

## Does new-type urbanization policy promote urban security competitiveness? An empirical examination of curbing crime

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### Abstract

China's new-type urbanization surfaces as a pivotal strategic framework in urban development during the new era in China, enhancing urban competitiveness through high-quality economic, social, ecological, and other dimensions. Nonetheless, the societal implications of new-type urbanization policy on crime suppression, in other words, its role in fortifying urban security competitiveness, have been scarcely scrutinized. Considering social stability stands as the cornerstone for cities to sustain long-term competitiveness, to elucidate the impact of new-type urbanization on social stability, we evaluate the causal effect of new-type urbanization policies on regional crime and its mechanism by employing employed data from 209 prefecture-level cities in China spanning the period from 2014 to 2021 and utilizing a time-varying difference-in-differences model. Additionally, a moderation effect model and simple slope analysis are utilized to discern the mechanism that influences the effectiveness of these policies. The findings indicate that the new-type urbanization policy significantly suppresses crime, demonstrating a crime-reducing effect. Considering endogeneity problems, sample selection bias, and interference from random factors, a series of robustness tests, such as establishing urbanization levels in China based on nighttime lights, confirm its high robustness. Furthermore, the crime-reducing effect of the new-type urbanization policy primarily manifests in the eastern regions. Taking PM2.5 as an example, air pollution could weaken the crime-reducing effect of the new-type urbanization policy. Finally, it would contribute to a comprehensive understanding of the societal policy implications of China's new-type urbanization in crime control. It would also offer valuable insights for fostering improving urban security competitiveness through inclusive and sustainable urbanization in developing countries.

**Keywords:** *New-type Urbanization, Crime; Air Pollution, Time-varying DID Model; Urban Security Competitiveness*

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### 1 INTRODUCTION

Security is one of the crucial dimensions for measuring urban competitiveness and emerges as an essential catalyst in enticing domestic and international tourists and investors (Komasi et al., 2022), while frequent crime would diminish urban security and impede long-term urban competitiveness (GOGLIO, 2004). Crime is a behavior that breaks the rules of conduct stated in law (Wikström & Kroneberg, 2022), having numerous detrimental effects on victims, social stability, and economic development (Shapland & Hall, 2007; Tayebi et al., 2014). Whether considering its social costs or the enduring harm to urban security competitiveness, tackling the issue of crime is a pivotal benchmark. However, it substantially increases societal preventive expenditure (GOGLIO, 2004). Confronted with intricate urban systems and the embodiment of urban competitiveness (Ginevicius, 2019), a rational strategy and policy for urbanization

development are vital in propelling urban economic growth while ameliorating social issues like crime and further augmenting the urban sense of security. The correlation between urbanization and crime is evolving, showing that the bigger the cities, the less crime (Chang et al., 2019), even though it has been proven at the population urbanization level. Urbanization has begun to play a role in promoting urban security. To deepen this exploration, we find an appropriate quasi-natural experiment of well-planned urbanization known as the new-type urbanization in China, the biggest developing country.

In 2014, China promulgated the first official urban planning (Taylor, 2015), the National New-Type Urbanization Plan, initiating a new urbanization strategy. This new type of urbanization is called “new-type urbanization” (Chen et al., 2023; Xiao et al., 2023; Zhang et al., 2023; Taylor, 2015) or the “new urbanization” (Cheng, 2022; Li et al., 2016) by domestic and foreign scholars, mainly referred to by the former. The term “new-type” corresponds to the traditional urbanization in China and the extensive urbanization in the old era. Since the reform and opening-up in 1978, China has experienced a period of rapid and high-speed traditional urbanization, accompanied by rapid economic growth (Chen et al., 2018). Meanwhile, the negative characteristics of “four highs and five lows” are also evident, including high investment, high consumption, high emissions, low levels, poor quality, limited harmony, insufficient inclusiveness, and sustainability (Guan et al., 2018). In contrast, new-type urbanization makes innovative changes. Compared to traditional urbanization, new-type urbanization emphasizes human and social development, utilizes resources intensively and efficiently, integrates urban and rural development, constructs sustainable cities, prioritizes urban ecological civilization, restricts land expansion, and promotes institutional innovation (Guan et al., 2018). Concretely speaking, new-type urbanization is an urbanization model that, through a series of policy innovations, addresses challenges related to sustainable urban development, urban integration, urban-rural integration, and inclusive urban development, with a focus on human development as the core, considering aspects related to people, land, and the economy, and comprehensively promoting long-term urban competitiveness, thereby achieving sustained social and economic growth.

As an urbanization model to enhance urban competitiveness comprehensively, few studies have provided evidence of its effectiveness in urban safety competitiveness. Its pilot policy has engendered yield positive policy effects in economic, social, market, and ecological aspects (Zhang et al., 2023; Cheng et al., 2023; Yu, 2021; Li et al., 2018). Meanwhile, it alleviates societal impoverishment and disparities that significantly cause crime (Sugiharti, 2023; Song et al., 2020). However, few empirical studies have explored its social effects from the perspective of crime suppression, and there is limited focus on the ramifications of such urbanization on the diffusion of urban security competitiveness. Thus, we explore the following questions. How does the new-type people-oriented urbanization affect the criminal issues that impede the augmentation of urban security competitiveness? Does its pilot policy effectively inhibit crime in the pilot cities? If so, are other factors influencing it?

