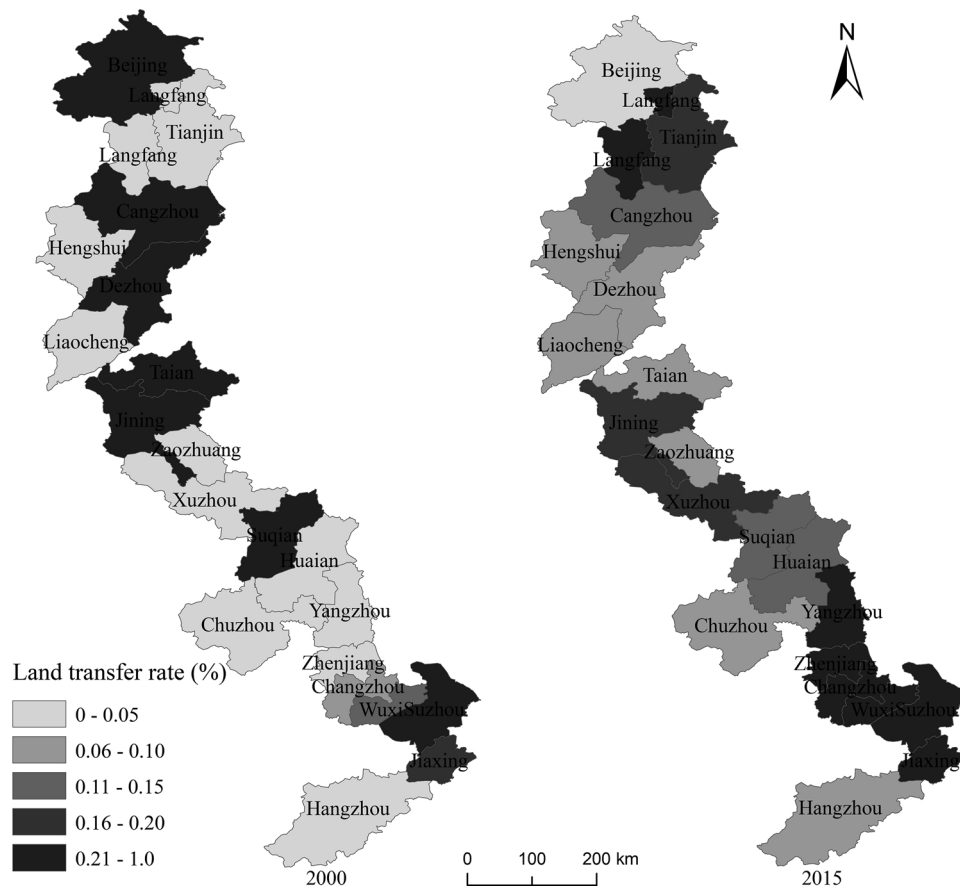
Fig. 3. LTs of cities alongside the Beijing–Hangzhou Grand Canal.

exhibited middle-level coupling coordination degrees, accounting for 65 % of the total number of cities. Located in the southern region of the Beijing–Hangzhou Grand Canal, the two cities, Changzhou and Suzhou, with high numbers of LTs had high-level coupling coordination degrees. Other cities had run-in coupling coordination degrees. Generally, the coupling coordination level between urban socioeconomic benefits and LTs in 2015 was higher than in 2000 and the influence of LTs on urban development increased from 2000 to 2015. However, most cities with

high numbers of LTs had middle-level and run-in coupling coordination degrees. The influences of LTs on urban development in these cities were lower than those in Beijing, Suzhou, and Cangzhou.

