



# Urban Planning and Land Market Regulation in the Oriental Region of Morocco : An Empirical Case Study

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**Abstract :** Urban planning and land market regulation are key policy instruments through which public authorities influence spatial development, land allocation, and socio-economic equity. In developing and emerging economies, rapid urbanization combined with weak regulatory enforcement and institutional fragmentation often results in speculative land practices, inefficient land use, and growing socio-spatial disparities. Morocco exemplifies these challenges, particularly in its peripheral regions.

This paper examines the interaction between urban planning instruments and land market regulation in the Oriental region of Morocco. It adopts an integrated analytical framework that combines urban economic theory, institutional analysis, and spatial econometric modeling. The study draws on bid-rent theory, hedonic price modeling, and spatial econometrics to analyze the determinants of urban land prices and the role of planning and regulatory mechanisms. Due to limited access to parcel-level land transaction data, the empirical analysis relies on a simulated dataset calibrated using Moroccan empirical studies, institutional reports, and regional planning documents. The dataset reflects realistic distributions of land prices, accessibility, infrastructure provision, zoning status, and socio-economic characteristics. Descriptive statistics, hedonic regressions, and spatial econometric models are used to assess both direct and spillover effects of planning decisions on land values.

The results show that zoning status, infrastructure provision, and accessibility exert strong and statistically significant effects on land prices. Spatial dependence is substantial, indicating that land price dynamics are influenced by neighborhood effects and spatial spillovers. Policy simulations suggest that isolated planning interventions may reinforce spatial inequalities, while integrated planning and land market regulation strategies lead to more balanced and sustainable urban development.

**Keywords :** Urban planning ; Land market regulation ; Hedonic pricing ; Spatial econometrics ; Land governance ; Oriental region ; Morocco.

## 1. Introduction

### 1.1 Urbanization and Land Market Pressures

Urbanization is one of the most significant structural transformations of the contemporary world economy. According to international estimates, more than half of the global population currently lives in urban areas, and this proportion is expected to increase steadily over the coming decades. Rapid urban growth has intensified

pressure on land markets, particularly in developing countries where planning systems and regulatory frameworks often struggle to adapt to demographic and economic change.

Urban land represents a scarce and strategic resource. It is simultaneously a production factor, a financial asset, and a social good. As cities expand, land markets become arenas where public policy objectives, private investment strategies, and social needs intersect. In the absence of effective regulation, urban land markets tend to generate speculative behavior, inefficient spatial patterns, and unequal access to urban services.

Urban planning and land market regulation therefore play a central role in guiding urban development. Planning instruments define land-use rights, densities, and development conditions, while regulatory mechanisms influence land supply, transaction costs, and price formation. Their interaction largely determines urban spatial structure and long-term sustainability.

### 1.2 Urban Planning as a Market-Shaping Mechanism

From the perspective of urban economic theory, planning is traditionally justified as a corrective response to market failures. Classical models highlight the inability of unregulated markets to internalize externalities related to congestion, environmental impacts, and infrastructure provision. Zoning, development control, and public investment are designed to coordinate private decisions and promote socially desirable outcomes.

However, planning interventions also reshape land market dynamics. By altering development rights and accessibility, planning decisions directly influence land values and expectations. Numerous empirical studies demonstrate that zoning changes and infrastructure investments generate substantial land value increments. When these gains are captured privately rather than redistributed, planning may inadvertently fuel speculation and exacerbate inequality.

### 1.3 Urbanization and Land Markets in Morocco

Morocco has experienced rapid and sustained urbanization since the 1960s. The national urbanization rate has increased from less than 30% to over 60%, driven by rural–urban migration, population growth, and economic restructuring centered on urban areas. Urban expansion has largely followed a horizontal pattern, characterized by peri-urbanization and extensive land consumption.

Urban planning in Morocco is based on a hierarchical system of instruments, including national spatial strategies, urban master plans (SDAU), and local development plans (PA). Despite this formal framework, implementation gaps remain significant. Informal settlements, unauthorized subdivisions, and mismatches between planned land uses and market demand persist, particularly in peri-urban areas.

**Table 1. Urbanization and Land Market Indicators in Morocco**

Indicator	2000	2010	2023
<b>Urban population share (%)</b>	55	60	63
<b>Annual urban land consumption (ha)</b>	3,200	4,100	5,000
<b>Share of informal urban expansion (%)</b>	22	25	27
<b>Average urban land price growth (%)</b>	6.5	8.2	9.1

Source: Calibrated from UN-Habitat (2016) and World Bank (2020); informal expansion from Navez-Bouchanine (2012).

### 1.4 The Oriental Region: A Peripheral Case

The Oriental region, located in northeastern Morocco, occupies a peripheral position within the national urban system but has experienced significant urban growth over the past two decades. Cities such as Oujda, Nador, Berkane, and Taourirt have expanded rapidly due to public investment programs, housing demand, and remittances from the Moroccan diaspora.

Urban expansion in the region has largely taken place in peri-urban zones, where planning enforcement is weaker and land tenure regimes are more complex. These conditions have contributed to fragmented urban forms, rising land prices, and difficulties in infrastructure provision.

Table 2. Selected Socio-Economic Indicators – Oriental Region

Indicator	Oriental Region	National Average
Urban growth rate (%)	2.9	2.1
Unemployment rate (%)	15.2	11.8
Share of peri-urban development (%)	41	28
Average land price (MAD/m <sup>2</sup> )	2,300	3,100

Source: Regional planning documents; CESE (2024); Benkirane (2014)

The main objective of this study is to analyze how urban planning and land market regulation influence land price dynamics and spatial development in the Oriental region of Morocco.

The paper addresses the following research questions :

1. What are the main determinants of urban land prices in the Oriental region ?
2. How do planning instruments such as zoning and infrastructure provision affect land values ?
3. To what extent do spatial spillovers influence land price formation ?
4. Which regulatory strategies promote more balanced and sustainable urban development ?

Table 3. Analytical Framework and Research Design

Component	Approach
Theoretical basis	Bid-rent theory; Hedonic pricing
Empirical method	OLS; Spatial lag and error models
Data	Simulated parcel-level dataset (n = 200)
Policy analysis	Scenario-based simulations

Source: Author's synthesis based on Alonso (1964), Rosen (1974), Anselin (1988).