In response to the first question, this study investigates the policy effect of new-type urbanization on curbing the growth of crime from the perspective of individuals and social development, based on the theory of criminal sociology, proposing the research hypothesis. To answer the second question, we use panel data from 209 cities in China at the prefecture level and the time-varying difference-in-differences model, as well as a series robustness test. The results indicate that new-type urbanization policy reliably has a negative effect on crime. For resolving the third question, we discuss the moderating effect of air pollution, considering that environmental pollution can change crime conditions. Utilizing the moderating effect model and simple slope analysis, we find that air pollution can alter the extent of the policy effect on crime, with poor air quality weakening the crime-reducing effect and good air quality

strengthening it. Additionally, we examine the regional heterogeneity test discover that the crime-reducing impact of the policy is more pronounced in economically developed eastern areas.

This study enriches the societal effect of new-type urbanization on social safety, and the main contributions are as follows. First, different from previous research approaches regarding the correlation between urbanization and crime, this study employs China's new-type urbanization policy as a quasi-natural experiment and, based on the DID model, more accurately discerns the crime-inhibiting effect of a well-planned urbanization model. Second, compared with national research based on provincial panel data, we utilize sample data from 209 prefecture-level cities over 7 periods for empirical analysis, enhancing the reliability of the conclusions. Third, unlike the existing study of mechanisms primarily focusing on traditional urbanization, this study examines the mechanism of new-type urbanization on crime by considering the moderating effect of air pollution.

The remainder of the study is structured as follows. The second section comprises a thorough examination of pertinent literature. The third section clarifies the institutional background and factual attributes, elucidates theoretical mechanisms, and presents research hypotheses. The fourth section introduces the research model, variables, and data. The fifth section presents the empirical analysis and results. The sixth section discusses the research findings. Lastly, the seventh section concludes the study and offers policy recommendations.

## 2 LITERATURE REVIEW

### 2.1 Research on urbanization and crime

Our study is predicated upon the research on the nexus between urbanization and crime. As urbanization experiences protracted and intricate progress, the correlation between urbanization and crime gradually evolves. In the past, a plethora of domestic and international research elucidated the intimate nexus linking metropolitan and crime, as well as urbanization and crime, based on criminology, criminal economics, and related disciplines (Bettencourt et al., 2007; Glaeser & Sacerdote, 1999). The result of the correlation between urbanization and crime was intertwined with unregulated urbanization. In the 21st century, urbanization in most nations was still hasty and disordered, burdening society immensely in their quest for immediate economic growth, notably prevalent in developing countries (Okkels et al., 2018). Drawing from the case of China, empirical evidence illustrated that the nation's conventional model of urbanization significantly caused an upsurge in criminal activity (Chen, 2010), particularly during the rapid phase rather than a suitable phase (Guo & Yan, 2014).

As urbanization advances towards a sustainable model that does not sacrifice the well-being of marginalized groups and the environment, understanding the connection between urbanization and crime begins to evolve. Ghani (2017) argued that urbanization and crime were correlated, not causally linked. He posited that elements like destitution and societal disparity fostered a propensity for criminal conduct among individuals, consequently resulting in elevated crime rates in urban areas. Multiple scholars have validated the superlinear relationship between urban population size and crime rates (Chang et al., 2019; Bettencourt, 2013). Wang and Wei (2013) found that high-quality urbanization could notably diminish crime, based on provincial panel data from China. They further contend that increased urban population measured by registered residents did not lead to higher crime levels.

The mechanism of the correlation has centered around traditional urbanization. It spawned a myriad of environmental, societal, cultural, political, and economic challenges predisposing to fomenting social unrest and fostering urban criminality (Bettencourt et al., 2007).

Fundamentally, urbanization denoted the expansion of urban populace and scale (Wang et al., 2015). The institutional deficiencies of traditional urbanization were laid bare through the transient population, branding the migrant cohort as a “stigmatized” conduit for the surge in crime during urbanization (Qi, 2019). Jin et al. (2020) demonstrated that the growing population diversity stemming from the influx of migrant laborers undermines social trust, culminating in an upsurge of criminality, yet efficacious institutions could control crime.

In conclusion, the potential for urbanization to bolster urban security competitiveness has been gradually unveiled. However, the assertion that urbanization decreases crime has only been substantiated at the population urbanization level without thoroughly exploring the intricacies of urbanization. Additionally, the emphasis on its impact mechanism primarily pertains to traditional urbanization, with scant empirical evidence to validate the underlying mechanisms under effective urbanization policies.

