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Article

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Journal of Urban Management

Provided in Cooperation with:

Chinese Association of Urban Management (CAUM), Taipei

Suggested Citation: Lai, Shih-Kung (2020) : Effects of land use plans on urban development: a property rights approach, Journal of Urban Management, ISSN 2226-5856, Elsevier, Amsterdam, Vol. 9, Iss. 1, pp. 1-5,
<https://doi.org/10.1016/j.jum.2019.12.002>

This Version is available at:

<https://hdl.handle.net/10419/271371>

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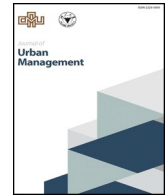
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Editorial

Effects of land use plans on urban development: A property rights approach



1. Introduction

Cities are the outcomes of individual spatial decisions that interact with each other (Batty, 2019). To understand how cities evolve, it is fundamental to understand the land development behavior of individual agents *and* how they interact. The usual difficulties in modeling the land development process are that the process involves so many participants with conflicting perspectives, and that it is almost impossible to characterize the behavior of the participants in a common framework. For example, the process can be described in terms of decision sequences, focusing on how decisions are made in the process, or using a production-based approach, which emphasizes how the final products are established (Gore & Nicholson, 1991). Given the idiosyncratic characteristics of the land development process depicted in different descriptive models, we argue that two elements are pervasive in any type of land development process: information and property rights.

A land development process is usually divided into four phases: acquisition, approval, construction, and letting. In the first phase, the developer must locate a parcel of land that might yield profit from the project. Once the land is secured, the process enters the second phase, in which the developer must apply for the necessary permits. Construction commences in the third phase. In the fourth phase, the final output after construction is then sold or leased on the market in order to yield profit for the developer. As argued by Schaeffer and Hopkins (1987), in each phase, planning yielding information is conducted with respect to environments, values, and related decisions. Plans are made and revised as sets of related, contingent decisions based upon the information gathered. As a result, the land development process is a sequential decision making problem, with the decisions made in each phase being contingent on those to be made in the future. To clarify the roles that information and property rights play in the land development process, we focus in this editorial on the first phase: land acquisition. Interpretations of behaviors during the other phases can be made in a similar fashion.

Property rights play an important role in the land development process, so it is useful first to define property rights. Property rights are the powers to consume, obtain income from, and alienate the assets over which the owners have the rights (Barzel, 1991). Thus, the property rights over a parcel of land are the powers to use the land to make a profit through cultivating, improving, or exchanging it. According to Barzel, however, property rights are, in reality, impossible to delineate completely in any exchange. Thus, transaction costs arise due to incomplete information about the attributes of assets. For example, in making investment decisions, developers usually acquire information about the locational advantages of parcels of land with a certain amount of cost. This implies that some of the attributes of exchanged goods, unknown to either party involved in the exchange, are left in the public domain, such that the exchanging parties are motivated to capture these attributes during the exchange.

This is particularly true in land transactions, regardless of the types of land tenures involved. More specifically, the property rights to a parcel of land can be divided into fixed legal rights and variable economic rights. Whereas fixed legal rights are those legally protected by the government, such as documented ownership of the land, variable economic rights are the attributes of the land affecting its valuation, such as its accessibility via transportation networks. Because the fixed legal property rights usually incur the fixed cost of land acquisition as indicated by land prices, we argue that it is the variable economic property rights that fundamentally affect how and why developers proceed in the land development process. If the economic property rights were not taken into account in the land development process, the developer would be indifferent between two parcels of land with the same amount of fixed legal costs but differing in terms of other attributes. However, this is obviously not the case in reality, regardless of the types of land tenures involved.

