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The Impact of Local Government Overtime on Urban Economic Growth: Evidence from 313 Cities in China

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Abstract

Existing research on overtime work has primarily focused on the corporate level, with insufficient attention paid to overtime phenomena at the government level-and even less to their impact on urban economic growth. Therefore, this study aims to explore the influence of local government overtime(LGO) on urban economic growth(UEG) and its micro-level mechanism of action. Employing a two-way fixed effects model, we analyze panel data of 313 cities in China from 2012 to 2025. Empirical results indicate that LGO exerts a significant inverted U-shaped relationship with UEG. Mechanism analysis reveals that LGO affects UEG mainly by altering government innovation capacity. Moderating effect analysis demonstrates that government digital transformation plays a moderating role in the relationship between LGO and UEG.

Keywords

Local Government; Overtime Intensity; Urban Economic Growth; "Inverted U-shaped" Relationship.

1. Introduction

Under the pressure of performance assessment and inter-jurisdictional economic competition, local governments strive to promote economic growth by setting tiered growth targets, with overtime work becoming a key institutional tool for enhancing the implementation effectiveness of economic policies. Most research on overtime focuses on labor welfare and productivity in the private sector, while empirical studies on overtime behavior in the public sector remain relatively scarce. Regarding the impact of government policies on economic development, existing literature primarily emphasizes governance efficiency[1], fiscal decentralization[2], and government debt levels[3], but lacks systematic analysis of the causal effect and transmission mechanism of government overtime on urban economic growth.

This study aims to systematically test this hypothesis using panel data from 313 Chinese cities over 2012–2025. Specifically, it empirically examines the direct effect of local government overtime on urban economic growth, the mediating mechanisms through government innovation capability, and the moderating role of government digital transformation. The empirical results confirm the hypothesised inverted-U-shaped relationship.

2. Hypotheses Proposed

2.1. Local Government Overtime and Urban Economic Growth

Local government overtime may have an "inverted U-shaped" impact on urban economic growth. Overtime below the critical value can be defined as "moderate government overtime", while that above the critical value is "excessive government overtime". From the perspective of Keynesian economics, moderate government overtime can enhance the government's macro-control capabilities and administrative governance efficiency. When facing greater economic downward pressure, the government can quickly formulate and implement fiscal stimulus policies through overtime[4-5]. These policies can inject vitality into the market in a timely

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manner, stimulate consumption and investment, effectively alleviate economic recession, and stabilize economic growth[6]. However, when the overtime intensity exceeds the threshold, the limited cognitive resources of government staff lead to a decline in information processing capabilities, making it difficult for them to conduct complex cost-benefit analysis[7]. Which is likely to cause misalignment between policy design and actual needs, thereby exerting an adverse impact on urban economic growth. Based on the above analysis, we propose the following hypothesis:

H1: The impact of local government overtime on urban economic growth presents an "inverted U-shaped" relationship of "first promoting and then inhibiting".

2.2. The Mediating Effect of Government Innovation Capacity

Becker's human capital theory holds that human capital is formed through education, training, and accumulation of practical experience[8]. Moderate government overtime creates more practical opportunities for government staff, enabling them to quickly accumulate experience and improve professional skills in handling complex government affairs. At the same time, the common working hours created by moderate government overtime facilitate knowledge sharing and learning within government departments, thereby enhancing the government's innovation capability[9]. This improvement in capability not only helps improve administrative governance efficiency but also provides more professional decision support for economic activities such as regional industrial planning and investment promotion, directly promoting urban economic growth[10]. On the other hand, excessive local government overtime causes serious erosion of human capital in government departments, thereby reducing the government's innovation capability. From the perspective of Romer's knowledge production function, long-term high-intensity overtime of government staff leads to deterioration of health conditions and lagging updates of professional skills[11], resulting in a slowdown in knowledge accumulation and a reduction in the effective labor input coefficient in the knowledge production function. This makes government decisions deviate from the reasonable range and hinders urban economic growth.Based on the above analysis, we propose the following hypothesis:

H2: Local government overtime affects urban economic growth by changing the government innovation capability.

2.3. The Moderating Effect of Government Digital Transformation

Government digital transformation exerts a key moderating effect on the inverted U-shaped relationship between local government overtime work and urban economic growth by optimizing the mode, efficiency, and boundaries of administrative intervention. On the one hand, through process optimization, information integration, and resource coordination[12], government digital transformation enables the administrative input from moderate government overtime work to more accurately align with market demands and economic development shortcomings, reduces efficiency losses caused by redundant routine work, amplifies the positive effects of administrative intervention in remedying market failures, and strengthens the promotional role of moderate government overtime work in economic growth. On the other hand, government digital transformation standardizes the boundaries of intervention and reduces decision-making blindness through data empowerment[13]; meanwhile, it replaces some repetitive overtime work with automated and intelligent tools, lowers resource misallocation, policy fluctuations, and administrative internal friction caused by excessive overtime work, and slows down the rate of diminishing marginal returns. Furthermore, the government affairs transparency and process standardization driven by digital transformation can constrain the impulse of excessive government intervention[14], preventing administrative input from exceeding the bearing capacity of the market and the

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economy, thereby weakening the inhibitory effect of excessive government overtime work on urban economic growth. Based on the above analysis, we propose the following hypothesis:

H3: Government digital transformation plays a moderating role in the impact of local government overtime work on urban economic growth.