## 2.2 Research on policy effect of new-type urbanization and relevant policies

In the discourse on achieving socially beneficial urbanization, there is a matching case study in China, which is new-type urbanization. With the implementation of the pilot policy of new-type urbanization, there exists an empirical foundation for scientifically assessing the impacts of such urbanization, leading research on policy effect to emerge as a highly discussed subject of interest in the studies of new-type urbanization. Specifically, new-type urbanization policy significantly affects the economy, market, ecology and society, which can be assessed through indicator systems or a differences-in-differences model, to improve urban competitiveness. Regarding the economic, market, and ecological ramifications, new-type urbanization possessed the capacity to propel the development of urban areas with high quality (Cheng, 2022), steering the economy towards high-quality, environmentally friendly progress (Zhang et al., 2023). It exerted a positive influence on tourism, land, energy, and labor markets (Zhang & Xing, 2023; Cheng et al., 2023; Feng et al., 2023), increasing the vitality in the market. Simultaneously, it aided in the reduction of carbon emissions and enhancement of the ecological environment (Yang et al., 2023), giving rise to profound ecological effects (Yu, 2021). Foremost, regarding social impacts and from a social policy standpoint, new-type urbanization held the capacity to promote personal growth and foster sustainable rural development (Zhao et al., 2018; Li et al., 2018), as well as bolster poverty alleviation (Long et al., 2016). It also could augment the subjective well-being of urban and rural inhabitants (Li et al., 2021) and promote equalization of essential public services while conferring societal welfare effects (Duan et al., 2020), thus propelling society towards collective prosperity.

Therefore, it is evident that research on the policy effect of new-type urbanization primarily refers to urban development, socioeconomic factors, rural-urban development, and green development. However, a notable lack of attention is given to social security and safety. Despite Foster et al. (2016) finding that for every 10% increase in overall policy compliance with new urbanism in Western Australia, the likelihood of becoming a victim decreases by 40%, its new urbanism prioritizes considerations such as compactness in urban spatial planning, pedestrian-friendliness, and mixed land use just spatially.

Furthermore, considering the human well-being and sustainable characteristics of new-type urbanization as a social policy, we also combed through the studies on the impact of such kinds of policies from other countries on crime. As asserted by Liszt, the best social policy is also the best criminal policy. This is evident in social welfare policies. Otsu et al. (2022) contend that the implementation of a health insurance policy in the United States, named Medicare-for-all, could decrease crime rates and inequality because healthier workers were less inclined to engage in criminal activities following adjustment to work hours. Fallesen et al. (2018) observed a notable reduction in the male crime rate among uninsured, unemployed individuals

in Denmark who responded favorably to active labor market policies. From investigating urban community crime, Powell and Porter (2023) concluded that addressing urban community violence necessitates more than reliance on criminal punishment. It should prioritize aiding economically disadvantaged communities and fostering the residential mobility of individuals within these communities to mitigate concentrated disadvantages and racial segregation, thereby mitigating crime. Moreover, this aspect is also evident in enhancing urban infrastructure policies. Hidalgo et al. (2021) demonstrated, through case studies conducted in Latin American cities, that the quality of urban and educational infrastructure could mitigate crime. Spader et al. (2016) identified, through an inquiry into the NSP's public housing redevelopment program, that demolition activities could diminish theft in the Cleveland area.

### 2.3 Research on urbanization, air pollution and crime

Finally, we examine the mechanisms involved in the causation of crime, specifically focusing on the secondary role of natural environmental factors, notably air pollution, from a macroscopic perspective. Studies in the United States, the United Kingdom, and China have demonstrated a close relationship between environmental pollution, specifically air pollution, and urban crime (Herrnstadt et al., 2021; Bondy et al., 2020; Gong et al., 2020). Air pollution's health and social costs contribute to its moral cost (Gong et al., 2020; Manisalidis et al., 2020; Lu et al., 2018), playing an undeniable secondary role in crime and social security. Meanwhile, the relationship between urbanization and air pollution remains complex, with some scholars proposing a positive correlation between extensive urbanization and environmental pollution, while others suggest a non-linear relationship (Zhu et al., 2019; Alvarez et al., 2017). The relationship between urbanization and air pollution is still a topic of debate. Despite the recent revelation of the ethical implications of air pollution, there has been a lack of research discussing these three factors within the same framework.

## 3 INSTITUTIONAL BACKGROUND AND RESEARCH HYPOTHESIS

### 3.1 Institutional background and characteristic facts of crime

New-type urbanization is people-oriented, focusing on intensive and efficient resource utilization, urban ecological civilization, integrating urban-rural development, as well as inclusive and sustainable urban urbanization (Guan et al., 2018). To promote new-type urbanization, the governments issued the National New-type Urbanization Plan (2014-2020) in 2014. They officially announced three batches of pilot cities for new-type urbanization in December 2014, November 2015, and December 2016, respectively, including two provinces and 246 sub-provincial areas (involving cities, districts, counties and towns), of which there are 83 prefecture-level pilot cities. After eliminating the interference of the pandemic, we take the crime of infringing upon personal rights and democratic rights of citizens as an example to conduct a preliminary analysis of crime characteristics in the context of the new-type urbanization pilot policy. It shows that pilot cities' crime levels decrease to different degrees, offering preliminary evidence for the research. Subsequently, we explore the matter rigorously, encompassing both theoretical and empirical aspects.

### 3.2 The impact of new-type urbanization policy on crime

This study mainly delves into how the means and accomplishments of new-type urbanization policy concerning population development, urban construction, and rural-urban coordination could ameliorate societal crime.