The influence of LTs on urban development shows that Beijing is the administrative centre, as the government transferred a substantial amount of state-owned land to developers for urban development in Beijing during 2000. More state-owned land was transformed for the purpose of commercial and residential use while the city continued to

Fig. 4. Coupling coordination between LTs and urban socioeconomic benefits.

attract a large number of people and expand. Because of guiding administrative forces, Beijing quickly became the centre of the northern region. Suzhou and Changzhou in the south experienced rapid industrial development in the early 21 st century. A large number of people were attracted to the southern region and the demand for land continued to increase. Thus, the government had to transfer more state-owned land, thereby promoting urban expansion. Over time, these two cities gradually became the economic centres in the south. The timing of LTs across both the northern and southern economic centres had important effects on urban development. Other cities, such as Cangzhou, Dezhou, Jining, and Suqian, in the central region had substantial numbers of LTs during 2000–2015. However, these cities had lower EBs and SBs than did Beijing and Suzhou because of a lack of appeal to the population. Although the government transferred a large area of state-owned land, labour shortages limited urban industrial development. In short, land transfers in the north and central cities, such as Beijing, are mainly driven by the government, whereas land transfers in the southern cities, such as Suzhou and Changzhou, are driven by the market. According to the coupling coordination analysis, we found that government-led and market-led LTs could promote urban development and the latter could be more sustainable than the former.

3.3. Game analysis of LTs

In the empirical analysis, EBs, SBs, and LTs experienced the same changes during 2000–2015. The socioeconomic benefits of all cities in the south increased as LTs increased, whereas those of most cities in the northern and central regions decreased as LTs decreased (Fig. 5).

According to game theory, EBs are composed of G1(D2), D1(C2 – D2 – D3), and C1 while SBs are composed of G2 and D3. The northern and central cities, such as Beijing, of government-led LTs excessively pursued population and land urbanization. Since 2000, much state-owned land has been transferred to develop real estate and the government has invested in the corresponding infrastructure and public service facilities. Investment funds were primarily drawn from land transfer fees (G1). The developer had to improve the prices of real estate (C2) for higher profits (D1). However, the wages (C1) of the consumers were far lower than C2. Some consumers residing in urban villages relied on land demolition compensations, which increased as land prices (G1) increased. Others had hoped to raise their incomes to purchase real estate, resulting in the increase in D3. Each of the player's behaviours caused housing prices and land prices to grow, and, once LTs were reduced, the socioeconomic benefits dropped significantly. In the future, as the number of consumers buying real estate decreases, the land prices (G1) and real estate profits (D1) will drop significantly. At the same time in the cities, there will be many social problems, such as urban villages without urban facilities, empty towns without industry, idle land, and unfinished construction projects.

The southern cities, such as Suzhou and Changzhou, of market-led LTs have promoted population and land urbanisation through industrial development. With the demand for economic development and population migration, the government has had to increase the LTs. In addition, the prices of transferred land (G1) were lower than those of government-led LTs for the developer while the corresponding infrastructure and public service facilities were built by the investments (G2 and D3) of both the government and the developer. Because of the developed economy, consumers (C1) received higher wages than did those in the north, increasing their ability to buy real estate. The lower land prices (D2) meant that the developer would not significantly increase the real estate prices (D1). Each player's behaviour controlled the land prices (G1) and the real estate prices (D1); thus, urban development is sustainable with a continuous increase in the LTs. In the future, the consumer will continue to purchase real estate at a steady rate while the land prices (G1) and real estate profits (D1) will remain stable or show only small increases, so the result will reach the Nash equilibrium (Table 3). However, the cities with market-led LTs do have some problems, including disorderly layouts of urban constructions and land scarcity caused by population and industrial agglomerations. Thus, the cities of market-led LTs require appropriate governance.