3. Research Design

3.1. Model Construction

According to the research hypothesis, the urban economic growth effect of local government overtime may present an "inverted U-shaped" relationship between local government overtime intensity and urban economic growth. To test this hypothesis, the following benchmark regression model is constructed:

$$UEG_{it}=\alpha+\alpha_1 LGO_{it}+\alpha_2 LGO2_{it}+\sum_n \alpha_n Controls_{it}+\lambda_i+\mu_t+\varepsilon_{it} \quad (1)$$

where i represents a city, and t represents a year; LGO and LGO2 represent the local government overtime intensity and its quadratic term, respectively; α represents the constant term; β_1, β_2 and β_n represent the coefficients of the linear term of government overtime intensity, the quadratic term of government overtime intensity, and the control variables, respectively; Controls represents the control variables; λ_i is the city fixed effect; μ_t is the year fixed effect; ε_{it} is the random error term.

Based on a theoretical analysis, local government overtime work may have an impact on urban economic growth by altering the government innovation capacity(GIC). To deeply explore the influencing mechanism of local government overtime, this study constructs a mediating effect model and adopts the following econometric model:

$$MED_{it}=\beta+\beta_1 LGO_{it}+\beta_2 LGO2_{it}+\sum_n \beta_n Controls_{it}+\lambda_i+\mu_t+\varepsilon_{it} \quad (2)$$

$$UEG_{it}=\gamma+\gamma_1 LGO_{it}+\gamma_2 LGO2_{it}+\gamma_3 MED_{it}+\sum_n \gamma_n Controls_{it}+\lambda_i+\mu_t+\varepsilon_{it} \quad (3)$$

where MED is mediating variables, including GIC.

Furthermore, theoretical analysis further indicates that the government digital transformation (GDT) plays a moderating role in the impact of local government overtime on urban economic growth. To deeply explore the moderating effects of GDT, this study constructs a moderating effect model and adopts the following econometric model:

$$UEG_{it}=\delta+\delta_1 LGO_{it}+\delta_2 LGO2_{it}+\delta_3 GDT_{it}+\sum_n \delta_n Controls_{it}+\lambda_i+\mu_t+\varepsilon_{it} \quad (4)$$

$$UEG_{it}=\epsilon+\epsilon_1 LGO_{it}+\epsilon_2 LGO2_{it}+\epsilon_3 GDT_{it}+\epsilon_4(LGO_{it}\times GDT_{it})+\epsilon_5(LGO2_{it}\times GDT_{it})+\sum_n \epsilon_n Controls_{it}+\lambda_i+\mu_t+\varepsilon_{it} \quad (5)$$

3.2. Variable Definition

3.2.1. Dependent Variable

Urban Economic Growth (UEG). We adopt the mainstream methods in the existing literature and take the real GDP growth rate as the proxy variable for measuring urban economic growth.

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3.2.2. Independent Variable

Local Government Overtime (LGO). LGO is measured using high-frequency satellite nighttime light (NTL) data, with research subjects covering municipal-level governments including municipalities directly under the central government, sub-provincial cities, prefecture-level cities (autonomous prefectures) and provincial cities. First, NASA-calibrated daily VNP46A2 NPP/VIIRS nighttime light data with 500-meter resolution is downloaded and calibrated to eliminate interference from cloud cover and environmental factors. After acquiring the geocoordinates of government headquarters via map APIs and address correction, ArcGIS tools are applied to extract nighttime light intensity of government sites and their eight surrounding grids. Second, overtime is identified through a dual spatial-temporal criterion: temporally, the median light brightness of the government grid on statutory holidays serves as the baseline, and daily brightness exceeding this baseline indicates potential overtime; spatially, the median brightness of surrounding grids on workdays is taken as the baseline, with higher government grid brightness suggesting potential overtime. Overtime is determined only when both criteria are satisfied. Finally, LGO is defined as the annual number of overtime days of local governments, where more days represent higher overtime intensity. Three indicators-LGO, LGO_spatial, and LGO_time-are constructed to measure overall, spatial-dimensional and temporal-dimensional government overtime intensity respectively.

3.2.3. Mediating Variable

Government Innovation Capacity (GIC).The government innovation capacity is measured by the proportion of the local government's fiscal science and technology expenditure final accounts to the total local government's fiscal expenditure final accounts.