First, with the citizenization of peasant migrants, new-type urbanization tackles the predicament of individual deviant crime from social anomie under urbanization and population semi-

urbanization. It also addresses crimes arising from emotional detachment among itinerant families. Urbanization has an inevitable result, population mobility, which is the central subject of embodying the people-oriented ideology, and in China, it is mainly constituted by migrant workers (Bernard & Vidal, 2020). To develop migrants, the citizenization of peasant migrants becomes paramount to the new-type urbanization policy (Chen et al., 2016). It aims to facilitate their integration into the urban environment, encompassing ideology, social identity, and way of life. In China, the Chinese dream, the social goal, is also an urban dream (Taylor, 2015). Within the Chinese societal context, the “Chinese Dream” represents an urban aspiration as well (Taylor, 2015), denoting equitable entitlements and freedom of mobility for both rural and urban residents (Guan et al., 2018). For the transient population, their Chinese dream signifies that they could integrate into the urban setting and have the capacity to relish urban existence as authentic city dwellers (Guan et al., 2018; Taylor, 2015). Nevertheless, under traditional urbanization, the rigorous household registration system impedes their legitimate objectives (Li et al., 2016). Consequently, migrant workers lack access to government-sponsored health insurance and retirement benefits due to their status, and they have to bear the burden of their offspring’s educational expenses and higher public service expenditures because of the absence of lawful urban resident rights (UN-Habitat, 2014). The disconnection and rupture between the means offered by this social structure and the goals provided by the cultural structure constitutes the manifestation of social anomie (Merton, 1968). Furthermore, when individuals embrace socially acknowledged goals but reject the authorized methods set forth by society to attain such objectives, the itinerant populace is prone to embracing aberrant values stemming from the dearth of viable institutional avenues, thereby leading to engagement in transgressive criminal acts. Confronted with this actuality of mobile populace and cultural conflicts, the policy endeavors to alleviate this issue by expediting the reform of the household registration system, such as lowering the settlement prerequisites for cities of varying magnitudes (Lin & Zhu, 2022). These measures, in turn, extend opportunities and legitimate avenues for migrant workers aspiring to establish roots within urban areas. Furthermore, the broadening scope of basic public services, such as enforcing the interim provisions on residence permits, ensures that all urban dwellers, irrespective of their possession of urban hukou, partake in the benefits of communal welfare, thus facilitating the assimilation of the transient population into society (Chen, 2018). Consequently, it surmounts the prevalent predicament of social anomie in conventional urbanization while concurrently diminishing the incidence of deviant criminal conduct.

The citizenization of peasant migrants also tackles the predicament of semi-urbanization that denotes the circumstance wherein migrants have achieved a successful vocational transition but not an identity transition to enjoy the advantages and entitlements afforded to city denizens (Liu et al., 2016), which is inextricably linked to crime (Wang & Wei, 2013).

Moreover, in further pursuit of urbanization, the basic public education for the children of migrant workers not only guarantees access to fundamental public education for migrant offspring but also increases the time for parents to accompany and educate their children. This fortifies the bond between parents and children, serving as a pivotal cornerstone in crime prevention. It gives children more acceptance from their parents. It also internalizes their parents’ expectations and requisites to curtail their manifestation of illicit conduct (Hirschi, 1969), thereby diminishing the probability of engagement in criminal endeavors. Additionally, an inverse relationship exists between maternal attachment and low self-control (Miller et al., 2009). Higher self-control during childhood bodes well for stronger social ties and a lower propensity for criminal conduct in the future. Meanwhile, the peer effect of crime is less likely to be magnified among the crowds with strong self-control (Wright et al., 2001).

Second, enhancing urbanization quality is one of the pivotal undertakings within new-type urbanization (Guan et al., 2018). It promotes high-quality urbanization (Zhang et al., 2023; Cheng, 2022) to establish modern cities and improve urban governance. This endeavor facilitates the modernization of crime management and diminishes the expenses associated with crime prevention by harnessing urban big data for law enforcement and judicial evidence acquisition, thereby amplifying the effectiveness of urban security administration. Moreover, a higher level of governance means the allocation of supplementary police and city surveillance cameras to serve to fortify crime prevention measures and deter potential wrongdoers.

Third, the coordination of urban and rural development is an indispensable conduit for propelling the amalgamated urban-rural advancement in tandem with the national Rural Revitalization Strategies (Chen et al., 2021), tackling disparities in urban and rural development and the misalignment of social cost subjects. After substantial institutional changes amid periods of societal transformation, underprivileged peasant groups bear the cost of swift economic expansion and struggle to benefit from the rewards of social progress, culminating in divergences in urban and rural progress. The results of the unreasonable distribution of social developmental achievement and the misalignment of social cost subjects potentially impel vulnerable groups to resort to illicit methods to safeguard their sustenance and uphold their concerns. Meanwhile, the resulting social inequality markedly escalates crime rates (Song et al., 2020; Kelly, 2000), particularly violent transgressions (Kelly, 2000). New-type urbanization upholds the principle of coordinating urban and rural evolution to foster concord between urban and rural. It not only nurtures farmer progression by broadening avenues to augment farmers' earnings and endeavoring to lessen the urban-rural income chasm (Liu et al., 2022) but also catalyzes rural advancement by championing the expansion and enhancement of urban communal amenities and services into rural vicinities. Consequently, by advocating for a degree of social benefit sharing, it aids in resolving issues surrounding the misalignment of social cost subjects and social disparity, thereby mitigating societal conflicts and upholding social stability.

### 3.3 The moderating effect of air pollution

In contrast to social factors, air pollution, as a natural element capable of triggering criminal behavior, sets itself apart from direct causes as a possibility factor. It could modify the rationality, emotions, and likelihood of illness, influencing the efficacy of new-type urbanization policy on curbing crime.