### 1.6 Structure of the Paper

The remainder of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature on urban land markets and planning. Section 3 presents the theoretical and econometric framework. Section 4 describes the study area, data, and methodology. Section 5 reports empirical results and spatial analysis. Section 6 discusses policy simulations and implications, and Section 7 concludes.

## 2. Literature Review

### 2.1 Classical Foundations of Urban Land Economics

The analysis of urban land markets is deeply rooted in classical urban economic theory, which conceptualizes land as a scarce resource allocated through market mechanisms shaped by accessibility, location, and transport costs. One of the most influential theoretical contributions is the **bid-rent theory** developed by Alonso (1964). This framework explains how land rents decline with distance from the central business district (CBD), as households and firms trade off accessibility against land costs.

The monocentric city model assumes competitive land markets, rational agents, and a single employment center. Although highly stylized, this framework has provided a durable analytical foundation for understanding urban spatial structure. Subsequent extensions by Mills (1972) and Muth (1969) incorporated housing production, income differentiation, and density gradients, thereby increasing the model's empirical relevance. Despite criticisms regarding its simplifying assumptions, bid-rent theory remains widely used as a conceptual benchmark. In developing-country contexts, where transport infrastructure is often uneven and employment remains concentrated, distance-based land price gradients frequently persist.

Table 4. Classical Urban Land Economics : Key Contributions

Author	Model / Concept	Core Insight	Relevance for This Study
<b>Alonso (1964)</b>	Bid-rent theory	Land rent declines with distance	Justifies distance variables
<b>Muth (1969)</b>	Housing production	Density and housing choice matter	Links land and housing
<b>Mills (1972)</b>	Urban equilibrium	Income and location interaction	Explains price gradients

Source: *Alonso (1964); Muth (1969); Mills (1972)*.

## 2.2 Hedonic Price Theory and Land Market Analysis

While bid-rent theory emphasizes accessibility, **hedonic price theory** provides a more flexible empirical framework. Formalized by Rosen (1974), the hedonic approach treats land prices as the outcome of multiple attributes bundled into a single market price. Each attribute reflects an implicit price corresponding to households' or firms' willingness to pay.

Hedonic models allow researchers to decompose land prices into structural, locational, neighborhood, and regulatory components. This makes them particularly suitable for analyzing urban land markets characterized by heterogeneity, regulatory intervention, and uneven infrastructure provision.

In developed economies, hedonic models have been widely applied to estimate the capitalization of public amenities, environmental quality, and transport infrastructure into land and housing prices. In developing countries, they have proven especially valuable for identifying the effects of informality, infrastructure deficits, and planning interventions.

Table 5. Hedonic Price Models in Land Market Research

Study Context	Main Attributes Included	Key Findings
<b>Developed countries</b>	Accessibility, amenities, environment	Strong capitalization effects
<b>Developing countries</b>	Infrastructure, informality, zoning	Large regulatory price gaps
<b>Moroccan cities</b>	Distance, services, neighborhood	Zoning and access dominate

Source: *Freeman (2003); Gibbons & Machin (2005); Zakaria et al. (2021)*.

## 2.3 Spatial Dependence and Spatial Econometrics

A major limitation of traditional hedonic models is the assumption that observations are independent. In reality, land prices exhibit strong **spatial dependence**: prices in one location influence, and are influenced by, prices in neighboring areas. This occurs through neighborhood effects, shared infrastructure, expectations, and market signaling.

Spatial econometrics provides a formal framework to address this issue. Anselin (1988) introduced diagnostic tools such as Moran's I and Lagrange Multiplier tests to detect spatial autocorrelation. Two dominant model specifications are widely used:

- **Spatial Lag Model (SAR)**: captures price spillovers between locations.
- **Spatial Error Model (SEM)**: accounts for omitted variables that are spatially correlated.

Empirical studies consistently show that ignoring spatial dependence leads to biased and inefficient estimates of land price determinants.

Table 6. Spatial Econometric Models in Land Market Studies

Model	Source of Spatial Dependence	Policy Interpretation
<b>SAR</b>	Price spillovers	Planning impacts diffuse spatially
<b>SEM</b>	Omitted neighborhood effects	Hidden spatial inequalities

Source: *Anselin (1988); LeSage & Pace (2009)*.

#### 2.4 Urban Planning, Zoning, and Land Value Creation

Urban planning plays a central role in shaping land values by defining development rights, land uses, and densities. Zoning regulations, in particular, determine whether land can be developed and at what intensity, thereby directly influencing its market value.

Empirical evidence shows that up-zoning, infrastructure provision, and planning approvals generate significant land value increments. These increments are largely produced by public decisions rather than private investment. When planning-induced gains are captured privately, planning may unintentionally reinforce speculation and inequality.

This phenomenon has motivated the development of **land value capture** instruments, including betterment levies, development charges, and land readjustment schemes. Such mechanisms aim to redistribute planning-generated gains and finance public infrastructure.

#### 2.5 Institutional Economics and Land Market Regulation

Beyond planning instruments, land markets are embedded in institutional and regulatory frameworks. Institutional economics emphasizes that land transactions depend on property rights, legal certainty, administrative procedures, and governance quality (North, 1990).

Secure property rights are often viewed as a prerequisite for efficient land markets. However, evidence from developing countries suggests that formalization alone does not guarantee equitable outcomes. In contexts where regulation is weak, formalization may facilitate speculation and land concentration.

Land market regulation typically involves :

- Subdivision control,
- Land registration and titling,
- Taxation of land and transactions,
- Public land management.

The effectiveness of these instruments depends on institutional coordination and enforcement capacity.

**Table 7. Land Market Regulation Instruments**

Instrument	Objective	Common Challenges
<b>Zoning control</b>	Guide land use	Selective enforcement
<b>Land titling</b>	Legal security	High transaction costs
<b>Property taxation</b>	Limit speculation	Weak valuation systems
<b>Public land policy</b>	Stabilize supply	Governance constraints

Source: North (1990); De Soto (2000); CESE (2024).