4. Discussion

In recent years, land urbanisation has been of great concern to scholars at home and abroad. Their research has mainly covered the spatial patterns and the evolution of land urbanisation (Cobbinah and Niminga-Beka, 2017; Pou et al., 2017), the influencing factors and driving mechanism of land urbanisation (Melia et al., 2018; Zhou et al., 2018), and regional human–land relationships (Fan et al., 2019; Tzortzakaki et al., 2019). The relationship between land urbanisation and urban development is mainly studied from an economic perspective. In most developed countries, land taxation is an important manifestation of land economic benefits (Almeida and Buainain, 2016), because these countries have perfect land transaction markets with relatively stable land transaction prices (Ortega-Pacheco et al., 2019),
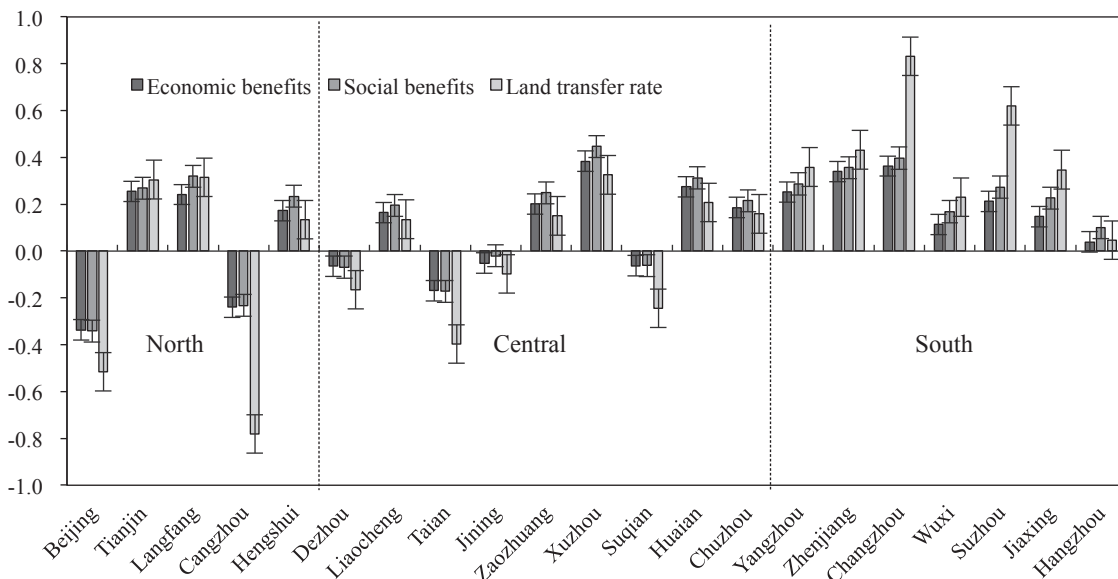

Fig. 5. Differences between the socioeconomic benefits and LTs rates during 2000–2015.

Table 3
Game changes of players.

Time	Earlier						Later						Future					
Players	Government		Developer		Consumer		Government		Developer		Consumer		Government		Developer		Consumer	
Government-led	G1↑	G2↑	D1↑	D2↑, D3↑	C1↑	C2↑	G1↑↑	G2↑	D1↑↑	D2↑, D3↓	C1↑	C2↓	G1↓	G2↑	D1↓	D2↓, D3↓	C1↑	C2↓
Market-led	G1↑	G2↑	D1↑	D2↑, D3↑	C1↑	C2↑	G1↑	G2↑	D1↑	D2↑, D3↑	C1↑	C2↑	G1→	G2↑	D1→	D2→, D3↑	C1↑	C2→

and their state-owned land is dominated by leasing, which has lower land benefits. In China, the system of transferring state-owned land is an essential achievement of socio-economic reforms, which have played a significant role in the economic growth of cities. In most cities, LTs fees are the primary sources of funding for large-scale urban constructions by the government (Gao et al., 2018). Thus, some experts believe that state-owned LTs have promoted the socio-economic development of the cities and provided the government with sufficient fiscal revenues. However, there are several severe social problems, including high real estate prices, government over-reliance, and unbalanced land acquisition compensation, regarding LTs. Other state-owned LTs are unsustainable and have a certain restrictive effect on urban development in later periods.

In this study, we explored the influence mechanism of land urbanisation on socio-economic benefits by applying game theory to analyse the coupling coordination relationship between LTs and socio-economic benefits. We used a combination of quantitative and qualitative analyses to investigate the socioeconomic benefits of land urbanisation by taking the Beijing-Hangzhou Grand Canal as a typical sample zone. The relationships between LTs and socio-economic benefits in different cities were analysed by using the coupling coordination model. The results revealed coupling coordination differences in LTs and socio-economic benefits, as well as the influence mechanism of LTs on urban development driven by the government and the markets, of which the latter could be more sustainable than the former because most market-led LTs are driven by the needs of industrial development and economic expansion, so their land prices are lower than those driven by administrative expansion. Developers would also implement lower real estate prices and the cities would attract more consumers to work and live while the government would also earn more revenue except for land transaction fees, such as industrial and personal taxes. If the government increases public facility inputs and controls land prices, then developers, consumers, and the government will achieve a Nash equilibrium while the relationship between LTs and urban development will achieve high-level coupling coordination. Government-led LTs will have higher land prices while developers will increase real estate prices. Although political location advantages can promote urban socio-economic development, high real estate prices will drive increasing numbers of consumers away from the cities. Developers, consumers, and the government will have huge conflicts of interest while the relationship between LTs and urban development will achieve low-level coupling coordination.