From a physiological and psychological standpoint, air pollution would influence the neurotic characteristics accountable for transmitting information within the cerebral and nervous systems. Prolonged exposure to contaminated air could disrupt these neurotic characteristics, exerting an impact on human cognition, emotional processing, and consciousness while concurrently heightening the probability of aggressive responses (Chen & Li, 2020; Valavanidis et al., 2013). Moreover, it engenders detrimental psychological manifestations encompassing anxiety, tension, ire, and despondency (Braithwaite et al., 2019). Accordingly, in lousy air, individuals are more likely to demonstrate irrational and myopic assessments concerning the anticipated lawful advantages associated with new-type urbanization, adopting a prejudiced and pessimistic mindset towards social change. It increases the potential for criminal decision-making from misguided perceptions or extremist conduct.

From a sociological standpoint, financially constrained impoverished households may encounter difficulties adjusting their risk-bearing capacity to address the escalating expenses associated with the prevention, treatment, and hospitalization of illnesses caused by deteriorating air quality (Wu et al., 2021). The heightened probability and frequency of sickness

may impel them to resort to illicit means for survival. In order to provide enhanced assistance to vulnerable demographics amidst inevitable risks, the new-type urbanization policy assumes a pivotal role in mitigating poverty and augmenting welfare (Duan et al., 2020; Long et al., 2016). Nevertheless, an increasing number of households harboring expected risks that surpass their capacity to bear risks signifies the need to expand the reach of institutional benefits to encompass a broader population range. This expansion may result in the inefficient allocation of limited societal resources, potentially leaving genuinely impoverished families without substantive amelioration in their living conditions and consequently diminishing the efficacy of new-type urbanization policy on curbing crime. As the coverage extends further to embrace additional groups, the crime suppression impact of the policy may dissipate.

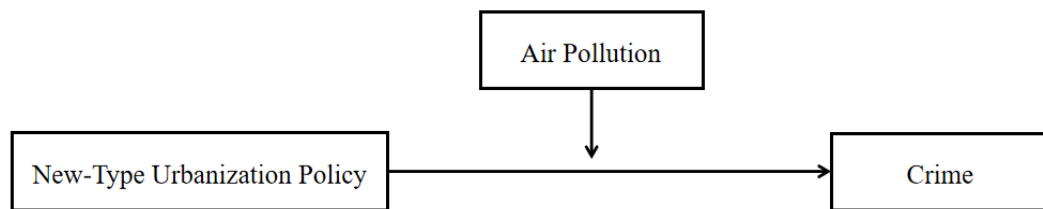


Fig. 1 – The impact of new-type urbanization policy on crime.

Source: own research

Drawing upon the analysis above, we established a theoretical framework for the impact of new-type urbanization policy on crime (illustrated in Figure 1). Consequently, it proposes the ensuing research hypotheses:

**H1:** New-type urbanization policy could reduce the occurrence of crimes, thereby engendering an effect of crime containment.

**H2:** Air pollution is a moderating variable in the relationship between new-type urbanization policy and crime. As air conditions deteriorate, it attenuates the negative impact of such policy on crime; conversely, as these conditions improve, they amplify this effect of crime containment.

## 4 METHODOLOGY AND DATA

### 4.1 Model

#### *Policy effect model*

Based on the panel data, we construct a model of the effect of new-type urbanization policy on crime using the differences-in-differences model, taking the new-type urbanization pilot policy as a quasi-natural experiment. The pilot policy of new-type urbanization was announced in three batches of pilot cities in late 2014, late 2015, and late 2016, respectively. So 2015, 2016, and 2017 are taken as the years of implementation of the pilot policy for the corresponding pilot batch of pilot cities, respectively. Taking into account multiple pilot tranches, we adopt the differences-in-differences method with multiple periods to assess the policy effects of new-type urbanization on crime (Bertrand & Mullainathan, 1999). The policy effect model is constructed as follows. First of all, according to whether to participate in the pilot program, the cities are divided into the control group (non-pilot cities) and the experimental group (pilot cities) to get the treatment group dummy variable (Treat); Then treatment period effect dummy variable (Year) is set according to whether the pilot policy has been implemented or not in the year in which the experimental group is located; Finally, the two multiplied by the policy dummy variable obtained as a core independent variables of the model (D). Construction of the baseline model is as follows:



$$Crime_{it} = \beta_0 + \beta_1 \times D_{it} + X_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

$$D_{it} = Treat_i \times Year_{it} \quad (2)$$

Where, *i* and *t* represent area and time, respectively; *CRIME* denotes the number of crimes. *Year<sub>it</sub>* is the dummy variable for the pilot period, *Year<sub>it</sub>* = 0 indicates that new-type urbanization policy has not been implemented in period *t* of area *i* and *Year<sub>it</sub>* = 1 indicates that new-type urbanization policy has been implemented in period *t* of area *i*. *Treat<sub>i</sub>* is the dummy variable for the pilot area, *Treat<sub>i</sub>* = 0 indicates that new-type urbanization policy has not been implemented in area *i* and *Treat<sub>i</sub>* = 1 indicates that new-type urbanization policy has not been implemented in area *i*. *DID<sub>it</sub>* is the intersection of the area and time dummy variables, which represents the new-type urbanization policy variables. *X<sub>it</sub>* is a set of control variables that have an impact on crime. *μ<sub>i</sub>* and *λ<sub>t</sub>* stand as the city's fixed effect and year fixed effect respectively, and *ε<sub>it</sub>* denotes the random error term and is clustered to the city level. Here, *β<sub>1</sub>* is an important estimated parameter, representing the economic implication of the impact of the new-type urbanization policy on crime.