#### 2.6 Empirical Evidence from Moroccan Cities

Empirical research on land markets in Morocco has expanded over the past decade but remains geographically concentrated. Most studies focus on major metropolitan areas such as Casablanca and Rabat.

Hedonic analyses consistently identify distance to employment centers, infrastructure provision, and neighborhood characteristics as key determinants of land prices. More recent studies incorporating spatial econometric methods confirm the presence of strong spatial autocorrelation.

Institutional analyses emphasize land tenure complexity and gaps between formal planning and actual development, particularly in peri-urban areas.

#### 2.7 Peripheral Regions and Knowledge Gaps

Peripheral regions such as the Oriental region remain underrepresented in empirical research. Existing studies suggest that land markets in such regions are more volatile due to:

- Weaker institutional capacity,
- Greater dependence on public investment,
- Higher land tenure complexity.

Infrastructure projects and planning decisions may therefore have disproportionate effects on land prices, often triggering speculative behavior in anticipation of future development.

## 2.8 Synthesis and Analytical Implications

The literature reviewed highlights several key conclusions :

1. Urban land prices are shaped by both market forces and public interventions.
2. Planning instruments are powerful creators of land value.
3. Spatial dependence is a fundamental feature of land markets.
4. Institutional quality critically mediates planning outcomes.
5. Peripheral regions remain empirically understudied.

These insights justify the integrated analytical framework adopted in this study, which combines hedonic modeling, spatial econometrics, and policy simulation to examine land market dynamics in the Oriental region.

## 3. Theoretical and Mathematical Framework

### 3.1 Analytical Rationale

This section presents the theoretical and mathematical framework used to analyze the interaction between urban planning, land market regulation, and land price formation in the Oriental region of Morocco. The framework integrates three complementary strands of urban analysis : classical urban economic theory, hedonic price modeling, and spatial econometrics.

The rationale for combining these approaches is threefold. First, urban land prices are simultaneously influenced by accessibility and regulatory constraints. Second, land markets exhibit strong spatial interdependence due to neighborhood effects and market signaling. Third, planning variables such as zoning and infrastructure provision may be endogenous to land price dynamics, requiring careful econometric treatment.

### 3.2 Bid-Rent Theory and Urban Spatial Structure

#### 3.2.1 The Monocentric City Model

Bid-rent theory, originally developed by Alonso (1964), provides a foundational explanation of how land rents vary across urban space. In its simplest formulation, the city is assumed to be monocentric, with economic activity concentrated in a central business district (CBD). Households and firms compete for land based on their willingness to pay for accessibility.

The bid-rent function can be expressed as:

$$R(d) = Y - C - T \cdot d$$

where:

- $R(d)$  is the land rent at distance  $d$  from the CBD,
- $Y$  denotes income or output,
- $C$  represents fixed production or construction costs,
- $T$  is the transportation cost per unit of distance.

The model predicts a negative land rent gradient with increasing distance from the city center. Although the monocentric assumption is stylized, empirical studies consistently confirm the relevance of accessibility in explaining land price differentials.

#### 3.2.2 Relevance for Moroccan and Peripheral Cities

In Moroccan cities, particularly in peripheral regions, urban structure is often polycentric and shaped by uneven infrastructure provision. Nevertheless, accessibility to administrative centers, transport corridors, and economic hubs remains a major determinant of land values. In this study, bid-rent theory is therefore used as a conceptual benchmark rather than a literal spatial description.

**Table 8. Bid-Rent Theory : Conceptual Implications for Empirical Modeling**

Theoretical Element	Empirical Proxy	Expected Effect
<b>Distance to CBD</b>	Distance (km)	Negative
<b>Transport cost</b>	Accessibility index	Positive
<b>Income/productivity</b>	Neighborhood income proxy	Positive

Source : *Alonso (1964); Mills (1972).*

### 3.3 Hedonic Price Modeling of Urban Land

#### 3.3.1 Conceptual Foundations

Hedonic price theory, formalized by Rosen (1974), conceptualizes land prices as the outcome of multiple attributes bundled into a single market price. Each attribute contributes implicitly to the observed price according to agents’ willingness to pay.

The general hedonic price function is expressed as:

$$P_i = f(X_{i1}, X_{i2}, \dots, X_{ik})$$

where:

- $P_i$  is the price of land parcel  $i$ ,
- $X_{ik}$  represents parcel-specific attributes.

This framework is particularly suitable for urban land markets characterized by heterogeneity in location, infrastructure provision, zoning status, and socio-economic conditions.

#### 3.3.2 Baseline Hedonic Specification

Based on the literature and Moroccan institutional context, the baseline hedonic model adopted in this study is specified as:

$$P_i = \alpha + \beta_1 D_i + \beta_2 I_i + \beta_3 A_i + \beta_4 Z_i + \beta_5 S_i + \epsilon_i$$

where:

- $P_i$ : land price (MAD/m<sup>2</sup>),
- $D_i$ : distance to urban center (km),
- $I_i$ : infrastructure index,
- $A_i$ : accessibility index,
- $Z_i$ : zoning status (1 = buildable),
- $S_i$ : socio-economic characteristics,
- $\epsilon_i$ : error term.

Each coefficient  $\beta_k$  represents the marginal implicit price of the corresponding attribute.

**Table 9. Hedonic Model Variables and Expected Signs**

Variable	Definition	Expected Sign
<b>Distance</b>	Distance to center (km)	-
<b>Infrastructure</b>	Composite index (0–10)	+
<b>Accessibility</b>	Travel-time-based index	+
<b>Zoning</b>	Buildable land (dummy)	+
<b>Socio-economic</b>	Income/employment proxy	+

Source: *Rosen (1974); Moroccan hedonic studies.*

### 3.4 Urban Planning and Regulatory Variables

Urban planning and land market regulation enter the hedonic framework through variables that are directly influenced by public policy. Zoning status captures planning decisions regarding development rights, while infrastructure and accessibility indices reflect public investment choices.

These variables are central to the analysis because they represent **policy-controllable determinants** of land prices. Their inclusion allows the model to evaluate how planning decisions translate into economic outcomes in the land market.

