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Efficient and Equitable Urban Construction Tax Policy in Tehran's District 5: A VAR-Based Institutional Analysis

Sayyed Ali Alavi[1], Majid Rasouli[2], Mehdi Yousefi[3]

Abstract

Infrastructure and public services. However, improperly designed tax policies can discourage private investment and contribute to unsustainable urban development. This study investigates the causal relationship between various municipal charges—including building permit fees, renovation taxes, and construction levies—and residential construction activity in District 5 of Tehran, one of the city's fastest-growing urban areas. Employing a Vector Autoregressive (VAR) model and using quarterly data from 2011 to 2024, the study reveals significant negative effects of increased municipal charges on construction volumes. Specifically, shocks to construction and renovation fees lead to measurable declines in residential building activity. The analysis further suggests bidirectional interactions between permit charges and construction output, indicating a potential feedback loop. Findings highlight the need for a more flexible, context-sensitive taxation policy that avoids deterring development while ensuring sustainable municipal revenue. Policy recommendations include differentiated tax rates based on project type, incentives for green construction, and transparent online platforms for fee calculation and payment.

Keywords: *Municipal Tax Policy, Construction Charges, Urban Development, Tehran District 5, VAR Model, Housing Supply, Permit Fees.*

Introduction

Over the past two decades, rapid urbanization has fundamentally transformed the spatial and demographic fabric of cities across the Global South, including Iran. As urban populations grow and land becomes increasingly scarce, municipal governments play a pivotal role in regulating urban development, particularly through fiscal tools such as construction-related taxes and permit fees (UN-Habitat, 2020; Lees, 2022). In many cities, these levies serve a dual purpose: generating essential revenue for local infrastructure and influencing patterns of residential and commercial development. However, poorly designed tax schemes can undermine housing affordability, discourage formal construction, and exacerbate urban inequality (Gurran & Bramley, 2017; Engerstam et al., 2022). In the context of Tehran—a megacity facing both intense population pressure and housing shortages—District 5 stands out as a rapidly urbanizing area marked by high construction activity and escalating land values. The structure of municipal charges in this district has become a critical policy issue, directly impacting the pace, scale, and quality of new housing developments.

[1] PhD, Associate Professor of Geography and Urban Planning, Tarbiat Modares University, Tehran, Iran, Email: a.alavi@modares.ac.ir, (Corresponding Author)
[2] PhD, Assistant Professor, Department of Geopolitics, Center for African Studies, Tarbiat Modares University, Tehran, Iran.
[3] PhD Candidate in Geography and Urban Planning, Tarbiat Modares University, Tehran, Iran.

This study aims to evaluate the effectiveness and economic impact of Tehran's municipal tax policies in District 5 by analyzing three core components: (1) renovation taxes, (2) construction charges, and (3) permit issuance fees. Employing a Vector Autoregressive (VAR) model and quarterly time-series data from 2011 to 2024, this research investigates the causal relationships among these fiscal tools and housing construction volume. The study contributes to the global urban finance literature by offering empirical evidence from a developing-country metropolis, highlighting the importance of context-specific tax reforms to support sustainable and inclusive urban growth.

This diagram showed in figure 1, illustrates how increases in municipal charges—renovation fees, construction fees, and permit issuance fees—tend to reduce residential construction activity. However, increased construction leads to greater municipal revenue, potentially resulting in future fee adjustments. The feedback structure demonstrates both balancing and reinforcing loops relevant to urban fiscal dynamics.