3.2.4. Moderating Variable

Government Digital Transformation (GDT).The amount of digital products and services purchased by the government with fiscal funds is used to measure the digital transformation of the government. Government digital procurement converts and accumulates funds into capital elements. To a certain extent, the procurement amount of the current year reflects the level of government digital transformation. Firstly, we obtain local government procurement announcement data from the China Government Procurement Network through web crawler technology, and combine text analysis technology to build a government digital procurement thesaurus to identify government digital transformation procurement projects and amounts. Secondly, we distinguish the types of purchasing units through the hierarchical naming rule and eliminate the purchasing projects of units such as educational institutions and enterprises that have no relation or weak connection with government functions. Finally, we reviewed and summed up the digital procurement amount and the number of projects to obtain the digital transformation level of the municipal government.

3.2.5. Controlling Variable

To control for other factors affecting urban economic growth, this paper introduces control variables including Highway Density, Financial Development Level, Population Density, Opening-Up Level, Education Expenditure, Government Self-Sufficiency Capacity, and Fiscal Decentralization Degree.

3.3. Data Sources

Since 2012, the Chinese government has further promoted the policy of reducing the burden on local governments, effectively curbing formalism and bureaucracy. Therefore, this study takes 2012–2025 as the research time range and 313 cities as the research objects. The data sources in this study are as follows: The local government overtime data is obtained from the NPP/VIIRS nighttime light data of NASA and manually collated; the data of the explained variable and control variables are obtained from the China Economic Information Network

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Statistical Database, China Economic and Financial Research Database, EPS Data Platform, and China Statistical Yearbook. Missing values are supplemented using the linear interpolation method and trend prediction method.

4. Empirical Analysis

4.1. Benchmark Regression Analysis

Table 1 reports the benchmark regression results of the impact of local government overtime intensity on urban economic growth. Column (1) only controls the city fixed effect, and Column (2) further controls the year fixed effect. The benchmark regression results show that the regression coefficient of the linear term of LGO is significantly positive, while the LGO2 is significantly negative. This initially indicates that the impact of local government overtime on urban economic growth presents an "inverted U-shaped" characteristic.

Table 1. Benchmark regression results

Variables	UEG	
	(1)	(2)
LGO	0.014***	0.015***
	(0.008)	(0.007)
LGO2	-0.003**	-0.002***
	(0.001)	(0.001)
Controls	Yes	Yes
City FE	Yes	Yes
Year FE	No	Yes
N	4,382	4,382
R^2	0.308	0.483

*Notes: *, *, and *** indicate significance at the 10%, 5%, and 1% levels, respectively; standard errors are in parentheses. The same below.

Table 2 presents the U-test results. The Slope interval is positive first and then negative, and the inflection point value is within the range of the local government overtime intensity data. This indicates that there is a threshold (3.750) for the impact of local government overtime on urban economic growth: when the local government overtime intensity is less than this threshold, local government overtime promotes urban economic growth; when it is greater than this threshold, local government overtime inhibits urban economic growth. The above results verify Hypothesis 1, i.e., local government overtime first promotes and then inhibits urban economic growth.

Table 2. U-test results

Variables	Lower bound	Upper bound
Interva	0	4.997
Slope	0.103	-0.088
t-value	0.789	-1.330
P>|t|	0.215	0.092

4.2. Endogeneity Test

To overcome the endogeneity problems caused by sample selection, omitted variables, and reverse causality, and ensure the robustness of the regression results, the instrumental variable method are used for endogeneity testing.

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Table 3 presents the test results of the instrumental variable method. Considering the persistent impact of local government overtime on urban economic growth, to alleviate the interference of reverse causality on the main conclusions as much as possible, the first lag of urban economic growth (L.REG) is selected as the instrumental variable for endogeneity testing. Column (1) of Table 3 shows that after re-regression using the first lag of the explained variable, the "inverted U-shaped" impact of local government overtime on urban economic growth remains significant.

Furthermore, the spatial and temporal variables of local government overtime (LGO_spatial and LGO_time) are used to replace the original LGO variable. Column (2) of Table 3 shows that the coefficients of LGO_spatial and LGO_spatial2 are 0.046 and -0.006 respectively, both significant at the 1% level, which is consistent with expectations. Similarly, Column (3) of Table 3 shows that the coefficients of LGO_time and LGO_time2 are significantly positive and negative at the 5% levels, which is consistent with the benchmark regression results.