### 3.5 Spatial Econometric Modeling

#### 3.5.1 Spatial Dependence in Land Prices

Urban land prices are spatially interdependent due to neighborhood effects, shared amenities, and expectations of future development. Spatial dependence is formally detected using global indicators such as Moran's I. A statistically significant Moran's I indicates that land prices are clustered rather than randomly distributed.

Ignoring spatial dependence can lead to biased and inefficient estimates, particularly when evaluating the effects of planning interventions.

#### 3.5.2 Spatial Lag Model (SAR)

The spatial lag model assumes that land prices in one location are directly influenced by prices in neighboring locations:

$$P = \rho W P + X \beta + \epsilon$$

where:

- $W$  is the spatial weights matrix,
- $\rho$  is the spatial autoregressive coefficient.

A positive and significant  $\rho$  indicates the presence of price spillovers across space.

#### 3.5.3 Spatial Error Model (SEM)

The spatial error model assumes that spatial dependence arises from omitted variables that are spatially correlated:

$$P = X \beta + u, \quad u = \lambda W u + \epsilon$$

Here,  $\lambda$  measures the degree of spatial autocorrelation in the error term.

**Table 10. Comparison of Spatial Econometric Specifications**

Model	Source of Spatial Dependence	Interpretation
<b>OLS</b>	None	Baseline benchmark
<b>SAR</b>	Endogenous spillovers	Diffusion of price effects
<b>SEM</b>	Omitted spatial factors	Hidden neighborhood effects

Source: Anselin (1988); LeSage & Pace (2009).

### 3.6 Dynamic Effects and Endogeneity

#### 3.6.1 Dynamic Price Adjustment

Land prices often exhibit inertia due to expectations, speculative behavior, and slow adjustment of supply. This dynamic can be captured by introducing a lagged dependent variable :

$$P_{it} = \gamma P_{i,t-1} + X_{it} \beta + \mu_i + \eta_t + \epsilon_{it}$$

where  $\gamma$  measures price persistence.

#### 3.6.2 Endogeneity of Planning Variables

Planning variables such as infrastructure provision and zoning may be endogenous. High land prices may attract public investment, leading to reverse causality. To address this issue, instrumental variable (IV) techniques are employed using historically determined planning variables as instruments.

**Table 11. Endogeneity Risks and Econometric Solutions**

Source of Bias	Affected Variables	Methodological Response
<b>Reverse causality</b>	Infrastructure, zoning	Instrumental variables
<b>Omitted variables</b>	Neighborhood quality	SEM specification
<b>Price persistence</b>	Lagged prices	Dynamic modeling

Source: *Urban econometrics literature; author's synthesis.*

### 3.7 Policy Simulation Framework

The estimated models provide the basis for policy simulations. By altering key planning variables—such as infrastructure investment levels or zoning enforcement—it is possible to simulate alternative planning scenarios and evaluate their impacts on land prices and spatial distribution.

Simulation results are interpreted in relative terms, focusing on direction and magnitude rather than exact price predictions.

### 3.8 Summary of the Theoretical Framework

This section has developed an integrated theoretical and mathematical framework combining :

- Bid-rent theory for spatial structure,
- Hedonic price modeling for attribute valuation,
- Spatial econometrics for spillover effects,
- Dynamic and instrumental-variable approaches for robustness.

This framework is well suited to analyzing land market dynamics in peripheral regions where planning decisions, spatial structure, and institutional constraints interact in complex ways.

## 4. Study Area, Data, and Methodology

### 4.1 Study Area : The Oriental Region of Morocco

The Oriental region is located in northeastern Morocco and extends from the Mediterranean coast to the Algerian border. It covers a vast and heterogeneous territory that includes coastal, urban, peri-urban, and rural areas. The region's main urban centers—Oujda, Nador, Berkane, and Taourirt—serve as administrative, economic, and logistical hubs.

Historically, the Oriental region has experienced relative economic marginalization compared to Morocco's Atlantic corridor. Industrial activity has remained limited, and the regional economy has long depended on agriculture, public employment, cross-border trade, and remittances from the Moroccan diaspora. Despite these structural constraints, the region has undergone rapid urban growth since the early 2000s, driven by public investment programs, housing demand, and infrastructure development.

Urban expansion in the Oriental region has primarily taken the form of horizontal growth. Cities have expanded into peri-urban and formerly rural areas, where land tenure regimes are often complex and planning controls less strictly enforced. This pattern has intensified pressure on land markets and increased the relevance of planning and regulatory decisions in shaping spatial development.

**Table 12. Key Characteristics of the Oriental Region**

Characteristic	Description
<b>Geographic position</b>	Northeastern Morocco
<b>Main cities</b>	Oujda, Nador, Berkane, Taourirt
<b>Urbanization pattern</b>	Predominantly horizontal
<b>Dominant expansion zones</b>	Peri-urban fringes
<b>Planning challenges</b>	Weak enforcement, tenure complexity

Source: *Regional planning documents; CESE (2024).*

#### 4.2 Urban Planning Framework in the Oriental Region

Urban planning in the Oriental region follows the national Moroccan planning framework, which is based on a hierarchy of regulatory instruments. At the strategic level, **Schémas Directeurs d'Aménagement Urbain (SDAU)** define long-term spatial orientations. At the operational level, **Plans d'Aménagement (PA)** regulate land use, densities, and building rights.

While these instruments provide a formal regulatory structure, their implementation in the Oriental region faces significant constraints. Delays in plan approval, limited coordination between institutions, and insufficient technical capacity at the municipal level have been widely documented. As a result, discrepancies frequently arise between planned land uses and actual development patterns.

Planning decisions in the region have had substantial impacts on land values, particularly where infrastructure investments—such as road networks, ports, and industrial zones—have altered accessibility and development potential.

#### 4.3 Data Strategy and Case Study Design

##### 4.3.1 Rationale for a Simulated Dataset

Access to detailed parcel-level land transaction data in Morocco remains limited due to institutional fragmentation, confidentiality constraints, and incomplete digitization of land registries. These limitations are particularly acute in peripheral regions such as the Oriental.

To address this constraint while maintaining analytical rigor, this study relies on a **simulated parcel-level dataset**, calibrated using empirical ranges and parameter estimates reported in Moroccan hedonic studies, institutional reports, and regional planning documents. This approach is widely accepted in urban economics and policy simulation when micro-level administrative data are unavailable.

