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Analysis of an Urban Development Boundary Policy in China Based on the IAD Framework

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Abstract: Although urban growth control policies are widely adopted to help sustainable development in various countries, including China, few studies have been conducted to investigate the effectiveness and optimization of such policies in Chinese cities. Hangzhou, China, was chosen for this study as the research object, where the local authorities manage the urban sprawl via an urban development boundary policy. The institutional analysis and development (IAD) framework was employed to identify the conflicts between the central government and the local government as well as the developers and homebuyers in the formal/informal stage. The analysis shows that, with the implementation of the policy, problems such as fiscal crises, property inflation, and illegal construction will appear as a result of actors' interactions. The study also highlights that industrial land transfer inside the boundary should be controlled in a reasonable range and that a land value tax should be introduced during the implementation of the urban development boundary policy.

Keywords: urban development boundary; urban growth; land use; urban governance; sustainable development

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1. Introduction

Due to the continuous extension of traffic infrastructure to the periphery of cities, low-density developments appear in large numbers, leading to the unsustainable development of the economy and society. Countries all over the world have responded to the growing concern about the issues associated with urban sprawl by creating urban containment policies designed to manage urban growth and protect open space [1,2]. This phenomenon can be described as policy transfer, a process in which knowledge on policies in one place is used in the development of policies in another place [3].

An urban containment policy is broadly considered to be necessary for efficient land use and the promotion of sustainable development in rapidly changing cities. Specific urban containment policies are often named differently in practice (e.g., greenbelts, urban growth boundaries (UGBs), and urban development boundaries (UDBs)) [4] but share quite a few commonalities. The earliest urban containment policy was the "greenbelt", referring to the naturally undeveloped lands that surround urban areas. In 1935, green belt scheme was launched by local planning authorities. Cities that have successively implemented a greenbelt policy include Moscow, Berlin, Korea, and Toronto [5]. The urban containment policy in the United States uses an urban growth boundary, which is very similar to a greenbelt. An urban growth boundary was first implemented by the city of Salem in the United States in 1976. It is a boundary that separates urban areas from surrounding natural

and agricultural lands. Subsequently, cities in Oregon, Washington, and Tennessee also began to implement an urban growth boundary policy [6,7].

In China, a disorderly expansion dilemma has become the main stumbling block to reasonable and balanced development. Urban land in China has undergone extensive expansion since the early 1990s through economic system reform. Notably, land in the cities is owned by the state, not by individuals. Local governments do have the right to exercise state land ownership, and they are keen to transfer land for economic development [8]. According to statistics, the urban construction land area increased by 41.04% from 2010 to 2018, whereas the urban population increased by only 24.13%, approximately half the rate of land growth. For the sake of preventing the disorderly spread of urban development, the authorities stated that the supply of new construction land in the eastern region will be phased down in the future. The quota of new construction land will not be reallocated to megacities with a population of 5 million or above, except for residential land[1]. That is to say, the supply of new construction land in the east is supposed to be gradually reduced. In these circumstances, 14 cities, including Hangzhou, adopted an urban containment policy to reduce the enthusiasm of local governments for transferring land and limit urban land expansion during years of economic boom. The exact name of the policy is "urban development boundary", which has the same connotations as an urban growth boundary.

For years, scholars have debated the potential impact of an urban containment policy, which is broadly considered necessary for intensive land use in rapidly changing cities [9]. Cities rely on this policy to restrict the disorderly development of cities, preserve agricultural land, and maintain ecological goods and services [10,11]. Advocates of urban growth boundaries believe that they should be established by planners to constrain urban land expansion, increase the density of urban services, and preserve natural areas [12–14]. The defects of an urban containment policy have also sparked widespread discussions, particularly its spillover effect on housing prices. Numerous studies on the effects of an urban containment policy on urban housing markets have been conducted. Bae and Jun [15] suggest that boundary delineation has generated significant social problems, including densification, congestion, and housing shortages, in urban areas. Nelson [16] explains that a boundary creates another submarket that is outside the growth boundary and can be called an exurban land market. Opponents of urban containment policies, using methods such as two-stage quantile spatial regression, GIS, and Amemiya–MaCurdy models, argue that land use restrictions reduce the supply of residential land and affect the housing supply-and-demand equilibrium [17–19].

Although there are many possible shortcomings of urban containment policies, they have still worked quite well in some cities. An example is Portland, where the area has increased by only 14%, while the population has jumped by a remarkable 61%[2]. Since an urban containment policy has been a popular policy among regions because of constant urban growth, the following question inevitably arises: will an urban containment policy be effective in Chinese cities? The outcome of a policy transfer remains uncertain. Such uncertainty is the result of a crisis, political conflict, or a lack of information [20]. A policy transfer can be rational but only if the policy is compatible with the value system of the recipient region and builds on existing organizational strengths [21]. In this context, the effectiveness of an urban development boundary policy in Chinese megacities should be questioned.

During the process of urbanization, an urban development boundary policy is set in order to stem the tide of increasingly land-consumptive development [22]. Chinese scholars put a strong emphasis on research on urban development boundary policies. More attention is being paid to delimitation, and methods such as remote sensing technology, the CA model, and the Sleuth model are constantly being adopted to analyze the urban land use change and delineate boundaries [23–25]. Based on the particularity and complexity of urban spatial growth, delimitation always follows the rules in spatial structure guidelines [26]. However, few attempts have been made to discuss the effectiveness of and optimize the urban development boundary policy itself. Therefore, the aim

of this study was to investigate the effectiveness of the urban development boundary policy in China and explore the policy implications by using the IAD framework. Research priority was given to evaluating the operation process of the urban development boundary policy, which is beneficial to finding the root cause and then to solving the subsequent problems. A comparative analysis is also included in the discussion of the action arena, actors, and their interactions in the selected research area.