#### *Moderating effect model*

To prove the existence of the moderating effect of air pollution, taking PM<sub>2.5</sub> as an example, the moderating effect model is shown in the following Equation (3) by putting the moderating variable and the interaction of the moderating variable and policy variable into Equation (1).

$$Crime_{it} = \beta_0 + \beta_1 \times DID_{it} + \beta_2 M_{it} + \beta_3 DID_{it} \times M_{it} + X_{it}\gamma + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

Where, *M<sub>it</sub>* denotes year *t* of the severity of air pollution in the city *i*, denoted by PM<sub>2.5</sub>; *DID<sub>it</sub>* × *M<sub>it</sub>* represents the interaction of policy variable and air pollution. *β<sub>2</sub>* and *β<sub>3</sub>* are the parameters of moderating and interaction variable, and *β<sub>3</sub>* is the concerned parameter that represents the moderating effect of air pollution on the relationship between new-type urbanization policy and crime in Equation (3).

## 4.2 Variables

### *Crime variable*

Taking the crime of violating the personal rights and democratic rights of citizens as the object, we use the number of criminal judgments of the first instance of such crime from the China Judgment Documents Network to measure the level of crime. The number of corresponding documents in each area is aggregated upward based on the year of upload by the court unit. These courts include the intermediate people, railway, and maritime courts at the prefecture level. We employ two sample statistical standards based on the type of courts, including only considering the intermediate people's court or all three types of courts. By aggregating the annual judgment count for each city using the criteria above, we obtain the core independent variable, *Crime*, and one of the robust variables, *Crime2*. Additionally, as another alternative crime variable for robustness test, crime rate variable is constructed by calculating the ratio of *Crime* to the number of permanent residents in prefecture-level cities per 10000 people, recorded as *Crimerate*.

### *New-type urbanization policy variable*

After designating the pilot policy of new-type urbanization as the experimental subject, we create a policy dummy variable as the policy variable (detailed construction has been revealed in the Model part), denoted as *D*. In the robustness test, we utilize the comprehensive urbanization level index (CNLI) to replace *D*, which is measured by night light data.

### *Control variables*

In order to control for confounding variables, the model incorporates variables that are closely associated with crime. These variables include the following. First, demographic factors, such as population size and population density, represented by the ratio of permanent population per 10,000 individuals and the population size relative to the land area of the administrative region, denoted as *Popsize* and *Popdensity*, respectively. Second, economic development, measured by per capita GDP, denoted as *Gdp*. Third, income disparity, measured by the absolute difference between urban and rural incomes, denoted as *Urgap*. Fourth, government expenditure, measured by the general public budget expenditure of local finance per 10,000 individuals, recorded as *Public*. Fifth, otherness in uploading judgment documents, quantified by the number of judgment documents of first instance in criminal cases per 10,000 incidents of violating civil rights of individuals, recorded as *Othercrime*. The reasons for the selection of control variables are as follows. Firstly, the size of the population is intricately connected to crime. As population density increases, there is a higher likelihood of contact between potential criminals and potential victims, resulting in a potential increase in crime (Hipp & Roussell, 2013). Secondly, the level of economic development is a critical control variable in the empirical study of crime causes. In criminal economics, the more developed the economy, the higher the proceeds of crime (Detotto & Otranto, 2012). Thirdly, in China, the gap between urban and rural is the most typical problem of unequal distribution (Ma et al., 2018), including income. The growing gap between urban and rural would lead to social imbalance, accentuate regional conflicts, and ultimately may result in an escalation of crimes. Fourthly, crime is influenced by the government's allocation of funds towards public security. The augmentation of law enforcement personnel and the infusion of additional resources will deter criminal activities. Ultimately, in order to mitigate disparities in the understanding and circumstances surrounding the submission of regional judicial documents, we control the variable of the otherness in uploading judgment documents, according to Jiang and Liang's study (2022) about the measuring method of such a variable.

#### *Moderator variable*

Air pollution is the moderator variable, exemplified by  $PM_{2.5}$ .  $PM_{2.5}$  denotes minute particulate matter, measuring 2.5 microns or less in diameter per cubic meter of air, standing as a significant parameter for gauging air quality. This fine particulate matter serves as the primary air pollutant in China (Chen et al., 2020), persisting in the atmosphere for extended durations and posing severe ramifications on human health (Apte et al., 2015). It is calculated by the average annual concentration.

#### 4.3 Data

The sample data covers the period from 2014 to 2021. After excluding regions with mostly missing control variables, 209 urban samples were selected, including 83 pilot cities for new-type urbanization and 126 non-pilot cities. The pilot cities in the three batches were 59, 9, and 15, respectively. Due to the absence of judgment of crimes of infringing upon personal rights and democratic rights of citizens of Sanya City and Danzhou City in 2021, the total sample size is 1,670.