Consider the case of a developer looking for an appropriate parcel of land for a certain type of development during the first phase of the development process. The attributes of each parcel of land vary depending on its location, land price, geological conditions, access to public facilities and infrastructure, the socioeconomic conditions of the surrounding environment, landscape, amenities, and environmental considerations. No two parcels of land are identical, and the methods used to measure these attributes are expensive

<https://doi.org/10.1016/j.jum.2019.12.002>

Available online 06 January 2020

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and often imperfect in their results. As a result, complete information about land attributes is prohibitive in cost to obtain, which results in positive transaction costs. Put another way, both of the exchanging parties will expend resources in order to measure the attributes of the land before deciding whether to proceed with the exchange. After the transaction cost expenditures, the prospective developer and the owner of the land will each obtain only a certain, incomplete amount of the information about these attributes. The information obtained by both parties will be incomplete because the information obtained will be asymmetric, or at least different, in nature because the complete measurement of all attributes of a parcel is, again, prohibitively costly.

As a result, some attributes are unspecified and left in the public domain. For example, an owner might conceal a high crime rate in the community where the land is located, while a developer might be secretly informed of a public transit facility that will be constructed near the property, thereby increasing the value of the land. Consistent with this, we argue that, in deciding which parcel of land to acquire for development, a developer will seek to secure the land from which he or she can maximize the value of property rights by capturing those left in the public domain.

Before effecting an exchange, a prospective developer and owner invest resources into gathering information about the attributes of the land in question in order to reduce uncertainties/risks. These investments are the major source of transaction costs. Thus, planning in the form of information gathering occurs during each transaction. It is worth noting, relatedly, what information the exchanging parties should gather and how they should proceed in gathering it. According to [Friend and Hickling \(1987\)](#), [Hopkins \(1981\)](#), and [Schaeffer and Hopkins \(1987\)](#), a developer is faced with four types of uncertainties: uncertainty about the environment, uncertainty about values, uncertainty about related decisions, and uncertainty about the search for alternatives. In the land development context, before land acquisition, the developer is uncertain about whether the investment will yield net gains. Such gains are dependent on the trends affecting the surrounding environment of the land, government policies concerning future community development, related development decisions of other developers and the government, and the possible final outputs of built forms. All these different types of information influence the profit-yielding attributes of the land under consideration.

As argued earlier, the complete measurement of the attributes of a parcel of land is prohibitively expensive since the measurement process itself incurs costs. Therefore, uncertainties cannot be eliminated completely, and the planning, i.e. information gathering, that occurs requires the investment of resources. Planning produces additional information for the developer and landowner, and the value of that information consists of the discrepancy between the expected values of outcomes with and without that information. As a result, whether the developer should engage in planning depends on whether the increase in the value of the information produced by the planning exceeds the costs of conducting the planning. In a case of land acquisition, if planning with respect to the attributes of parcels of land at different locations results in an increase in the expected value of the property rights captured from the public domain that exceeds the cost of conducting the planning, then said planning is worthwhile and should be conducted by the land developer.

In deciding whether the developer should plan, the information relevant to the four types of uncertainty that is gathered through any planning must be specified a priori. That is, the developer must determine beforehand what information to gather. It has been proven that the information must be payoff relevant and sufficiently accurate; that is, it should consist of information affecting expected gains in making decisions ([Lai, 2002](#)). The proof in question was based on the notion of optimal information structures that would yield the highest expected utility given a best action. These conditions provide a useful guideline for information gathering in reality. In the land development context, the developer should acquire the information that is related to the value of the property rights captured in the land exchange, and that both accurately measures the attributes of the land and accurately predicts possible consequences resulting from the exchange.

In short, the seemingly idiosyncratic process of land development can indeed be described as a sequence of property rights-capturing activities. By completing the contractual exchange, the developer captures the property rights in terms of the land attributes that are not fully delineated and are left in the public domain. The transaction costs incurred in the exchange result mainly from information gathering or planning concerning the measurement of these attributes or the reduction of uncertainties. Since that measurement is costly, not all planning activities yield benefits; rather, any benefits are dependent on whether the information gathered exceeds the cost of conducting the planning. Since uncertainty cannot be eliminated completely, it follows that some property rights are always left in the public domain and that the capturing of these rights will always occur in any land development process, regardless of how much is invested in planning. In the next section, a hypothetical case study is provided as an example of how land use plans can be analyzed using the proposed method, while Section 3 depicts a conceptual model of urban development derived from the concepts introduced in the first two sections. Section 4 then discusses some possible extensions of the model, and Section 5 provides the main conclusions.