The remainder of this paper is organized as follows. Section 2 describes the methods and materials used in the research. Section 3 outlines the choice of Hangzhou as a research object in the analysis of the urban development boundary policy's ineffectiveness using the proposed framework, which contains the exogenous variables, action arena, and interactions in the action arena. Section 4 contains a discussion and suggestions for improving the function of the urban development boundary policy, including the introduction of taxation and land usage regulation. Section 5 concludes this study.

2. Methods and Materials

The success or failure of a policy remains uncertain without an initial comprehensive evaluation. A policy will be functional only when it provides a feasible method of operation while being applicable empirically to specific areas to conform to the local policy environment [27]. Thus, the question of whether or not existing policies can shape key aspects of politics and policymaking should be discussed. A more systematic understanding needs to be developed not only on the institutional level but also in the broader context that determines management decisions and their outcomes.

In this study, the IAD framework was used as a basic analysis framework to discuss the effectiveness of an urban development boundary policy. IAD evolved out of the studies of scholars involved in the Workshop in Political Theory and Policy Analysis of Indiana University [28]. This framework explains how exogenous variables (e.g., application rules) influence policy outcomes during autonomous governance on public pod resources, which can be utilized to improve existing institutional arrangements [29]. Thus, we primarily used the institutional analysis and development (IAD) framework to assess the urban development boundary policy in Hangzhou. The data used in this study were sourced from a combination of the China Statistical Yearbook and official documents for local urban planning.

External variables for policy analysis include biophysical condition, community attributes, and rules in use. An urban development boundary policy is established to address intensive land use. A broad range of land beyond the urban development boundary is forbidden from being developed. Developed countries entered the stable urbanization stage many years ago. Thus, governments have observed drastic changes to land as a result of cities' expansion and a series of urban and social problems, including inefficient land use, food insecurity, and environmental deterioration. Accordingly, an urban development boundary policy was designed and implemented in order to limit the extension of key public facilities or restrict urban development beyond a well-defined urban boundary [30]. We can conclude that the urban development boundary policy emerged in a situation where city growth was considered to have occurred randomly.

Given the above, the biophysical conditions for an urban development boundary policy must include the resource endowment and socioeconomic development. Therefore, the regional economic situation, urbanization, and natural resources can be used to describe the biophysical condition [31,32]. The attributes of a community involve the hierarchical structure of the power of the government and features of interest groups that are most likely to be affected by a proposed intervention or affect the results of the intervention [33,34]. Changes in the behavior of interest groups as they adjust to and look for the opportunities presented by multi-area policymaking may threaten existing communities. Thus, "interest groups" represent the attributes of a community. The rules in use refer to the urban development boundary policy as a method for managing urban expansion and rationalizing urban growth.

2.1. Action Arena Design

The IAD framework requires the establishment of an action arena in which interest groups interact with each other. Each interest group holds their own views. On various occasions, the groups may or may not share the same stance. Evidently, they pursue their respective profits and show a diverse performance. This is referred to in the present study as a game among actors whose choices directly affect the final consequence. The action arena in urban growth management is a market in which the government, developers/enterprises, and purchasers interact with one another. Strategic interactions among these actors have long been a crucial issue in public policy [35]. Growth control is closely interconnected to properties. Thus, purchasers were divided into two types, namely type I and II homebuyers. Type I homebuyers are buyers who aim to be owner–occupiers, whereas a type II homebuyer refers to a speculative buyer.

The analysis attaches immense importance to the results of an action in an actual urban expansion control process. Accordingly, the following questions should be answered. Does the urban development boundary policy serve growth management purposes? Has the urban development boundary policy influenced the housing requirements and caused a potential shortfall in residential land supply? Can the urban development boundary policy promote sustainable development? These questions will be answered in the action assessment from the perspective of housing prices, efficiency, and sustainability.

2.2. IAD Framework Materialization

The original IAD framework focuses on an action arena that results in interactions and outcomes. Urban growth management is a complex system in which different groups participate and interact with one another. The framework is depicted Figure 1. It consists of external variables, interactions in the action arena, and an outcome evaluation. The revised framework for an urban development boundary policy can be described as an action arena in which the external variables act. The central government, the local government, developers, and homebuyers interact with each other, and the results of their collaborative interaction are evaluated by certain criteria. Finally, strategies are proposed according to the results to change the exogenous variables, thereby affecting the action arena and making the policy implementation effective.