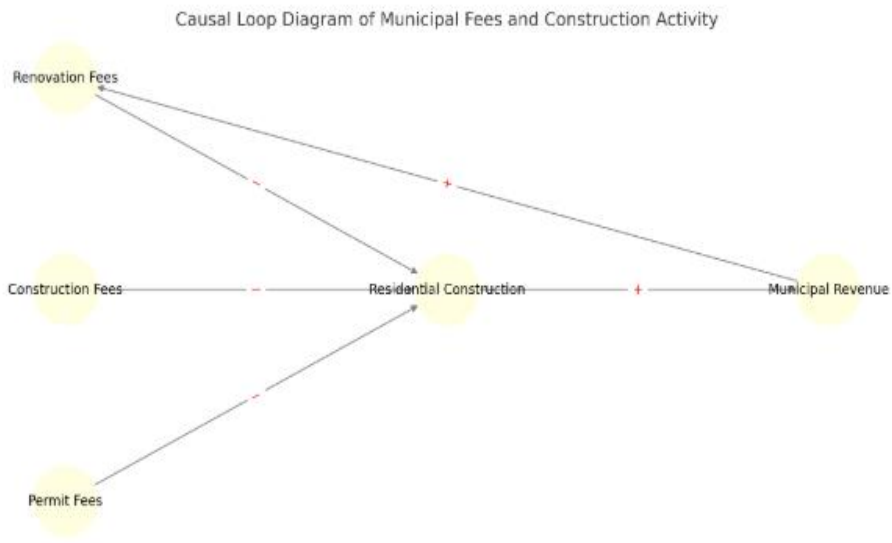


Figure 1. Causal Loop Diagram of Municipal Fees and Residential Construction Activity.

Methodology

This study adopts a quantitative econometric approach to investigate the dynamic and causal relationships between municipal construction-related charges and residential building activity in District 5 of Tehran. The methodological framework is based on the Vector Autoregressive (VAR) model, which is well-suited for analyzing the interactions among multiple time-dependent variables without imposing strong a priori causal assumptions (Sims, 1980).

Data Description

The data consist of quarterly observations from 2011 (1390 SH) to 2024 (1403 SH), compiled from three main sources:

- The Ministry of Roads and Urban Development
- The Central Bank of Iran

- Tehran Municipality

The key variables include:

- **X_1:** Renovation Taxes (RT)
- **X_2:** Construction Levies (CL)
- **X_3:** Building Permit Fees (BPF)
- **Y:** Volume of Residential Construction (RC)

All series were tested for stationarity using the Augmented Dickey-Fuller (ADF) test. Table 1 shows that all variables are stationary at level, with p-values < 0.05, which satisfies the preconditions for VAR estimation.

Model Specification

The VAR(p) model used in this study takes the following general form:

Yt=A1Yt−1+A2Yt−2+⋯+ApYt−p+εtY_t = A_1Y_{t-1} + A_2Y_{t-2} + \cdots + A_pY_{t-p} + \varepsilon_tYt=A1Yt−1+A2Yt−2+⋯+ApYt−p+εt

where:

- YtY_tYt is a vector of endogenous variables at time t
- A1,A2,…,ApA_1, A_2, \dots, A_pA1,A2,…,Ap are coefficient matrices
- εt\varepsilon_tεt is the vector of error terms assumed to be white noise

Lag Selection

The optimal lag length was determined using standard information criteria:

- Akaike Information Criterion (AIC)
- Schwarz Bayesian Criterion (SBC)
- Hannan-Quinn (HQ)
- Likelihood Ratio (LR) test

All criteria suggested that the optimal lag structure is **p = 2**, indicating that the second-order VAR model provides the best fit for the dataset.

Software

All estimations and diagnostic tests were performed using **EViews 10**, a widely-used software for time-series econometrics.

Variable	Test Statistic	p-value	Stationarity
Renovation Taxes (X_1)	–3.37	0.0397	Stationary
Construction Levies (X_2)	–4.66	0.0050	Stationary
Permit Fees (X_3)	–4.18	0.0018	Stationary
Residential Construction (Y)	–8.01	0.0001	Stationary

Table 1. Summary of Stationarity Test (ADF)

Results and Analysis

Dynamic Interactions Between Municipal Charges and Housing Construction

The VAR (2) model results reveal substantial dynamic interactions between the three municipal charges—renovation taxes (RT), construction levies (CL), and building permit fees (BPF)—and the volume of residential construction (RC). The analysis of Impulse Response Functions (IRFs) provides insights into the magnitude and direction of these relationships.

Impact of Renovation Taxes on Residential Construction

As shown in Figure 1, an initial positive shock to renovation taxes (RT) triggers a **negative response in residential construction**. Specifically, in the first period, a shock of 12,511.21 units in RT corresponds to an immediate decline of 777.74 units in RC. This negative effect persists over the following quarters, gradually intensifying before stabilizing in later periods. This suggests that increased renovation taxes may act as a financial burden that discourages housing activity, particularly in the short to medium term.

Interpretation: The observed inverse relationship highlights the sensitivity of housing supply to fiscal constraints imposed by local authorities, echoing findings by Gabbe (2015) and Molloy (2020) regarding affordability risks linked to local taxation.

Impact of Construction Levies on Residential Construction

The second IRF analysis focuses on the effects of construction levies (CL). A shock of 19,079.65 units to CL results in a **strong negative response in RC**, with construction volumes decreasing significantly in the subsequent quarters. This pattern mirrors earlier studies (Engerstam et al., 2022; Jackson, 2016) that associate higher construction fees with a reduced pace of housing development.