2. Effects of Land Control of land use plans: an example

As a concrete example of how the property rights approach to land development can be used to interpret developers' behavior in response to changes in land policy, such as policies relating to land use planning, consider a city with various land uses that are subject to public land controls. Suppose that initially all land uses are legally permissible and that the land prices are determined through the market mechanism. In this hypothetical example, imposing a land control policy, such as one relating to land use planning, that would limit all land uses to a single particular use, for example, residential use, would be similar to imposing price controls on the land market. How would a developer react to such a land control policy?

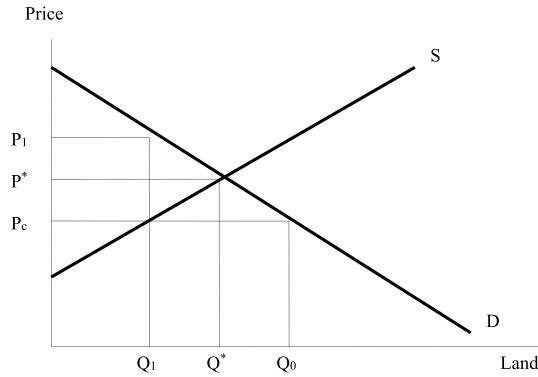


Fig. 1. Effects of land control as indirect price control.

In Fig. 1, the initial demand and supply curves for land are shown as D and S. Viewing land as an intermediate, not the final, good of the land development process, the developer is on the demand side and the landowner is on the supply side. The market clearing price for land is P^* , with the associated amount of land exchanged being Q^* . Assume that a new land control policy regarding land use planning that limits all land uses to residential uses is initiated, indirectly imposing a price limit of land setting at P_c . The demand shifts from Q^* up to Q_0 , while the supply shifts from Q^* down to Q_1 . However, the developer is willing to pay up to P_1 to secure the land, and there seems to be a shortage of $Q_0 - Q_1$ amount of land in the marketplace. The difference in the amount between $P_1 \times Q_1$, consumers’ willingness to pay for the total amount of transacted land, and $P_c \times Q_1$, the amount consumers actually pay for the transacted land, is dissipated in the public domain without identified recipients.

The implication is that the developer is willing to pay that amount to purchase government issued bonds in order to acquire additional land. As argued by Barzel, the rationing of any type of good with a limited supply, for example, by waiting or queuing, is not caused by a “shortage” of the supply of the particular good as traditionally conceived by economists. Instead, the shortage of the particular good in the market is a result of the consumers’ maximization principle of capturing dissipated property rights. The same argument was applied to gas station owners’ reactions toward the oil crises during the 1970s. Other behavioral predictions can be derived in response to a land control policy by conducting analyses similar to the above analysis using the property rights approach.

3. A conceptual model of urban development

In this editorial, we focused on the interaction between a local government and a developer in making plans as a starting point. More complicated situations can be developed in the future based on the simplified model. Knaap, Hopkins, and Donaghy (1998) constructed a game-theoretic model to examine the logic and effects of land use planning. Their model provides useful insights into how plans could affect the behaviors of local governments and developers in a game situation, and they suggest various hypotheses for empirical testing. In their model, perfect rationality is assumed in that both the local government and the developer behave in order to maximize the value of the objective functions. However, while perfect rationality is powerful in the logic of the model, it is far from reality. In this editorial, therefore, we assumed that the local government and the developer behave according to bounded rationality. That is, neither the local government nor the developer is rational in the classical economics sense. An iterated prisoner’s dilemma game can be used to model the interaction more realistically. That is, the local government and the developer are the two players in the prisoner’s dilemma game, with property rights in land as the payoffs, as shown below:

		Developer	
		Cooperate	Defect
Local Government	Cooperate	R, R	S, T
	Defect	T, S	P, P

Note that $T > R > P > S$, and that these letters represent payoffs measured in terms of property rights in land. The local government could either regulate (cooperate) or not regulate (defect) on the uses of a piece of land, while the developer could either invest (cooperate) or not invest (defect). The Nash equilibrium for the game is for the local government not to regulate, while the developer does not invest. However, it will increase the benefits for both if the local government regulates and the developer invests. If the two players iteratively play the game indefinitely, cooperation might emerge so that the outcome would be for the local government to regulate, while the developer invests (Axelrod, 1984). It would be interesting to examine what would happen in the

situation if either the local government or the developer plans their moves, or if both plan their moves. In the iterated prisoner's dilemma game, no player has perfect foresight as to how the other player will behave; thus, bounded rationality is assumed.