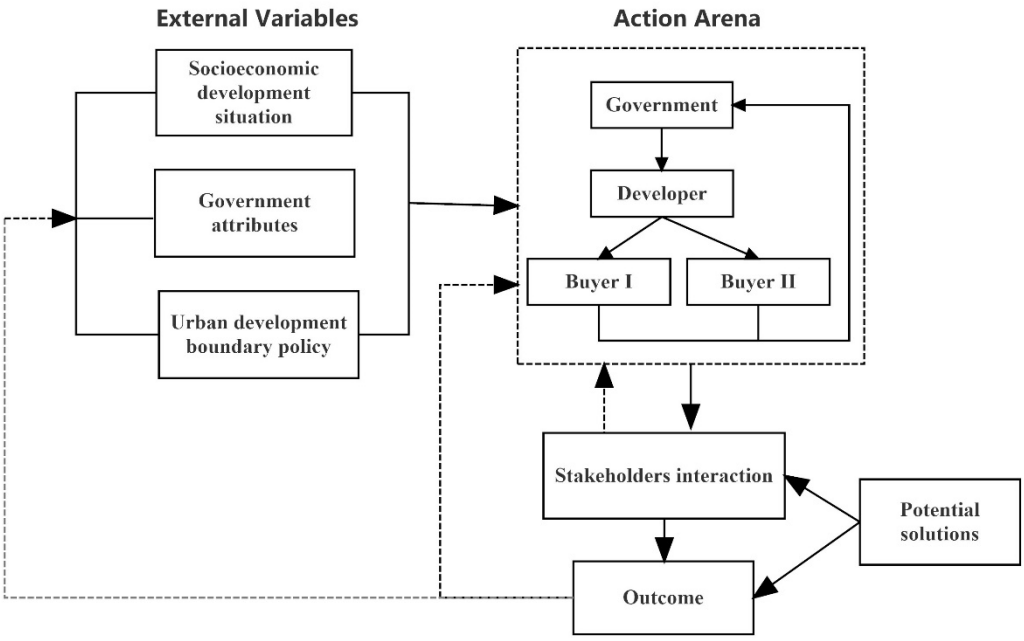

Figure 1. Framework materialization for an urban development boundary policy.

3. Case Study

3.1. Object of Study

The current case study is focused on Hangzhou, China and explores the transferability of an urban containment policy. Located on the southeast coast of China, Hangzhou is one of the crucial tourist cities (see Figure 2). It is famous for its natural beauty and historical and cultural heritage. Moreover, Hangzhou is an advanced city with immense potential for further growth that attracts a large floating population. Many migrant workers flock to this city in the pursuit of a high quality of life because of the unequal distribution of living and production resources between rural and urban areas [36]. The permanent population of Hangzhou exceeded 11.94 million in 2020 and the urbanization rate in the same year reached 76.2%.

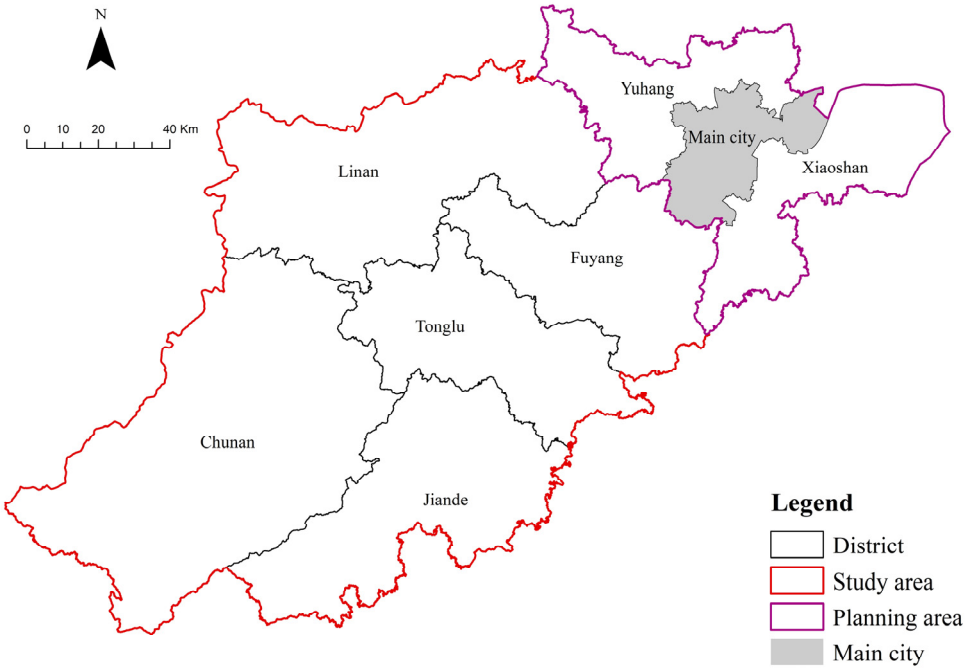

Figure 2. Urban morphology of Hangzhou, China.

3.2. Exogenous Variables

Exogenous variables include resource endowment and socioeconomic development situation. In this section, the regional economy, legal system, and land tenure system of Hangzhou are explained.

3.2.1. Socioeconomic Development Situation

Hangzhou achieved a GDP of 1610 billion CNY in 2020, up by 3.9% over the same period during the previous year. Regarding industrial structures, the tertiary industry accounted for more than 68% of the GDP, while the primary industry only accounted for 5% of the GDP. Figure 3 shows the GDP per capita in Hangzhou from 2000 to 2020. Obviously, the economic growth in Hangzhou steadily increased year by year. In 2000, the per capital GDP of Hangzhou was 22,342 CNY (the monetary unit in China); in 2020, Hangzhou ranked first in terms of economic growth in Zhejiang Province with a per capita GDP of 136,617 CNY. Hangzhou is representative of the rapid economic development in China. This proves that Hangzhou is quite similar to those cities that have already applied an urban development boundary policy successfully in terms of economic status.