To ensure the sustainable development of land urbanisation and urban stability coordination, we offer some suggestions that draw on foreign experiences of land urbanisation.

Firstly, land urbanisation must be scientifically planned and LTs should be consistent with urban planning. Small cities should formulate LTs plans based on urban development and population needs, focus on infrastructure and public service facilities concerning LTs, and encourage more consumers to buy real estate through better essential services. At the same time, plans for rapid urbanisation should also consider rural development and strengthen rural constructions to achieve rural in-situ urbanisation while avoiding the loss of rural resources and young labourers, which contributes to a growing gap between urban and rural development. A land urbanisation plan should be adopted according to local conditions. The fast-developing areas can increase the scale of the LTs and the slow-developing areas can control

the scale of the LTs rather than blindly pursuing land urbanisation (Liu et al., 2018).

Next, the government should employ legal means to suppress land market prices. The marketisation of LTs promotes urban economic development and effectively allocates state-owned land. Because of different natural resource and environmental conditions, each city has its own population and industrial carrying capacity. In some smaller cities, state-owned land has been transferred excessively, accompanied by low levels of urban infrastructure and public service facilities, which have resulted in idle land and the oversupply of real estate. Some larger cities had high real estate prices that have resulted in affluent residents hoarding property and poorer consumers being forced to take loans to buy houses. Thus, the government should regulate housing prices by increasing taxes, for example, by levying higher taxes on consumers and developers who own multiple properties. In addition to taxation, a complete land trading market should be built. The market should set regular land market prices according to the scales of the social and economic development of each city. The government is responsible for coordinating market operations and reducing its financial dependence on land transition fees. Instead, it should vigorously develop transferred land through industrial transformation, such as developing the information technology industry and the service industry on such land.

Lastly, the land system reform needs constant innovation. China is the largest developing country and has the largest population in the world, but the total area of urban land is much smaller than that of rural land. Thus, the government should employ a rural revitalisation strategy by focusing more on the transfer of rural land and relieving urban pressure by developing rural economies and building rural facilities. On the one hand, it is necessary to strengthen real-name registrations of urban and rural land users and renters, as well as the ability to monitor the status of each area of land dynamically. On the other hand, it is crucial to formulate sound land management laws and take legal sanctions against people who have deserted and occupied multiple areas of transferred land. The government or land market should classify areas of land and set a uniform compensation standard for each level to provide a legal basis for land demolition or requisition. Land system reform should pay more attention to combined land conservation and intensive use, as well as the link between land space development and function, which is an important guarantee for sustainable land use and high-quality development.

5. Conclusions

Rapid land urbanisation plays a significant role in promoting urban social and economic development in a certain period. However, because of the lack of reasonable planning and control, problems such as uneven urban-rural development and unstable real estate markets have arisen. Using game theory with the government, developers, and consumers as the "players", this study explored the mechanism between LTs and urban development. On this basis, we verified the theoretical mechanism through empirical analysis by using a coupling coordination model. The government, as the land supplier, obtains funds through LTs and enhances public service levels. The developer increases economic efficiency by increasing housing prices. The consumer must spend more to meet the demands of living and developing. Thus, developers are the greatest beneficiaries of LTs and consumers' interests are usually affected negatively, ultimately hindering LTs. The government should

implement measures to regulate land prices and adjust the relationships between developers and consumers, as well as reform land systems. The research of land use should be adapted to local conditions. Land urbanisation should be coordinated with the development of society and the market rather than only being promoted by the government, which can improve land use efficiency and ensure the sustainable development of land urbanisation. Using the qualitative analysis of the game among the government, developers, and consumers while combining the quantitative relationship between land transfer and socio-economic benefits, this study provides a new idea to explore the mechanism of land transfer on socio-economic development, which has great theoretical significance and value to the sustainable use of land transfers and urban-rural integration.