Table 3. Instrumental variable method test results

Variables	L.UEG	UEG	UEG
	(1)	(2)	(3)
LGO	0.021***		
	(0.010)		
LGO2	-0.003***		
	(0.001)		
LGO_spatial		0.046***	
		(0.013)	
LGO_spatial2		-0.006***	
		(0.002)	
LGO_time			0.024**
			(0.013)
LGO_time2			-0.003**
			(0.002)
Controls	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	4,069	4,382	4,382
R^2	0.595	0.486	0.483

4.3. Robustness Test

4.3.1. Removing Outliers

To avoid the impact of sample outliers on the regression results, the sample data is subjected to 5% bilateral winsorization, and the benchmark regression is re-conducted. Column (1) of Table 4 shows that the coefficients of LGO and LGO2 are significantly positive and negative at the 1% level respectively, indicating that the research conclusion is robust.

4.3.2. Excluding the Impact of Uncertain Events

The COVID-19 pandemic spread rapidly in 2020, and its impact was weakened until 2023. To exclude the impact of the COVID-19 pandemic (an uncertain event), the samples from 2020 to 2023 are excluded, and the benchmark regression is re-conducted. Column (2) of Table 4 shows that after adjusting the sample interval, the research conclusion remains robust.

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4.3.3. Excluding Samples of Municipalities Directly under the Central Government

The four municipalities directly under the central government (Beijing, Tianjin, Shanghai, and Chongqing) have characteristics such as public policy bias and heterogeneity in economic development levels. Therefore, these samples are excluded, and the benchmark regression is re-conducted. Column (3) of Table 4 shows that after excluding the samples of municipalities directly under the central government, the inverted U-shaped relationship between local government overtime and urban economic growth is still significantly established at the 5% level, which also proves the robustness of the research conclusion.

Table 4. Robustness test results

Variables	Removing outliers	Excluding the impact of uncertain events	Excluding municipalities directly under the central government
	(1)	(2)	(3)
LGO	0.032***	0.037***	0.017**
	(0.011)	(0.013)	(0.008)
LGO2	-0.005***	-0.005***	-0.003**
	(0.002)	(0.002)	(0.001)
Controls	Yes	Yes	Yes
City FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	4,382	3,130	4,326
R^2	0.483	0.341	0.482

4.4. Mechanism Testing

Table 5 shows that LGO and LGO2 are significantly positive and negative at the 1% significance level, respectively, while GIC is significantly positive at the 1% significance level. This indicates that GIC also plays a mediating role in the inverted U-shaped relationship between local government overtime and urban economic growth, thereby verifying Hypothesis 2.

Table 5. Results of the mediating effect of government innovation capacity

Variables	(1)	(2)
	GIC	UEG
LGO	0.029***	0.086***
	(2.779)	(5.038)
LGO2	-0.481***	-0.207***
	(19.485)	(5.029)
GIC		0.292***
		(26.153)
Controls	YES	YES
City FE	YES	YES
Year FE	YES	YES
N	4,382	4,382
R^2	0.345	0.060

Table 6 presents the results of the moderating effect analysis of government digital transformation. The coefficient of the interaction term between LGO and GDT (LGO*GDT) is significantly positive at 0.059, indicating that GDT exerts a significant positive moderating effect on the promotional impact of local government overtime on urban economic growth. In

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contrast, the coefficient of the interaction term between LGO2 and GDT (LGO2*GDT) is significantly negative at -0.058, suggesting that GDT plays a significant negative moderating role in the inhibitory effect of local government overtime on urban economic growth. These results demonstrate that, for the inverted U-shaped relationship between local government overtime and urban economic growth, GDT amplifies the promotional effect of local government overtime on urban economic growth before the inflection point is reached. After exceeding the inflection point, GDT alleviates the inhibitory effect of local government overtime on urban economic growth.

Table 6. Results of the moderating effect of government digital transformation.

Variables	(1)	(2)
	UEG	UEG
LGO	0.060***	0.059***
	(3.306)	(3.273)
LGO2	-1.006***	-1.007***
	(9.456)	(9.469)
GDT	2.294***	4.564***
	(3.372)	(1.479)
LGO*GDT		0.059***
		(2.574)
LGO2∗GDT		-0.058***
		(2.564)
Controls	YES	YES
City FE	YES	YES
Year FE	YES	YES
N	4,382	4,382
R^2	0.392	0.394

5. Conclusion

Based on the data of 313 cities in China from 2012 to 2025, this paper explores the impact of local government overtime on urban economic growth and its micro-mechanism of action. Through a series of empirical analysis, the following conclusions are drawn: First, local government overtime exerts a significant inverted U-shaped relationship with urban economic growth. Second, mechanism analysis reveals that local government overtime affects urban economic growth mainly by altering government innovation capacity. Third, moderating effect analysis demonstrates that government digital transformation plays a moderating role in the relationship between local government overtime work and urban economic growth. The inverted U-shaped relationship between local government overtime and urban economic growth, GDT amplifies the promotional effect of local government overtime on urban economic growth before the inflection point is reached. After exceeding the inflection point, GDT alleviates the inhibitory effect of local government overtime on urban economic growth.

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