Moreover, Hangzhou has undergone a period of unprecedented population growth since the turn of the 21st century. Many migrant workers have flocked to the cities in pursuit of a high quality of life due to the unequal distribution of living and production resources between rural and urban areas. Hangzhou is an advanced city with immense potential for

further growth that attracts a large floating population. In 2020, the urbanization rate in Hangzhou reached 83%. However, most people who have relocated do not receive the same treatment in terms of housing, employment, and social welfare as the townsfolk because of the dual structure of the urban and rural areas in the census registry in China [34]. This is called the dual household registration system, which is a household registration system that distinguishes between agricultural and non-agricultural household registrations in a legal sense. People in a non-agricultural household can obtain more resources and enjoy better public services, while people in agricultural households cannot. This inequality is not caused by the differences in the individual abilities of citizens but is simply because of the differential registration of households. Even if a migrant has lived in the city for years, they may not be able to live in a non-agricultural household; however, there are always more opportunities in the city than there are in rural areas. Thus, many people come to the cities, and numerous skyscrapers adorn the urban landscapes, which will continue to grow in the future.

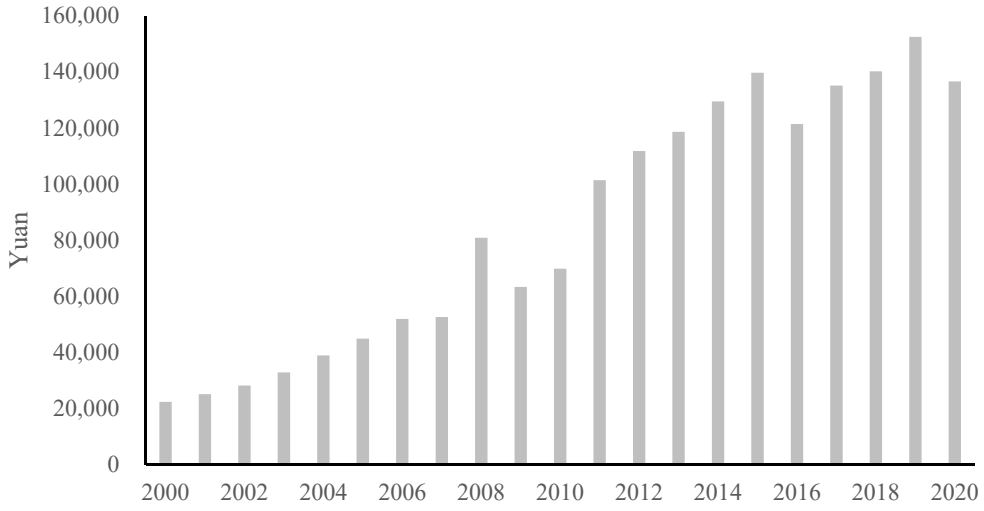

Figure 3. GDP per capita in Hangzhou.

3.2.2. Government Attributes

The legal system in Hangzhou, China has civil law or continental law jurisdictions; the main source of the law is legislation, and its core principle is to organize the law in a systematic manner. That is to say, judges are required to enforce the law strictly as it is written. To facilitate an understanding of the law, we introduced another legal system, namely common law. Common law is conceived of as all-inclusive and complete. Judicial decisions are the source and proof of the law; such pronouncements are made in connection with the actual cases. The United States has a common law system. Different legal systems affect the approaches to the development of executive branch authorities' systems.

Public administration in relation to land resources is an area that depends on the principles enshrined in the state land policy [37]. The land tenure systems in China and the United States are considerably different. Approximately 58% of the land in the United States belongs to individuals, and land owners enjoy permanent land property rights. Transactions involving land are regulated by law. In China, land use rights and land ownership were made separate during the reform of land policy in the early 1980s [38]. The Land Administration Law of 1986 states that land in the urban areas of a city shall be owned by the State, while that in rural areas or suburban areas of a city shall be owned by the farmer collectives. However, the law fails to define who comprises the farmer collectives [39] and forbids rural land from being leased for non-agricultural construction and assignment. By contrast, the State can expropriate land from farmers lawfully. Thus, the government is the only supplier of land to developers in the land market. In short, Chinese authorities hold both land ownership and land development rights.

3.2.3. Urban Development Boundary Policy

In contrast to regions where an urban development boundary policy has been applied for many decades, urban development boundary delineation was conducted in 14 large Chinese cities, including Hangzhou, in 2014. This was because, during the first 12 years of the 21st century, China had the highest rate and largest magnitude of urban expansion in the world [40]. The greatest contribution was made by the economic determinants, especially in megacities [41]. The land expansion situation in Hangzhou, which is representative of the economically developed cities, is also very poor. Figure 4 shows the distribution characteristics of built-up land and the population in Hangzhou in 2000 and 2014. The built-up land data were collected from the "Global Human Settlement Layer", and the population data were obtained from CIESIN Gridded Population of the World version 4. The expansion of built-up land mainly appears around the original central town. The geographical distribution of the population is very similar to that of the built-up land. During these 14 years, the total population increased from 6.8 million to 9.4 million with an annual growth rate of 2.3%. The area of land increased from 710 to 1121 km^2 with an annual growth rate of 3.3%, nearly 1.5 times the population growth rate. From this point of view, Hangzhou is in a relatively extensive stage of land use.