The crime data is derived from the judgment document published by each district court between 2014 and 2021, obtained from the China Judicial Documents website, and collected in March 2023. This website serves as an accessible online platform for judicial documents (Jiang & Liang, 2022). The Supreme People's Court's documents of judgments, rulings, and decisions with legal implications should generally be publicized online, except for exceptional circumstances prescribed by law (such as state secrets, juvenile crimes, or matters involving commercial secrets), stipulated in the Interim Measures for the Online Publication of Judgment Documents of the Supreme People's Court officially implemented in July 2013. About the

rationality of the sample period, considering the year of implementation of the interim measures, this study focuses on examining data from 2014 onwards. Considering the obligations of uploading judgment documents online, as well as the control variable of the uploading behaviors, it is assumed that the criminal judgment of the first instance has been completed, and most of them have been generated and uploaded in the 2-9 years from collection year, making sample period selection reasonable. The PM<sub>2.5</sub> data source is derived from the annual mean PM<sub>2.5</sub> concentration dataset conducted by Liu (2023). Its original dataset is the globally observed PM<sub>2.5</sub> concentration grid data set calibrated through geographically weighted regression (GWR) conducted by Washington University in St. Louis. This data source surpasses the original dataset and PM<sub>2.5</sub> published by the government statistics regarding accuracy and objectivity. The remaining data primarily originate from the regional urban statistical yearbook and the urban construction statistical yearbook issued by the Ministry of Housing and Urban-Rural Development. Any unreported data in the yearbook are supplemented by referencing the regional annual statistical bulletin, the annual government work report, and the statistical bulletin of human resources and social security development. Moreover, the data on night lights and house prices in the robustness test is from the National Oceanic and Atmospheric Administration of the United States and the National Information Center of China, respectively.

In terms of data processing, the missing data is filled by linear interpolation. When the filling value is negative, the value of the adjacent year is utilized. For the variables affected by prices, nominal variables such as GDP and income are adjusted to real variables based on 2013 using each city's Consumer Price Index (CPI) in each year (2013=1). Besides, the absolute value variables are all logarithmically transformed to eliminate interference from heteroscedasticity and dimensional influence. The descriptive statistical results are presented in Table 1.

Tab. 1 – Descriptive statistics of the variables.

Variable	Symbol	N	Mean	Std. Dev.	Min	Max
<b>Dependent variables</b>						
Crime level	Crime	1734	5.054	1.107	0.000	7.368
	Crime2	1734	5.054	1.108	0.000	7.370
Crime rate	Crimerate	1734	-0.586	0.732	-5.531	1.253
<b>Independent variables</b>						
New-type urbanization policy	D	1734	0.312	0.464	0	1
	CNLI	1670	0.011	0.015	5.1e-05	0.132
<b>Mechanism variable</b>						
Air Pollution	PM2.5	1662	3.636	0.407	1.586	5.054
<b>Control variables</b>						
Demographic factors	Popdensity	1686	5.525	1.295	-0.115	8.362
	Popsize	1686	5.684	0.801	3.182	7.659
Economic development	Gdp	1670	10.717	0.537	9.019	12.273
Government expenditure	Public	1670	9.238	0.410	8.041	10.708
Income disparity	Urgap	1670	9.671	0.274	8.246	10.435
Otherness in uploading judgement document	Othercrime	1670	1.384	0.606	-4.511	3.373
	Othercrime2	1670	1.385	0.607	-4.511	3.373
House price	Houseprice	1526	8.563	0.409	7.691	10.116

Unemployment rate	Unemploy	1526	2.939	0.779	0.390	5.700
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Source: own research

## 5 RESULTS

### 5.1 Baseline regression

According to Eq. (1), the DID results of assessing the impact of new-type urbanization policy on crime are shown in Table 2. Column (1) reports the regression results without control variables, and columns (2) to (6) shows the results of model (2) to model (6), gradually adding the control variables of demographic factors, otherness in uploading judgment document, economic development, government expenditure, and rural incomes. As shown, new-type urbanization policy’s effect on crime is significantly negative, and the models are all well-fitted, with R-squared greater than 0.88. Considering the theoretical soundness of the control variables, column (6) reveals the baseline regression result, which indicates that the policy makes the average of the logarithmic number of criminal first-instance judgment documents for the crime of infringing on citizens’ personal and democratic rights decrease by 0.0811 ( $p < 0.05$ ). Its economic meaning is that when the number of judgment documents about the crime is 10,000, the policy will reduce it by 779, a decrease of about 7.79% ( $(e^{(\ln 10000 - 0.0811)} - 10000)/10000$ ). Therefore, in the context of population growth, the new-type urbanization policy still significantly reduces crime, thereby verifying hypothesis 1.

In terms of control variables, the coefficients of *Popdensity* and *Othercrime* are both significantly positive, indicating that an increase in the population size of a district is strongly correlated with an increase in the number of crimes. And otherness in uploading judgment documents for a specific crime in district courts is reflected in variations in the number of other criminal offense cases, i.e., courts that are more active in uploading other criminal cases are typically more active in uploading criminal offense cases within the studied case class, which is similar to the results of the Jiang and Liang (2022) study on controlling for otherness in uploading judgment documents. However, the population density, GDP, government expenditure on public services, and absolute income gap between urban and rural areas exert no significant effect on crime, possibly due to the particular nature of the data source that emphasizes the importance of population size and otherness in uploading judgment document in the control variables, as well as the complex nonlinear relationship. Despite not passing the significance test, as they are theoretically supported and not regarded as core variables within the model, these control variables are still included.