CRediT authorship contribution statement

Jintao Li: Data curation, Writing - original draft, Writing - review & editing. **Zongfeng Sun:** Conceptualization, Methodology, Software, Visualization, Investigation.

Acknowledgments

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.landusepol.2020.104945.

References

Almeida, P.J., Buainain, A.M., 2016. Land leasing and sharecropping in Brazil: determinants, modus operandi and future perspectives. Land Use Policy 52, 206–220.

Angotti, T., 2013. Introduction: urban Latin America: violence, enclaves, and struggles for land. Lat. Am. Perspect. 40 (2), 5–20.

Cai, H.B., Wang, Z., Zhang, Q., 2016. To build above the limit? Implementation of land-use regulations in urban China. J. Urban Econ. 98, 223–233.

Chauvin, J.P., Glaeser, E., Ma, Y., et al., 2017. What is different about urbanization in rich and poor countries? Cities in Brazil, China, India and the United States. J. Urban Econ. 98, 17–49.

Cho, S.H., Wu, J.J., Boggess, W.G., 2003. Measuring interactions among urbanization, land-use regulations, and public finance. Am. J. Agric. Econ. 85 (4), 988–999.

Cobbinah, P.B., Niminga-Beka, R., 2017. Urbanisation in Ghana: residential land use under siege in Kumasi central. Cities 60, 388–401.

Fan, P.L., Ouyang, Z.T., Nguyen, D.D., et al., 2019. Urbanization, economic development, environmental and social changes in transitional economies: vietnam after Doimoi. Landsc. Urban Plan. 187, 145–155.

Gabbe, C.J., 2019. Changing residential land use regulations to address high housing prices: evidence from Los Angeles. J. Am. Plan. Assoc. 85 (2), 1–17.

Gao, J.L., Chen, W., Liu, Y.S., 2018. Spatial restructuring and the logic of industrial land redevelopment in urban China: II. A case study of the redevelopment of a local state-owned enterprise in Nanjing. Land Use Policy 72, 372–380.

Guo, Y.T., Wang, H.W., Nijkamp, P., et al., 2015. Space–time indicators in interdependent urban–environmental systems: a study on the Huai River Basin in China. Habitat Int. 45, 135–146.

Haeran, S., Sangwon, C., 2018. Urbanisation and land use transition in a second-tier city: the emergence of small factories in Gimpo, South Korea. Land Use Policy 77, 534–541.

Hemphill, T.A., 2010. Self-regulation, public issue management and marketing practices in the US entertainment industry. J. Public Aff. 3 (4), 338–357.

Hu, L.R., He, S.J., Han, Z.X., et al., 2019. Monitoring housing rental prices based on social media:an integrated approach of machine-learning algorithms and hedonic modeling to inform equitable housing policies. Land Use Policy 82, 657–673.

Hui, E.C.M., Shen, Y., 2006. Housing price bubbles in Hong Kong, Beijing and Shanghai: a comparative study. J. Real Estate Financ. Econ. 33 (4), 299–327.

Jusuf, S.K., Wong, N.H., Hagen, E., et al., 2007. The influence of land-use on the urban heat island in Singapore. Habitat Int. 31 (2), 232–242.

Kamphorst, D.A., Bouwma, I.M., Selnes, T.A., 2017. Societal engagement in Natura 2000 sites. A comparative analysis of the policies in three areas in England, Denmark and Germany. Land Use Policy 61, 379–388.

Li, Q., Chand, S., 2013. House prices and market fundamentals in urban China. Habitat Int. 40 (11), 148–153.

Li, W.B., Wang, D.Y., Li, H., et al., 2019. Quantifying the spatial arrangement of under-utilized land in a rapidly urbanized rust belt city: the case of Changchun City. Land Use Policy 83, 113–123.

Liu, Y.S., 2018. Introduction to land use and rural sustainability in China. Land Use Policy 74, 1–4.

Liu, Y.S., Yang, R., Li, Y., 2013. Potential of land consolidation of hollowed villages under different urbanization scenarios in China. J. Geogr. Sci. 23 (3), 503–512.