Unlike traditional payoff tables in which the payoffs are well-defined, we treat these payoffs in our conceptual model as property rights related to land, as depicted earlier. Therefore, even in the case of a strictly non-cooperative, pure conflict, the game is non-zero sum because both players can acquire rights in the public domain, such that one player's loss is not necessary the other's gain. This assumption is more reasonable in realistic economic exchanges. Planning has different substantive meanings for the local government and the developer respectively. For the local government, planning means gathering information to make linked decisions about whether to regulate, while for the developer, it means gathering information to make linked decisions about whether to invest. The rights of owning and leasing a parcel of land can be treated as a bundle of rights that are attributable to the payoffs in the payoff table. By distinguishing the two different types of ownership structure of land, we can investigate how the iterated prisoner's dilemma game of urban development would evolve in a situation in which planning and property rights play a central role. Empirically testable hypotheses can be derived from such a modeling approach to understand how different land ownership structures would affect planning, and thus urban development.

4. Discussion

The attributes of land are a central element of the property rights approach to land development. They are a function of inter-related decisions made by infrastructure providers, developers, landowners, and households. Therefore, the attributes associated with a parcel of land vary depending on the mutual adjustments made by the participants in the land development process. For example, infrastructure providers, usually government, can affect the attributes of a parcel of land by constructing sewers and water mains near the site. For a developer, forecasting and planning for the interrelated development decisions in the dynamic context can yield benefits in terms of captured property rights.

Planning is interpreted as a tool for coordinating decisions in order to reduce transaction costs (Alexander, 1992). One of the major functions of firms is to serve a similar purpose because organizations are another means by which to coordinate decisions. The property rights approach can be used to enhance our understanding about organizations by viewing skills, equipment, and labor as assets over which some decision-makers have rights. Most land development behavior is conducted through organizations. It is then possible to incorporate planning into organizational behavioral theory based on the property rights approach, so that planning behavior can be more fully understood in the context of the land development process. For example, the interactions of members in an organization can be viewed as property rights maximization processes in which people tend to acquire such rights left in the public domain in the form of skills, equipment, and labor.

As depicted in the hypothetical example, given the theoretical framework about the property rights approach to land development, we can anticipate potential behavioral reactions of developers in response to changes in land policy regarding land use planning and make predictions about how such a policy would affect urban development in different social and political settings. The theoretical basis for linking the micro-to macro-level urban spatial processes is provided (Webster & Lai, 2003) in that cities are viewed as self-organizing systems spatially and institutionally, and that property rights acquisition is a fundamental phenomenon within such spatial processes. The theoretical framework proposed here about a property rights approach to land development can thus readily be translated into a systemic view of self-organizing spatial processes of urban development.

5. Conclusions

We have proposed a conceptual framework of land development behavior based on a property rights approach in which information and property rights are two fundamental elements. The approach is so powerful that land development in the private sector of urban areas can be interpreted as a sequence of development decisions for capturing property rights left in the public domain through the acquisition, approval, construction, and letting phases, regardless of the lengths of land tenure systems in China. We have shown a hypothetical case in which the rationing of land due to a price control policy is not caused by a "shortage" of land in the market, but by the developer's capturing of dissipated property rights that resulted from that policy. We also outlined a game-theoretic approach to depicting the interaction between a local government and a developer through the prisoner's dilemma game, incorporating property rights into the dynamic model as measured by the payoffs in the game. The proposed model is sufficiently rich that insights into how land tenure systems and land use plans in China would affect urban development and how such plans should be made to improve urban development in China can be derived from the proposed modeling approach.

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