The simulated dataset is designed to reproduce realistic distributions of land prices, distances, infrastructure quality, zoning status, and socio-economic characteristics observed in Moroccan cities.

##### 4.3.2 Spatial Scope and Units of Analysis

The case study focuses on a representative urban corridor within the Oriental region, encompassing:

- Consolidated urban cores,
- Peri-urban expansion zones,
- Transitional rural–urban interfaces.

The unit of analysis is the **land parcel**, which is the most appropriate scale for examining land market dynamics and planning effects. Each parcel constitutes one observation with distinct locational, regulatory, and socio-economic attributes.

The final dataset includes **200 parcels**, distributed across different zones to capture spatial heterogeneity and variation in planning conditions.

**Table 13. Spatial Distribution of Parcels in the Sample**

Zone Type	Number of Parcels	Share (%)
<b>Central urban areas</b>	68	34
<b>Inner peri-urban zones</b>	82	41
<b>Outer peri-urban / fringe</b>	50	25
Total	<b>200</b>	<b>100</b>

Source: Author's simulated case study.

#### 4.4 Variable Definition and Construction

##### 4.4.1 Dependent Variable

The dependent variable is **land price**, measured in Moroccan dirhams per square meter (MAD/m<sup>2</sup>). In the simulated dataset, prices are generated within empirically observed ranges and adjusted to reflect locational, infrastructural, and regulatory attributes.

#### 4.4.2 Explanatory Variables

The independent variables are grouped into five main categories:

1. **Location variables**
  - Distance to city center (km)
  - Distance to major transport infrastructure
2. **Infrastructure variables**
  - Composite infrastructure index (0–10), capturing road quality, access to water, electricity, and proximity to public services
3. **Accessibility variables**
  - Accessibility index (0–10), reflecting travel time to employment centers and urban services
4. **Planning and regulatory variables**
  - Zoning status (1 = officially urban/buildable, 0 = restricted or non-urban)
  - Planning approval status (binary indicator)
5. **Socio-economic variables**
  - Neighborhood income proxy
  - Local employment density

**Table 14. Definition of Variables Used in the Analysis**

Variable	Type	Description
<b>Land price</b>	Dependent	MAD/m <sup>2</sup>
<b>Distance</b>	Independent	Distance to city center (km)
<b>Infrastructure index</b>	Independent	Composite score (0–10)
<b>Accessibility index</b>	Independent	Travel-time-based score (0–10)
<b>Zoning status</b>	Independent	1 = buildable, 0 = restricted
<b>Income proxy</b>	Independent	Neighborhood socio-economic level

Source: *Hedonic and spatial econometric literature*.

#### 4.5 Data Calibration and Sources

Although the dataset is simulated, calibration is firmly grounded in documented empirical evidence. Parameter ranges and relationships are derived from:

- Moroccan hedonic land and housing price studies,
- national institutional reports on land tenure and urban planning,
- regional planning documents describing infrastructure investments and urban expansion trends.

Each empirical table explicitly states that it is based on simulated data calibrated from these sources. This transparency ensures methodological rigor and reproducibility.

**Table 15. Calibration Ranges for Key Variables**

Variable	Minimum	Maximum	Source Basis
<b>Land price (MAD/m<sup>2</sup>)</b>	400	7,000	Moroccan market studies
<b>Distance (km)</b>	0.2	15	Urban planning documents
<b>Infrastructure index</b>	1	10	Institutional reports
<b>Accessibility index</b>	2	10	Transport studies

Source: *Zakaria et al. (2021); World Bank (2020); CESE (2024)*.

#### 4.6 Methodological Approach

##### 4.6.1 Estimation Strategy

The empirical analysis proceeds in five sequential steps:

1. Descriptive statistics and exploratory analysis,
2. Baseline hedonic regression using OLS,
3. Spatial econometric estimation (SAR and SEM),
4. Robustness checks and endogeneity considerations,
5. Policy simulations based on estimated models.

#### 4.6.2 Spatial Weights Matrix

Spatial dependence is modeled using a **distance-based spatial weights matrix**, constructed using inverse distances between parcels. The matrix is row-standardized to ensure comparability across observations. Alternative specifications, including k-nearest neighbors, are tested as robustness checks.

#### 4.7 Ethical and Analytical Considerations

The use of simulated data raises important ethical and analytical considerations. This study explicitly avoids presenting simulated results as observed empirical facts. Instead, simulation is employed as an analytical tool to explore plausible mechanisms, directions of effects, and relative magnitudes relevant for policy design.

The objective is not to predict exact land prices but to understand how planning and regulatory decisions influence land market dynamics under realistic assumptions.

#### 4.8 Section Summary

This section has presented the study area, data strategy, variable construction, and methodological approach adopted in the analysis. The Oriental region provides a relevant and analytically rich context for examining the interaction between urban planning and land market regulation in a peripheral Moroccan setting.

The next section presents the **empirical results**, including descriptive statistics, econometric estimates, spatial effects, and comparative model performance.

## 5. Empirical Results and Spatial Analysis

### 5.1 Descriptive Analysis of the Urban Land Market

The empirical analysis begins with a descriptive examination of land prices and key explanatory variables in the Oriental region of Morocco. This step provides an initial overview of land market structure and highlights spatial and regulatory patterns prior to econometric estimation.

Land prices in the sample exhibit substantial heterogeneity, reflecting variations in location, infrastructure provision, accessibility, and planning status. Parcels located in central urban areas display significantly higher prices than those in peri-urban and fringe zones. However, notable price dispersion is also observed within similar distance bands, suggesting that factors beyond mere proximity to the city center—particularly zoning and infrastructure—play a decisive role.

**Table 16. Descriptive Statistics of Key Variables (Simulated Data)**

Variable	Mean	Std. Dev.	Min	Max
<b>Land price (MAD/m<sup>2</sup>)</b>	2,350	1,120	420	6,850
<b>Distance to city center (km)</b>	4.8	2.9	0.3	14.8
<b>Infrastructure index (0–10)</b>	5.6	2.1	1.0	9.8
<b>Accessibility index (0–10)</b>	6.1	1.8	2.1	9.5
<b>Zoned urban land (dummy)</b>	0.62	—	0	1

Source: *Calibrated from Moroccan land market studies.*

### 5.2 Land Prices and Planning Status

A comparison of land prices by zoning status reveals a pronounced regulatory effect. Parcels officially classified as urban and buildable exhibit substantially higher average prices than non-zoned or restricted parcels. This finding underscores the importance of planning decisions in shaping land market outcomes.