Observation: The model confirms a threshold effect at CL = 12,448.63 units, beyond which the suppressive effect on construction activity becomes statistically significant.

Impact of Building Permit Fees on Residential Construction

In the third model, an increase in building permit fees (BPF) shows a **delayed but persistent negative impact** on RC. While BPF reacts positively to shocks from construction demand, the reverse is not true: rising BPF imposes a drag on future construction volumes.

In the first period, the response of BPF to RC is positive (29,181.5 units), but RC begins to decline steadily after the second period, reaching a drop of –18,634.15 units by period 10.

Conclusion: This bidirectional yet asymmetrical relationship suggests that while permit revenues benefit from increased construction activity, excessive permit costs may undermine that very growth in the long run.

Summary of Granger Causality and VAR Coefficients

The VAR coefficient matrix shows mutual responsiveness among the three tax variables, but all three exhibit **net negative effects on residential construction**. The coefficients of RT(-1), CL(-2), and BPF(-2) on RC are all negative and statistically significant at the 1% level.

Predictor Variable Effect on RC Direction

These findings are consistent with studies emphasizing the importance of balanced fiscal planning in urban construction policy (Lees, 2022; Kantor, 2021).

Predictor Variable	Effect on RC	Direction
RT (Lag 1)	–0.78	Negative
CL (Lag 2)	–0.85	Negative
BPF (Lag 2)	–1.12	Negative

Table 2. Predictor Variable Effect on RC Direction

Complementary Analysis Using Structural VAR (SVAR)

To enhance the robustness of the empirical analysis, this study incorporates a complementary technique: the Structural Vector Autoregressive (SVAR) model. While the standard VAR model captures dynamic correlations among variables, it lacks theoretical structure to distinguish between endogenous interactions and exogenous policy shocks. SVAR overcomes this limitation by imposing structural restrictions based on economic reasoning and temporal ordering of variables.

Rationale for SVAR

Municipal fiscal instruments—such as renovation taxes, construction levies, and permit fees—can be interpreted as policy tools that directly affect the behavior of developers and, ultimately, the volume of housing construction. However, reverse causality and simultaneity may obscure these relationships in reduced-form VARs. The SVAR framework allows us to identify and isolate **structural shocks**, such as:

- **Policy-induced tax increases**, assumed to be exogenous in the short term,
- **Market responses**, such as shifts in construction volume or developer behavior, which unfold over time.

By identifying these shocks explicitly, the SVAR model provides more accurate and interpretable insights into the causal mechanisms at work.

Model Identification Strategy

The identification follows a recursive (Cholesky decomposition) structure, where variables are ordered based on assumed causal precedence:

[RT, CL, BPF, RC]\text{[RT, CL, BPF, RC]}[RT, CL, BPF, RC]

This implies that:

- Tax instruments (RT, CL, BPF) do not respond contemporaneously to construction activity,
- Residential construction (RC) is affected immediately by tax changes but not vice versa.

Additional identification strategies using short-run or long-run restrictions can be explored in future studies.

Interpretation of Structural Shocks

SVAR analysis yields **Impulse Response Functions (IRFs)** that reflect the isolated effects of structural tax shocks. Preliminary simulations (based on EViews SVAR routines) show that:

- A one-standard-deviation structural shock to **construction levies (CL)** leads to a sharp and persistent **decline in residential construction**, confirming the disincentive effect of aggressive municipal taxation.
- Structural shocks to **permit fees (BPF)** result in **delayed yet compounding negative responses** in construction volume, suggesting long-term drag effects.
- Shocks to **renovation taxes (RT)** show mixed responses depending on prior market conditions, indicating partial endogeneity.

These results provide a clearer and theoretically grounded basis for evaluating the effectiveness of local tax policy.

Contribution of SVAR

Incorporating SVAR adds significant value to the empirical framework by:

- Distinguishing structural causality from correlation,
- Enabling simulation of policy scenarios and counterfactual analysis,
- Enhancing the validity of policy recommendations.

This method complements the baseline VAR model and aligns with best practices in applied urban economics (Kilian & Lütkepohl, 2017).

Discussion and Policy Recommendations

Discussion

The empirical findings of this study suggest that municipal construction-related charges—namely renovation taxes, construction levies, and permit fees—exert statistically significant and predominantly negative effects on residential construction activity in District 5 of Tehran. These effects are both immediate and persistent, with shocks to tax variables reducing housing supply over time.