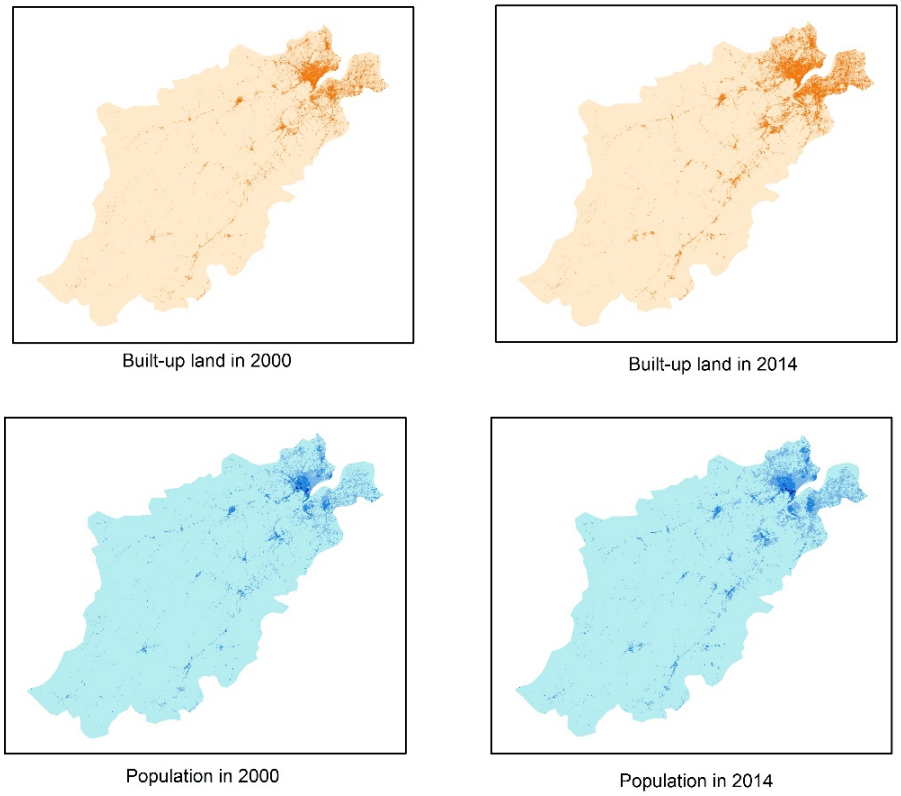

Figure 4. Built-up land in and population of Hangzhou in 2000 and 2014.

Therefore, in the revised version of Hangzhou's city master plan for 2001–2020, the urban–rural space is divided into three types: the strict protection zone, the controlled development zone, and the space expansion zone. In the strict protection zone, development activities that do not meet the functional positioning and protection requirements are prohibited. No non-agricultural construction land projects can be arranged. This rule also applies to the controlled development zone unless the construction project is officially approved. Generally, non-agricultural construction is carried out in the space expansion zone. The boundary between the strict protection zone and the controlled development zone is the basis for drawing the urban development boundary. The land area within the urban development boundary covers 35% of the total area, and the area outside the

boundary accounts for 65% of the total area. In order to implement the urban development boundary policy effectively, the city master plan stipulates that, by the end of the 13th Five-Year Plan (2016–2020), the area of land used for urban construction in Hangzhou Central Districts should not exceed 430 km^2. However, during the 12th Five-Year Plan (2011–2015), the urban construction land area increased from 374 to 418 km^2, a total increase of 44 km^2. In 2016, the area of land used for urban construction was 459 km^2. Therefore, complying with the urban development boundary policy is a challenge to Hangzhou.

3.3. Interactions in the Action Arena

During the interaction process, based on interest groups' preferences, mandates, benefits, and costs, the participating actors will respond in a way that allows them to achieve the goals.

3.3.1. Actors

Different actors have their own views on the urban development boundary policy. They pursue their respective profits and show a diverse performance. This is referred to in the present study as a game among actors. Actors' choices in the game will directly affect the final consequence. As mentioned earlier, the urban development boundary policy's backers believe that an urban development boundary can control urban growth and preserve open space, and the main reason for opposition to the urban development boundary is that it will drive up housing prices. Therefore, we conclude that the actors in the action arena of the urban development boundary policy's implementation include the central government, the local government, developers, and homebuyers. Here, we divide homebuyers into two types, namely type I and II homebuyers. Type I homebuyers are homebuyers who aim to be owner–occupiers, whereas type II homebuyers are speculative buyers.

To sum up, the present situation of land expansion in Hangzhou, the urban development boundary policy, and actors make up the action arena of the urban development boundary policy's implementation. First of all, the land area has been expanding for a long time because of the economic boom and population agglomeration. Secondly, the urban development boundary policy in Hangzhou remains in the "initial stage" of implementation. Finally, five types of actors are involved.

3.3.2. Formal Stage: Goals and Conflicts of the Government

The game stage of the actors closest to policymaking and policy implementation is defined as the formal stage. Therefore, formal stage actors include the central government and the local government. The central government uses urban development boundary policy to control urban growth and limit the size of big cities. Although the appearance of metropolitan areas seems to have brought prosperity to society, resources such as skilled workers and promising industries move in incessantly from small cities. For metropolitan areas, an increase in the population scale fills up the old localities and makes them crowded, and new localities need to be developed along with metro areas, which then spread out continually [42]. Small cities are unlikely to be well developed because of the shortage of resources. As time goes by, imbalances in the urban spread and regional development will affect the stability of the country. Therefore, the central government is pressing to apply an urban development boundary policy to control the scale of the big cities.