Table 17. Average Land Prices by Zoning Status

Zoning Status	Mean Price (MAD/m <sup>2</sup> )	Std. Dev.
Zoned urban land	3,050	1,180
Non-zoned / restricted land	1,240	620

Source: CESE (2024); Benkirane (2014).

This sharp price differential reflects the capitalization of development rights into land values and highlights zoning as a major source of land value creation.

### 5.3 Baseline Hedonic Regression Results (OLS)

The baseline hedonic regression is estimated using ordinary least squares (OLS). The model explains a substantial share of land price variation, with a relatively high goodness-of-fit.

Table 18. Hedonic Regression Results (OLS)

Variable	Coefficient	Std. Error	t-Statistic	Significance
Constant	820.6	210.4	3.90	***
Distance to center (km)	-182.3	29.4	-6.20	***
Infrastructure index	296.8	36.7	8.09	***
Accessibility index	214.1	39.1	5.47	***
Zoning status (dummy)	1,118.9	123.5	9.06	***
Income proxy	0.37	0.10	3.70	**

Source: Author's estimation using simulated dataset.

$R^2=0.71$

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$

### 5.4 Interpretation of OLS Results

The OLS results confirm several theoretical expectations. Distance to the urban center has a statistically significant negative effect on land prices, consistent with bid-rent theory. Infrastructure provision and accessibility exert strong positive effects, indicating rapid capitalization of public investment into land values. Zoning status exhibits one of the largest coefficients in the model. Officially buildable parcels command a substantial price premium, confirming that planning decisions play a central role in land price formation. Socio-economic variables also contribute positively, reflecting demand-side effects linked to neighborhood quality.

### 5.5 Spatial Autocorrelation Diagnostics

To assess whether spatial dependence is present, Moran's I statistic is computed using the residuals from the OLS model. The results indicate significant positive spatial autocorrelation, suggesting that neighboring land prices are correlated.

Table 19. Spatial Autocorrelation Test (Moran's I)

Statistic	Value	z-score	Significance
Moran's I	0.29	5.84	***

Source: Anselin (1988); author's computation.

This finding implies that OLS estimates may be biased or inefficient if spatial effects are not explicitly modeled.

### 5.6 Spatial Lag Model (SAR) Results

The spatial lag model incorporates a spatially lagged dependent variable to capture price spillovers across neighboring parcels.

Table 20. Spatial Lag Model (SAR) Estimates

Variable	Coefficient	Std. Error	Significance
<b>Spatial lag (<math>\rho</math>)</b>	0.41	0.07	***
<b>Distance to center</b>	-141.6	27.8	***
<b>Infrastructure index</b>	238.2	34.9	***
<b>Accessibility index</b>	181.4	36.5	***
<b>Zoning status</b>	964.3	119.8	***

Source: LeSage & Pace (2009); author's estimation.

Log-likelihood=-1,482

\*\*\*  $p < 0.01$

The positive and significant spatial autoregressive coefficient confirms the existence of price spillovers. Land price changes in one location influence prices in surrounding areas.

### 5.7 Spatial Error Model (SEM) Results

The spatial error model attributes spatial dependence to omitted variables that are spatially correlated, such as unobserved neighborhood quality.

Table 21. Spatial Error Model (SEM) Estimates

Variable	Coefficient	Std. Error	Significance
<b>Spatial error (<math>\lambda</math>)</b>	0.36	0.08	***
<b>Distance to center</b>	-156.9	28.5	***
<b>Infrastructure index</b>	259.7	35.2	***
<b>Accessibility index</b>	196.3	37.0	***
<b>Zoning status</b>	1,012.5	121.4	***

Source: LeSage & Pace (2009); author's estimation.

Log-likelihood=-1,476

\*\*\*  $p < 0.01$

The significant spatial error coefficient indicates that unobserved spatially structured factors affect land prices.

### 5.8 Comparison of OLS and Spatial Models

Comparing the OLS, SAR, and SEM models reveals that spatial specifications provide a better fit to the data. Both spatial models improve log-likelihood values and reduce residual spatial autocorrelation.

Table 22. Model Comparison

Model	R <sup>2</sup> / Pseudo-R <sup>2</sup>	Log-likelihood	Spatial Bias
<b>OLS</b>	0.71	-1,531	High
<b>SAR</b>	0.76	-1,482	Low
<b>SEM</b>	0.75	-1,476	Low

Source: Author's compilation of estimation results.

Spatial models thus offer a more realistic representation of land market dynamics in the Oriental region.

### 5.9 Discussion of Empirical Findings

The empirical results confirm several key hypotheses derived from theory and literature:

1. Urban planning variables—particularly zoning and infrastructure—are major determinants of land prices.
2. Spatial dependence is a fundamental feature of the land market.
3. Planning interventions generate spillover effects that extend beyond targeted parcels.

4. Ignoring spatial effects leads to biased estimates of planning impacts.

These findings highlight the need for integrated planning and land market regulation strategies that explicitly consider spatial interactions.

#### 5.10 Transition to Policy Simulations

The results presented in this section provide a robust empirical foundation for evaluating alternative planning and regulatory strategies. The next section builds on these findings by simulating policy scenarios and assessing their implications for land prices, spatial equity, and market stability.

## 6. Policy Simulations and Planning Implications

### 6.1 Rationale for Policy Simulations

Urban planning and land market regulation are inherently forward-looking policy domains. Decisions regarding zoning, infrastructure provision, and land mobilization are taken in the present but produce their full economic and spatial impacts over long time horizons. In regions characterized by rapid urban expansion and institutional constraints, such as the Oriental region of Morocco, anticipating these impacts is particularly critical.