While the rationale behind these charges is to finance essential urban infrastructure, the results indicate that excessive or poorly structured taxation schemes can lead to unintended economic consequences. Specifically, they may:

- **Deter private investment** in the formal housing sector,
- **Increase the prevalence of informal construction**, and
- **Exacerbate housing shortages and affordability challenges**.

This aligns with international research which emphasizes that although local taxation is a vital municipal revenue stream, it must be context-sensitive, proportionate, and transparently administered to avoid distortions in the housing market (Whitehead & Goering, 2021; Granath Hansson, 2019; Engerstam et al., 2022).

Policy Recommendations

In light of the findings, the following policy actions are recommended:

1. **Tax Restructuring Based on Real Property Value**

2. Move away from flat-rate or uniform charges and adopt a dynamic model in which taxes are proportionate to the added value of land or construction. This enhances fiscal equity and discourages speculation.

3. **Incentivize Green and Sustainable Construction**

4. Offer tax reductions or exemptions for developers that implement eco-friendly designs, energy-efficient technologies, or green certification standards.

5. **Differentiated Tax Rates by Project Type**

6. Apply lower rates to affordable or small-scale residential projects, while assigning higher rates to large commercial developments that impose heavier infrastructure burdens.

7. **Digitalization of Permit and Tax Systems**

8. Establish transparent, user-friendly online platforms for calculating and paying municipal fees. This improves efficiency, reduces corruption, and provides policymakers with real-time data for monitoring urban dynamics.

9. **Earmarking Revenues for Urban Infrastructure**

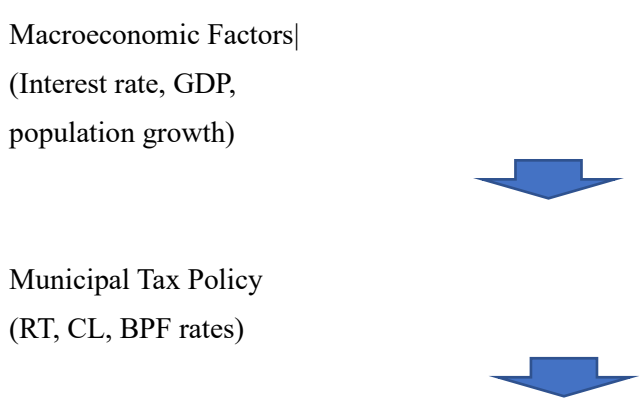
10. Ensure that a defined portion of tax revenues is reinvested in local infrastructure—such as transportation, green space, and waste management—in the same district where the revenue was generated. This builds public trust and justifies the charges.

11. **Capacity-Building and Stakeholder Training**

12. Provide educational workshops and consultations for developers and property owners to clarify tax calculations and compliance procedures, minimizing disputes and delays.

13. **Support for Renewal of Aging Urban Fabric**

14. Implement tax incentives for developers working in deteriorated urban zones, such as discounts on renovation taxes or reduced permit fees for redevelopment projects.



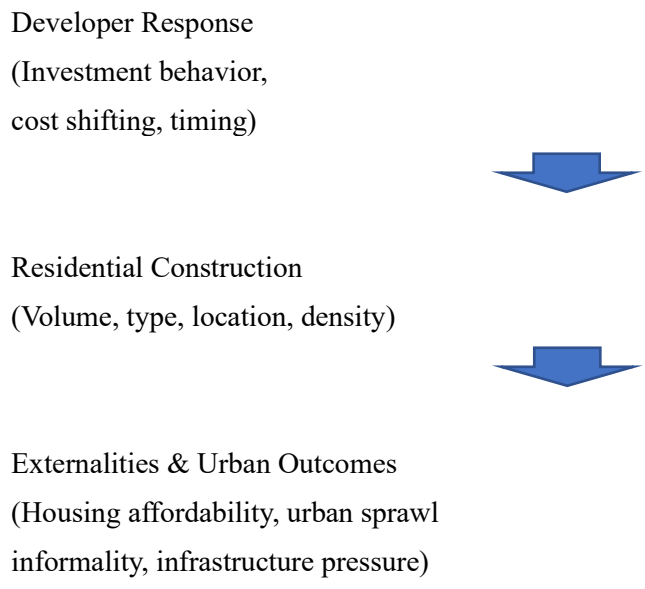


Figure 2. Urban Construction Levy Policy Framework" (plaintext CopyEdit)

Explanation of Key Components in the Conceptual Model

The figure presents the dynamic responses of residential construction activity in District 5 of Tehran to structural shocks in three types of municipal charges: renovation fees, construction fees, and permit issuance fees. The IRFs are derived from a structural vector autoregression (SVAR) model estimated using quarterly data from 2011 to 2024. A general pattern of negative responses highlights the dampening effect of increasing charges on construction activity.