For local government, however, things are different. Local governments pay more attention to performance appraisal and, currently, performance appraisal is mainly based on economic indicators [43]. Thus, the goal of the local government is to promote economic growth. Public choice theory also confirms that the basic motivation of politicians is to pursue their personal interests instead of an urgent public interest. Adequate local finance is a prerequisite for economic development. Land finance has become an important component of the disposable financial resources from which the local government gains fiscal revenues. The land tenure system confers on the local government the right to lease the land to developers with land transfer fees. From this point of view, local governments

are not active in the urban development boundary policy's implementation for it constrains land supply, which in turn reduces local revenues. This represents the conflict between the central government and the local government in the formal stage.

3.3.3. Informal Stage: Goals and Conflicts of Developers and Type I and II Homebuyers

Developers and type I and II homebuyers do not directly participate in the formulation and implementation of the policy. Therefore, we call the stage in which they are involved an informal stage. Real estate developers are interest groups that gain benefits from the market economy. This group's power, compared with type I and II homebuyers, is particularly strong. It is known that real estate development experiences lag. Enterprises may develop land several years after they first obtain it from the local government. In contrast to housing prices, the majority of the lands reserved by enterprises are acquired at a low price. Such an immense profit gap attracts many real estate investors. Thus, a fair proportion of developers are willing to accept the urban development boundary policy. Once the supply of land is limited, the original land, once in their hands, may become more valuable than before. This is also the case for type II homebuyers. Their houses are worth more after the urban development boundary policy's implementation. The proportion of property speculators in Hangzhou should not be underestimated. Instead, the purchasing power of type I homebuyers will be relatively reduced. According to the "China Financial Stability Report (2019)", Hangzhou's residents' leverage ratio reached 103.2%, making it the only city in the country with a leverage ratio of over 100%. In short, developers and type II homebuyers are optimistic about the urban development boundary policy, while type I homebuyers do not believe the policy can benefit them.

3.4. Results of the Interactions

It is evident that the built-up area in Hangzhou has been expanding for many years. The urban development boundary policy is therefore highly strict in terms of land supply control. The legal system in Hangzhou is civil law. The core principle of this law is organization in a systematic manner, which means that developing areas that fall outside the boundary is almost impossible. The urban development boundary policy remains in the initial stage of implementation in Hangzhou, and the actual results of its implementation have not yet been observed clearly from the objective reality. With the help of the method of analysis described above, however, we can derive some real possible outcomes.

3.4.1. Potential Fiscal Crisis

Urban growth can help the local government gain sufficient fiscal revenue. Once the urban development boundary policy is implemented, the local financial revenue decreases because of the reduction in the amount of available land for lease. Local financial revenue includes general public budget revenue and fund budgetary revenue. General public budget revenue comprises local tax revenue. fund budgetary revenue includes the fees from the lease of state-owned land and special funds. Despite the wide variety of sources of fund budgetary revenue, most income derives from the lease of land. For example, the amount of local financial revenue and fund budgetary revenue in Hangzhou has been increasing since 2010. In 2020, the former exceeded 385 billion CNY and the latter reached 140 billion CNY. Overall, fund budgetary revenue accounted for 36% of the local financial revenue. Obviously, revenue from the lease of land is an important part of the special fund budgetary revenue, which is quite essential to the government's budget. There is no doubt that the government at the local level desires more land to be leased [44].

However, the land transfer fee collected by the current local government is unlikely to benefit the next local government. If the urban boundary policy is fully implemented, the total amount of revenue obtained from the lease of land will be restricted. When the previous government sells more land and obtains more revenue, the next government's revenue, in a relative sense, will fall. This kind of intergenerational inequity in land

finance is certainly going to trigger a fiscal crisis panic. As a result, resistance to the urban development boundary policy's implementation may form.

3.4.2. Potential Escalating Housing Prices

The positive correlation between an urban development boundary policy's implementation and property inflation has been extensively studied [15–19]. A common view of the relationship is that the urban development boundary policy triggers an aggregate housing price increase directly through the land supply constraint, which leads to property inflation. Here, we attempt to challenge this stereotypical "urban development boundary–housing prices" view. The actual reason for property inflation is that land supply control leads to considerable speculative demand for housing, and the property prices rise thereafter.

Figure 5 shows how actors' choices change when housing prices are affected by an urban development boundary policy's implementation. The original economic equilibrium based on the balance of supply and demand is drawn as point E. The land supplier in Hangzhou is the government. On the demand side, the population in the urban region increases as the city expands due to the economic boom and population agglomeration. The curve of the housing demand moves to the right, that is, from DD to D'D'. Such a demand increase comes from type I homebuyers, who purchase for self-occupation. In terms of supply, no construction land is added due to the urban expansion control policy, and the supply curve remains as SS. However, the new balance is not E'. Due to land constraints, the amount of available housing becomes limited. Therefore, type II homebuyers have a positive view of future housing prices, which increases the number of speculative purchases. Hence, the demand curve D'D' moves to D"D". Lastly, the equilibrium point falls in E", and the housing prices move to PE" from PE.

Moreover, property inflation in Hangzhou may become even worse if the urban development boundary policy is fully implemented due to the current severe housing inflation. Table 1 compares the property prices of some major cities in the world. The values of the "price-to-income ratio" in China's megacities are higher than those in major cities in developed countries. It can clearly be seen that people in megacities such as Hangzhou experience great pressure to purchase houses. Based on some reports, housing prices in Hangzhou have increased by 172% in the past decade.