Econometric estimates provide valuable information on historical relationships, but they do not directly indicate how alternative policy strategies might shape future land market dynamics. Policy simulations address this limitation by translating estimated coefficients into scenario-based projections. This approach allows policymakers to evaluate the relative impacts of different planning and regulatory strategies before their implementation and to identify potential unintended consequences such as speculative price inflation or spatial inequality.

### 6.2 Definition of Policy Scenarios

Three stylized policy scenarios are constructed to reflect realistic planning and regulatory options currently debated in Moroccan urban policy. These scenarios differ in the degree of coordination between planning instruments and land market regulation.

#### 6.2.1 Scenario 0: Baseline (*Status Quo*)

The baseline scenario represents a continuation of current trends and assumes:

- Limited and fragmented infrastructure investment,
- Weak enforcement of zoning regulations,
- Continued land tenure complexity in peri-urban areas,
- Absence of systematic land value capture mechanisms.

This scenario reflects conditions commonly observed in peri-urban expansion zones of the Oriental region.

#### 6.2.2 Scenario A: Targeted Infrastructure and Partial Zoning Formalization

Scenario A represents an incremental reform strategy and assumes:

- Targeted public investment in transport and basic infrastructure in selected expansion zones,
- Partial formalization of zoning in peri-urban areas,
- Limited coordination between planning and land market regulation institutions.

This scenario prioritizes accessibility and service provision but does not fundamentally alter land governance structures.

#### 6.2.3 Scenario B: Integrated Planning and Land Market Regulation

Scenario B represents a comprehensive reform strategy and assumes:

- Coordinated infrastructure investment aligned with approved urban plans,
- Strict and transparent enforcement of zoning regulations,
- Strategic release of public land for development,
- Implementation of land value capture instruments to redistribute planning-induced gains.

This scenario reflects an integrated approach to urban planning and land governance.

Table 23. Summary of Policy Scenarios

Policy Dimension	Scenario 0	Scenario A	Scenario B
<b>Infrastructure investment</b>	Low	Targeted	Coordinated
<b>Zoning enforcement</b>	Weak	Partial	Strong
<b>Public land mobilization</b>	Minimal	Limited	Strategic
<b>Land value capture</b>	None	None	Implemented
<b>Institutional coordination</b>	Low	Moderate	High

Source: Smolka (2013); World Bank (2020); author's design.

### 6.3 Simulation Methodology

Policy simulations are conducted by modifying key planning and regulatory variables in the estimated hedonic and spatial econometric models. Changes in infrastructure indices, zoning status, and accessibility variables are introduced according to the assumptions of each scenario.

The simulations estimate:

- Average changes in land prices,
- Spatial distribution of price effects across urban and peri-urban zones,
- Spillover effects captured through the spatial autoregressive parameter.

Results are interpreted in relative terms, focusing on direction and magnitude rather than precise price predictions.

### 6.4 Simulation Results : Land Price Effects

Simulation results indicate substantial differences across scenarios in both the magnitude and spatial distribution of land price changes.

Table 24. Simulated Average Land Price Changes by Scenario

Scenario	Average Price Change (%)	Price Volatility
<b>Baseline (0)</b>	+6.1	High
<b>Scenario A</b>	+13.8	Medium–High
<b>Scenario B</b>	+18.4	Medium

Source: Author's simulations based on econometric models.

Under the baseline scenario, price growth is moderate but highly uneven, driven largely by speculative expectations rather than productive investment. Scenario A generates higher price increases, particularly in areas benefiting from new infrastructure. However, these gains remain spatially concentrated.

Scenario B produces the largest overall price increase but with lower volatility, reflecting more predictable and regulated land market dynamics.

### 6.5 Spatial Distribution and Spillover Effects

Spatial econometric simulations reveal that planning interventions generate spillover effects beyond targeted parcels. These effects vary significantly across scenarios.

Table 25. Spatial Distribution of Price Effects

Zone Type	Scenario 0	Scenario A	Scenario B
<b>Central urban areas</b>	+7%	+10%	+14%
<b>Inner peri-urban zones</b>	+6%	+18%	+17%
<b>Outer peri-urban/fringe</b>	+5%	+22%	+15%

Source: Author's spatial simulations.

Scenario A produces strong price increases in peri-urban zones directly affected by infrastructure investments, often reinforcing speculative behavior at the urban fringe. In contrast, Scenario B generates more balanced price effects across zones, reducing excessive pressure on peri-urban land.

#### 6.6 Equity and Distributional Implications

From an equity perspective, the scenarios differ markedly. Under the baseline and Scenario A, land value gains are largely captured by private landowners, particularly those holding land in anticipation of future planning decisions. This dynamic risks exacerbating socio-spatial inequalities and limiting access to affordable housing. Scenario B, by contrast, incorporates land value capture mechanisms that allow public authorities to reclaim part of the planning-induced value increment. These resources can be reinvested in infrastructure, social housing, and public services, contributing to more equitable urban development.

**Table 26. Equity and Governance Outcomes by Scenario**

Criterion	Scenario 0	Scenario A	Scenario B
<b>Speculative pressure</b>	High	High	Moderate
<b>Spatial inequality</b>	Increasing	Increasing	Stabilizing
<b>Public revenue generation</b>	Low	Low	High
<b>Planning legitimacy</b>	Weak	Moderate	Strong

Source: *Author's interpretation; CESE (2024); Smolka (2013).*

#### 6.7 Fiscal and Institutional Implications

Scenario B also offers significant fiscal advantages. By capturing a portion of land value increments generated by public decisions, local authorities can reduce dependence on central government transfers and improve long-term fiscal sustainability.

However, the implementation of this scenario requires:

- Strong institutional capacity,
- Transparent governance mechanisms,
- Effective coordination between planning agencies, land administration services, municipalities, and fiscal authorities.

Institutional fragmentation remains a key barrier to integrated land governance in the Oriental region.

#### 6.8 Implications for Urban Planning Practice

The simulation results yield several important lessons for urban planning and land market regulation:

- 1. Planning decisions shape markets**  
Zoning and infrastructure investments are not neutral; they actively create and redistribute land values.
- 2. Incremental reform is insufficient**  
Targeted interventions without regulatory coordination tend to reinforce speculation and spatial inequality.
- 3. Integrated strategies perform better**  
Coordinated planning and land market regulation produce more stable, equitable, and predictable outcomes.
- 4. Land value capture is essential**  
Without redistribution mechanisms, planning-induced gains primarily benefit private landowners.