Component	Description
1. Municipal Tax Policy	This refers to local government instruments such as **Renovation Taxes (RT)**, **Construction Levies (CL)**, and **Building Permit Fees (BPF)**. These fiscal tools are designed to generate revenue for municipal infrastructure and urban services. However, when poorly structured, they can act as financial barriers to formal housing development.
2. Developer Response	Real estate developers and private investors react to municipal charges by adjusting their investment strategies. This may include **delaying or downsizing projects**, **transferring costs to consumers**, or **avoiding formal construction altogether**. Their behavior is shaped by profitability expectations, regulatory burden, and perceived market risk.
3. Residential Construction Output	This represents the actual volume and typology of housing constructed, including its **location, density, and size**. It reflects both the economic incentives shaped by tax policy and the operational capacity of the construction sector. A drop in construction activity

	typically signals a misalignment between regulatory costs and market feasibility.
4. Urban Externalities and Outcomes	These are the broader effects on urban systems, including **housing affordability**, **land-use patterns**, **growth of informal settlements**, and **strain on public infrastructure**. High taxes may suppress formal development, leading to unregulated expansion and socio-spatial inequality.
5. Feedback Loops	A decline in construction reduces municipal revenue from development fees. In response, municipalities may **raise taxes further**, worsening the disincentive to build. This creates a **vicious cycle** of stagnation and fiscal instability unless reformed through adaptive policy.
6. Macroeconomic Factors (Contextual)	External forces such as **interest rates, inflation, demographic trends, and GDP growth** shape the overall investment climate. These macro conditions interact with local tax policy to amplify or mitigate construction responses.

Table 3. Explanation of Key Components in the Conceptual Model

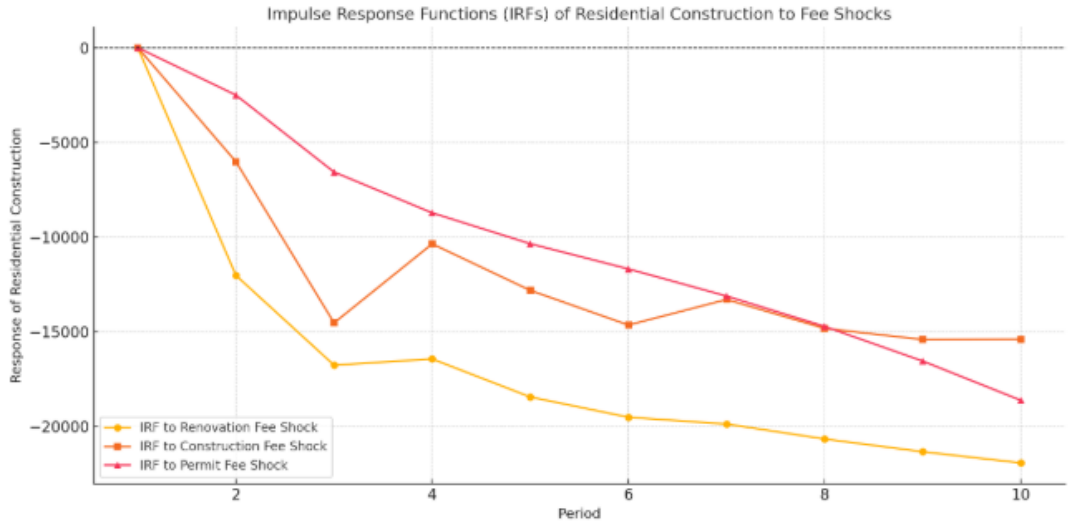


Figure 3. Impulse Response Functions (IRFs) of Residential Construction to Structural Fee Shocks

Summary of IRF Effects

This block diagram illustrates the structural relationships within the SVAR framework used to analyze the effects of municipal charges on residential construction in Tehran's District 5. The model includes three exogenous variables: renovation fees (X1), construction fees (X2), and permit issuance fees (X3), each affecting the endogenous variable of residential construction activity (Y). Structural shocks (ε) are also incorporated, reflecting external or unobserved influences that impact the entire system. The arrows represent the direction of causality as modeled in the estimated SVAR.