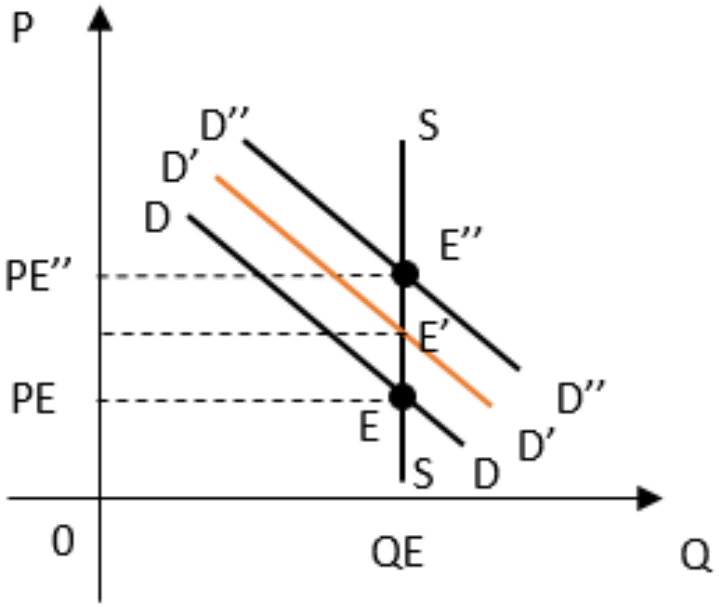

Figure 5. The effect of actors' choices on housing prices.

Table 1. Property prices in 10 major cities of the world.

City	Price-to-Income Ratio	Price-to-Rent Ratio—City Center	Price-to-Rent Ratio—Outside of the City Center
Beijing	48.09	76.02	61.02
Shanghai	43.96	52.26	55.58
Hong Kong	42.54	50.32	51.94
Mumbai	28.65	41.83	34.61
Hangzhou	22.96	46.59	38.64
London	22.25	35.96	28.75
Seoul	20.43	56.2	56.53
Tokyo	13.34	41.89	35.56
New York	12.46	19.09	17.38
Portland	5.11	12.04	11.27

3.4.3. Potential Illegal Construction Outside of the Urban Boundary

The highest transaction cost of the urban development boundary policy in China can be seen in the regulatory process. The local government's attitude towards the urban development boundary policy's implementation is somewhat negative. Housing prices escalate due to the urban development boundary policy's implementation. In some other countries under a common law system, the urban development boundary policy is occasionally elastic [2]. An example is in Bristol, where greenbelt boundaries can be altered in exceptional circumstances. A few different objectives for the use of land in the greenbelt are permitted after an application is approved. To date, no official document in Hangzhou stating that an urban development boundary policy can be altered in exceptional circumstances has been issued. Considering the conflicts between the central government and the local government, between the urban population size and housing demand, and between developers and homebuyers, it is not hard to imagine that illegal construction outside of the boundary could occur.

4. Discussion

The government has begun to explore efficient policies to control urban sprawl during high-quality urban development. Although Hangzhou's urban development boundary policy is still in the initial stage of implementation, it is still necessary to conduct an analysis of the policy. The environment of Chinese megacities is similar, and the analysis of exogenous variables and actors' interactions may apply to those cities. This means that the problems mentioned above may be general. Solving these problems and ensuring the effectiveness of the policy are keys to the next step. Hence, in this section, recommendations and possible solutions are put forward to improve the urban development boundary policy's implementation.

4.1. Inside the Border: Restricting Industrial Land Transfer

Results from the analysis of the actors' interactions show that the implementation of the urban development boundary policy could cause a fiscal crisis and property inflation. This finding is consistent with some previous research. During the process of its urbanization, many people have come to Hangzhou seeking a better quality of life, even though the urban population in Hangzhou already accounts for 76.2% of its total population. The local government should provide some assistance, such as jobs and houses, to the floating population [45]. Official performance in China is measured by GDP, which represents economic growth. Thus, GDP could be improved by transferring industrial lands to attract investments. An industrial area can accommodate industrial companies and provide job opportunities to local people [46]. The total amount of available construction land reduces as the implementation of an urban expansion control policy continues. However, intense competition for foreign investments among cities still exists, thereby indicating that the industrial land price is low and that the mass transfer of industrial land cannot be changed

immediately. Thus, governments should prefer to avoid a future decrease in industrial land provision and eventually reduce the supply of housing land. This type of land may be sold at a high price to achieve a fiscal balance. Thus, the issue of insufficient housing may emerge, and housing prices could increase further.

Mandatory rules from the states on the proportion of different types of land use in land leasing should be issued inside the border. Industrial land transfer within the boundaries needs reasonable control, and the amount of residential land leased must be guaranteed. A scientifically determined proportion coupled with a reliable monitoring mechanism is necessary to discourage authorities from constructing industrial parks.

4.2. Outside the Border: Introducing a Land Value Tax

Another problem caused by the implementation of the urban development boundary policy that needs consideration lies outside the border. Hangzhou employs a civil law system. This means that, without exception, neither governments nor developers are allowed to carry out construction activities outside the boundary because these activities violate the Planning Act. Thus, someone who wants to develop land but cannot obtain a judicial decision is liable for illegal land use. At present, the urban expansion control policy is mandatory, and no case law exists. Many scholars have called for the scale of the urban development boundary to not be used as a binding indicator [47,48]. If the boundary's scale is a strictly binding indicator, it can be considered that if significant illegal land use outside of the boundary does occur, forcible demolition could not happen because the local government lacks the autonomy to apply the urban expansion control policy.