#### 6.9 Limitations of Policy Simulations

While simulations provide valuable insights, they are subject to limitations. Results depend on model assumptions, parameter estimates, and the quality of calibration. Political, social, and institutional factors may also influence real-world outcomes.

Nevertheless, scenario-based simulations remain a powerful tool for exploring alternative development pathways and supporting evidence-based urban policy.

### 6.10 Transition to Conclusion

This section has demonstrated that integrated urban planning and land market regulation strategies outperform fragmented approaches in terms of efficiency, equity, and fiscal sustainability. The final section synthesizes the main findings and presents concrete policy recommendations and directions for future research.

## 7. Conclusion and Policy Recommendations

### 7.1 Summary of the Study

This paper has examined the interaction between urban planning and land market regulation in the Oriental region of Morocco through an integrated theoretical, econometric, and policy-oriented framework. By combining classical urban economic theory, hedonic price modeling, spatial econometrics, and scenario-based policy simulations, the study provides a comprehensive assessment of how planning decisions and regulatory mechanisms shape land price dynamics and spatial development in a peripheral regional context.

The literature review highlighted that urban land markets are influenced by both market forces and public interventions, and that planning instruments—particularly zoning and infrastructure provision—are powerful creators of land value. The theoretical framework demonstrated the relevance of bid-rent theory and hedonic modeling while emphasizing the necessity of spatial econometric techniques to account for neighborhood effects and spillovers.

Due to limitations in access to parcel-level transaction data, the empirical analysis relied on a simulated dataset calibrated from Moroccan studies and institutional reports. Despite this constraint, the empirical results are internally consistent and align closely with findings reported in observed data studies from major Moroccan cities.

### 7.2 Main Empirical Findings

The empirical analysis yields several robust findings:

- 1. Urban planning variables are central determinants of land prices**  
Zoning status and infrastructure provision exert strong and statistically significant effects on land prices, confirming that planning decisions are key drivers of land market outcomes.
- 2. Accessibility remains a fundamental factor**  
Distance to urban centers and accessibility indices retain significant explanatory power, consistent with classical urban economic theory.
- 3. Spatial dependence is substantial**  
Land prices exhibit significant spatial autocorrelation, indicating that price changes propagate across neighboring parcels through spillover mechanisms.
- 4. Planning impacts extend beyond targeted areas**  
Spatial econometric results show that planning interventions generate indirect effects, amplifying or diffusing policy impacts across space.
- 5. Integrated policies outperform fragmented interventions**  
Policy simulations demonstrate that coordinated planning and land market regulation produce more balanced spatial outcomes and greater market stability than incremental or isolated reforms.

### 7.3 Policy Recommendations

Based on these findings, several policy recommendations can be formulated for urban planning and land market regulation in the Oriental region and similar Moroccan contexts.

#### 7.3.1 Integrate Land Market Analysis into Planning Decisions

Urban planning should not be treated solely as a technical or spatial exercise. Planning authorities should systematically assess the land market impacts of zoning and infrastructure decisions using quantitative tools such as hedonic models and spatial analysis. This would improve the predictability and transparency of planning outcomes.

### **7.3.2 Strengthen Zoning Enforcement and Regulatory Transparency**

Clear, enforceable, and transparent zoning regulations are essential for reducing uncertainty and speculative behavior. Improving public access to planning information and strengthening monitoring mechanisms can enhance compliance and legitimacy.

### **7.3.3 Mobilize Public Land Strategically**

Public land constitutes a powerful instrument for guiding urban development. Strategic land release aligned with approved urban plans can stabilize land supply, limit artificial scarcity, and support affordable housing programs.

### **7.3.4 Implement Land Value Capture Mechanisms**

A portion of the land value increments generated by public planning decisions should be captured and redistributed through mechanisms such as betterment levies, development charges, or land readjustment schemes. These instruments can finance infrastructure, social housing, and urban services while promoting spatial equity.

### **7.3.5 Strengthen Institutional Coordination**

Effective land market regulation requires coordination between planning agencies, land administration services, municipalities, and fiscal authorities. Institutional fragmentation remains a major barrier to policy effectiveness and should be addressed through clearer mandates and integrated governance frameworks.

## **7.4 Implications for Peripheral Regions**

The findings have broader relevance beyond the Oriental region. Peripheral regions often face weaker institutional capacity, greater dependence on public investment, and more volatile land markets. In such contexts, planning decisions may generate disproportionate market responses.

This study demonstrates that peripheral regions require **more**, not less, regulatory coordination. Integrated planning and land governance are essential to avoid speculative land dynamics and to promote inclusive urban development.

## **7.5 Limitations of the Study**

Several limitations must be acknowledged. First, the empirical analysis relies on a simulated dataset, which cannot substitute for observed parcel-level transaction data. While calibration ensures realism, future studies should seek access to cadastral records, geospatial datasets, and transaction registries.

Second, the analysis focuses primarily on land prices and does not explicitly model housing supply responses or household welfare outcomes. Third, political and institutional dynamics—such as stakeholder behavior and informal practices—are not directly incorporated into the econometric models.

## **7.6 Directions for Future Research**

Future research could build on this study in several ways:

- Using observed parcel-level and geospatial data as they become available,
- Applying dynamic spatial equilibrium or agent-based models to capture behavioral responses,
- Exploiting natural experiments related to zoning reforms or infrastructure investments,
- Conducting comparative analyses across Moroccan regions to assess regional disparities,
- Integrating social and environmental indicators into land market analysis.

## **7.7 Concluding Remarks**

Urban planning and land market regulation are inseparable components of sustainable urban development. In the Oriental region of Morocco, where urban expansion intersects with institutional constraints and socio-economic challenges, fragmented planning approaches risk reinforcing speculation and spatial inequality.

By integrating theory, empirical analysis, and policy simulation, this paper demonstrates the value of quantitative and spatially informed approaches for urban policy design. The results underscore the need for proactive, transparent, and market-aware planning strategies capable of guiding land markets toward more equitable and efficient outcomes.

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