Liu, Y.S., Yang, Y.Y., Li, Y.R., et al., 2017. Conversion from rural settlements and arable land under rapid urbanization in Beijing during 1985–2010. J. Rural Stud. 51, 141–150.

Liu, Y.S., Li, J.T., Yang, Y.Y., 2018. Strategic adjustment of land use policy under the economic transformation. Land Use Policy 74, 5–14.

Marchetti, D., Oliveira, R., Figueira, A.R., 2019. Are global north smart city models capable to assess Latin American cities? A model and indicators for a new context. Cities 92, 197–207.

Melia, S., Chatterjee, K., Stokes, G., 2018. Is the urbanization of young adults reducing their driving? Transp. Res. Part A Policy Pract. 118, 444–456.

Murakami, J., 2018. The Government Land Sales programme and developers' willingness to pay for accessibility in Singapore, 1990–2015. Land Use Policy 75, 292–302.

Needham, B., 2016. Urban land rent: Singapore as a property state. Hous. Theory Soc. 34 (2), 1–2.

Ortega-Pacheco, D.V., Keeler, A.G., Jiang, S.G., 2019. Climate change mitigation policy in Ecuador: effects of land-use competition and transaction costs. Land Use Policy 81, 302–310.

Peng, C.W., Tsai, I.C., 2019. The long- and short-run influences of housing prices on migration. Cities 93, 253–262.

Pou, S.A., Tumas, N., Soria, D.S., et al., 2017. Large-scale societal factors and non-communicable diseases: urbanization, poverty and mortality spatial patterns in Argentina. Appl. Geogr. 86, 32–40.

Roth, A.E., 2010. The economist as engineer: game theory, experimentation, and computation as tools for design economics. Econometrica 70 (4), 1341–1378.

Salvati, L., Zambon, I., Chelli, F.M., et al., 2018. Do spatial patterns of urbanization and land consumption reflect different socioeconomic contexts in Europe? Sci. Total Environ. 625, 722–730.

Salvati, L., Zambon, I., 2019. The (Metropolitan) city revisited: long-term population trends and urbanization patterns in Europe, 1950-2000. Popul. Rev. 58 (1), 145–171.

Sealey, K.S., Binder, P.M., Burch, R.K., 2018. Financial credit drives urban land-use change in the United States. Anthropocene 21, 42–51.

Tan, R.H., Liu, Y.L., Zhou, K.H., et al., 2015. A game-theory based agent-cellular model for use in urban growth simulation: a case study of the rapidly urbanizing Wuhan area of central China. Comput. Environ. Urban Syst. 49, 15–29.

Tian, L., Ge, B.Q., Li, Y.F., 2017. Impacts of state-led and bottom-up urbanization on land use change in the peri-urban areas of Shanghai: Planned growth or uncontrolled sprawl? Cities 60, 476–786.

Tisdell, J., Harrison, S., 1990. Game theory and economic modelling. Econ. Anal. Policy 22 (2), 209–210.

Tzortzakaki, O., Kati, V., Panitsa, M., et al., 2019. Butterfly diversity along the urbanization gradient in a densely-built Mediterranean city: land cover is more decisive than resources in structuring communities. Landsc. Urban Plan. 183, 79–87.

Ye, J.Z., 2015. Land transfer and the pursuit of agricultural modernization in China. J. Agrar. Chang. 15 (3), 314–337.

Zhao, S.X.B., Zhan, H.Y., Jiang, Y.P., et al., 2017. How big is China's real estate bubble and why hasn't it burst yet? Land Use Policy 64, 153–162.

Zhou, T., Jiang, G.H., Zhang, R.J., et al., 2018. Addressing the rural in situ urbanization (RISU) in the Beijing–tianjin–hebei region: spatio-temporal pattern and driving mechanism. Cities 75, 59–71.

Zhou, Y., Guo, L.Y., Liu, Y.S., 2019. Land consolidation boosting poverty alleviation in China: theory and practice. Land Use Policy 82, 339–348.

Zienkiewicz, E., Okoński, M., Matuszewski, L., et al., 2014. Influence of urbanization level and gross domestic product on the prevalence of adolescent obesity in Poland. Ann. Agric. Environ. Med. 21 (1), 136–142.