Figure 6 shows the revenue loss when the urban expansion control policy was implemented during a period of urban growth. In Figure 6, V denotes the value for urban use, Va denotes the value for agricultural use, and D denotes the distance from the center. The relationship between V and D at time t1 can be described as I1. The price of land near the center becomes substantially higher as urbanization emerges, and the new distribution changes into I2 at time t2. The government can receive A+B profits from the lease of land. However, this component of the earnings is lost because the urban boundary restricts urban development to within D1 as a result of the urban expansion control policy. Most cities and provinces in China remain over-reliant on land sales, and the loss of land transfer fees makes governments reluctant to implement an urban expansion control policy.

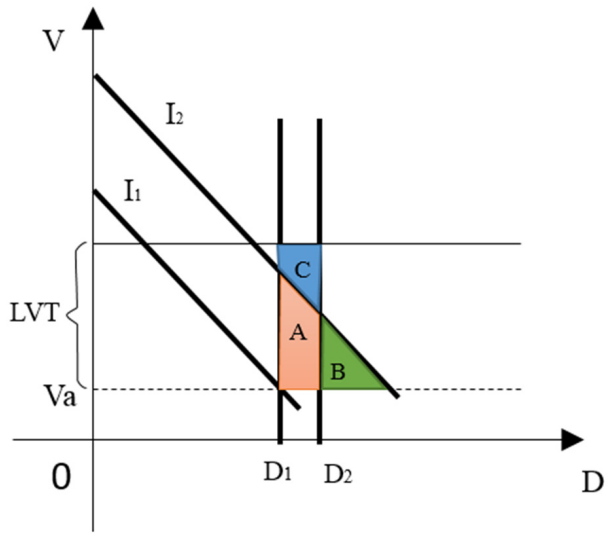

Figure 6. The effect of UCP with the introduction of a LVT.

Alternatively, a land value tax (LVT) estimated based on the underlying land value and the use of the land increases the benefits that the government gains from transferring agricultural land to urban construction land [49]. If a LVT is added to land transfer activities

outside of the boundary, then local authorities earn A+C profits with the cost of a relatively small parcel of land beyond the border, thereby moderating the government's resistance. LVTs enhance information opacity, thereby resulting in a high cost of information to type II homebuyers (speculators). The expectations for housing supply vary from person to person given that no one knows whether a specific site outside of the boundary has been developed. Therefore, speculation is curtailed, and housing prices decrease. The purchasing power of type I homebuyers correspondingly increases.

However, a companion problem that relates to LVTs is the potential for rent-seeking behavior. Therefore, land transfer activities beyond the boundary should be market-oriented, and the related laws must allow for applications from developers who want to develop land with an additional tax. Case-by-case judgment is a highly essential support tool that plays a role in a fair and equitable approval process.

Through a comparison between the original policy and the improved policy, it can be found that restricting industrial land transfer and introducing a land value tax may be favorable to an effective implementation of an urban development boundary policy (see Table 2).

Table 2. Comparison between the original policy and the improved policy.

	Initiative of Local Government	Information Cost to Homebuyer II	Purchasing Power of Homebuyer I	Local Financial Revenue Loss	Property Inflation	Illegal Construction
Original policy	Negative	Decreased	Weak	Severe	Severe	Increased
Improved policy	Improved	Increased	Strengthened	Moderate	Moderate	Improved

5. Conclusions

This study explored the effectiveness and optimization of the urban development boundary policy in Hangzhou, China using the IAD framework, which comprises the analysis of exogenous variables, interactions, and corresponding outcomes. The results show that there exist conflicts between the central government, the local government, developers, and homebuyers in the formal/informal stage. Moreover, the special economic development phases, the land tenure system, the legal systems, and actors' interactions were found to induce undesirable consequences during the urban development boundary policy's implementation. First, a fiscal crisis panic trigged by the intergenerational inequity in land finance will play a role in the local government's willingness to support the urban development boundary policy. Second, land supply control will produce considerable speculative demand for housing, and the property prices will rise thereafter. Lastly, illegal construction outside of the boundary will occur because of the high transaction cost of the regulatory process and the government's passive attitude towards the urban development boundary policy.

When the policy is implemented, governments will be inclined to transfer industrial land because industrial areas can accommodate industrial companies and provide job opportunities to locals. They will prefer to reduce the supply of residential land since the amount of land that they can supply is fixed. Thus, it becomes necessary to restrict the amount of industrial land transferred inside the boundary to mitigate property inflation due to the changes in supply and demand. Furthermore, given that land finance has become an important component of the local disposable financial resources, the government will lose revenue when the urban expansion control policy is implemented. It is therefore advised to add a LVT and case law to the rules outside the boundaries in the urban development boundary policy to compensate for this loss and promote government initiatives that reduce speculative activities.

This study contributes to the literature on the effectiveness of urban development boundary policies in Chinese megacities. It also provides an analysis framework for

public policy studies relating to urban land control. However, the urban development boundary policy is still in the early stage of implementation. The analysis in this study was only conducted in the context of current regulations. Further investigation that measures the urban expansion before and after the urban containment policy's implementation is recommended.

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1. More information available at http://www.gov.cn/govweb/gzdt/2014-01/13/content_2565170.htm (accessed on 1 May 2021).
2. More information available at https://modernfarmer.com/2016/09/portland-urban-growth-boundary/ (accessed on 1 June 2021).

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