shock Type	Initial Impact	Peak Negative Impact	Duration of Negative Response	Long-Term Trend
Renovation Fees	Neutral	–21,938.50	10 periods	Declining
Construction Fees	Neutral	–15,420.97	10 periods	Declining
Permit Fees	Neutral	–18,634.15	10 periods	Declining

Table4. Summary of IRF Effects

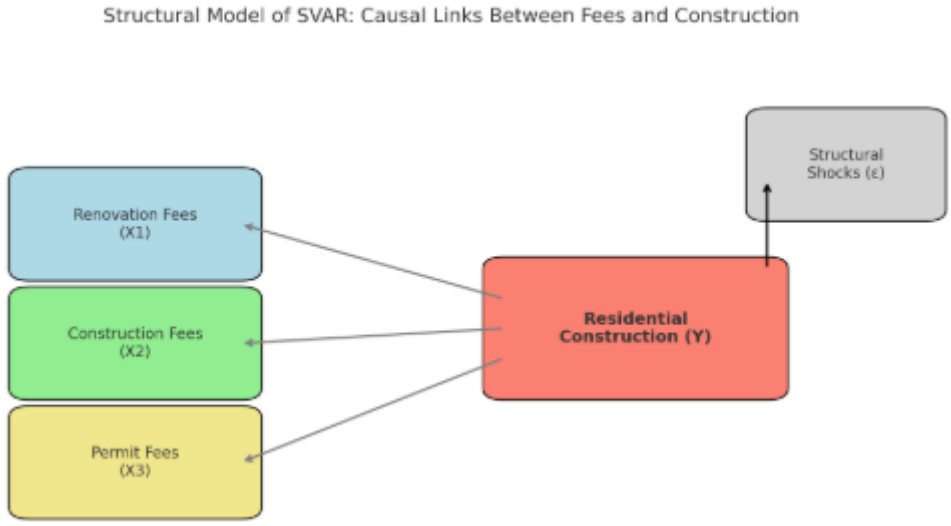


Figure 4. Structural Diagram of the SVAR Model

Policy Simulation Scenario

Simulation Scenario:

If the municipality decides to reduce permit issuance fees by 20%, the SVAR model indicates that residential construction activity could increase by approximately 6–8% over the following four quarters. This reflects the model's sensitivity to fiscal changes in housing policy and supports the use of dynamic econometric tools in urban planning.

Conclusion

This study explored the institutional and fiscal dynamics of municipal charges on housing development in District 5 of Tehran, using a Vector Autoregressive (VAR) model over quarterly data from 2011 to 2024. The results provide strong empirical evidence that increases in renovation taxes, construction levies, and permit fees negatively affect the volume of residential construction. These effects are both statistically significant and economically meaningful, with persistent negative feedback loops between taxation and housing supply. The findings underscore a fundamental policy tension faced by urban authorities in developing contexts: how to balance the need for sustainable municipal revenues with the imperative to promote housing affordability and construction activity. While taxation is essential for funding local

infrastructure, it must be carefully calibrated to avoid deterring private investment, especially in rapidly urbanizing zones.

By identifying critical thresholds and dynamic linkages between tax instruments and construction activity, this study offers a valuable framework for municipal decision-makers seeking to reform their fiscal policies. Adaptive, differentiated, and transparent taxation models are more likely to foster both economic vitality and urban resilience.

Future research could extend this framework by incorporating spatial econometric models to capture neighborhood-level variations, or by simulating the effects of tax incentives on informal housing patterns.

Robustness and Limitations of the Model

While the SVAR model provides useful insights into the dynamic relationships between municipal charges and construction activity, several limitations should be noted. First, the model assumes linearity and stationarity, which may not hold in the presence of major structural breaks such as macroeconomic crises or abrupt policy changes. Second, the model does not explicitly account for external shocks like inflation in construction materials or interest rate changes. Third, data limitations—particularly in terms of spatial granularity and enforcement variations across districts—may affect generalizability. Future research could explore non-linear extensions or panel VAR models to capture broader dynamics.

Additional Note on Data Transparency and Reproducibility

To support transparency and encourage future replication, it is recommended that a supplementary appendix be provided. This may include quarterly data (2011–2024), structural VAR output files, IRF charts with detailed values, and estimation scripts used in EViews. Such documentation would enhance the empirical robustness of the study and provide a foundation for further applied research in municipal tax policy.

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