Tab. 2 – Estimation results of differences-in-differences test.

Variables	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
	Dependent variable: Crime					
D	-0.1036* (0.0545)	-0.1109** (0.0551)	-0.0938** (0.0376)	-0.0846** (0.0367)	-0.0811** (0.0352)	-0.0811** (0.0352)
Popdensity		0.1280 (0.0969)	0.0420 (0.0410)	0.0293 (0.0390)	0.0268 (0.0395)	0.0273 (0.0405)
Popsize		-0.4041 (0.3280)	0.9374*** (0.1863)	0.9662*** (0.1993)	1.0652*** (0.2284)	1.0670*** (0.2309)
Othercrime			0.8233*** (0.0419)	0.8184*** (0.0419)	0.8179*** (0.0414)	0.8179*** (0.0415)
Gdp				0.0847 (0.0993)	0.0435 (0.0934)	0.0451 (0.0997)

Public					0.1665 (0.1364)	0.1659 (0.1375)
Urgap						-0.0117 (0.1791)
Constant	5.0860***	6.7208***	-1.5620	-2.5650	-4.2136*	-4.1244
	(0.0171)	(1.9372)	(1.0821)	(1.7970)	(2.5133)	(2.8268)
City fixed effect	YES	YES	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES	YES	YES
N	1,734	1,686	1,686	1,670	1,670	1,670
R-squared	0.882	0.875	0.951	0.950	0.950	0.950

Note: Where individual robust clustering standard errors are in parentheses; \*\*\*, \*\*, \* indicate P value less than 0.01, 0.05, 0.1 respectively. Similarly hereinafter.

Source: own research

### 5.2 Parallel trend test

The parallel trend test is a hypothetical prerequisite for the DID model. The net effect of policy implementation on crime can be effectively assessed on the condition that the parallel trend assumption is satisfied, i.e., there is no significant difference in crime between pilot and non-pilot cities before implementing the new-type urbanization pilot policy. According to Jacobson et al. (1993), the event study method was adopted to test the parallel trend for verifying the validity of the results based on Model 6 in Table 2. Figure 2 plots the dynamic effect of the policy, i.e., the estimated crime at the 95% confidence interval. As seen in Figure 2, before implementing the policy, the estimated value of the crime is not significantly different from zero, so there is the existence of common trends between the pilot cities and the non-pilot cities before implementing the policy, satisfying the assumption of the parallel trend. Moreover, the policy effect is significantly negative in each period starting from the lagged period, which supports the results of the benchmark regression.

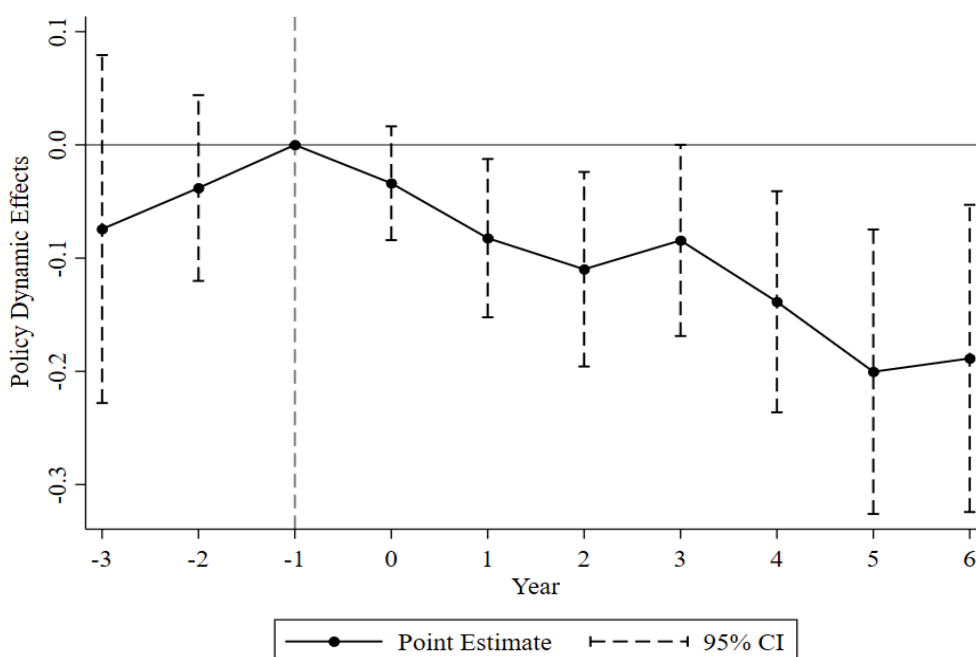


Fig. 2 – Parallel trend test.

Source: own research

### 5.3 Robustness tests

#### *Placebo test*

To mitigate the interference of non-observable factors, we use a permutation test to prove the robustness of the baseline regression. The permutation test is one of the placebo tests that can identify whether the estimates are statistically significant or randomly generated. Based on Liu and Lu (2015), we recreate the estimated results by re-randomizing the dummy policy variables and repeating the process many times to complete the placebo test. The hypothesis is that new-type urbanization policy has no significant impact on crime, which indicates that randomly generated policy variables should not affect the dependent variable.

Figure 3 shows the results of the placebo test recreating the policy variables about 1,000 times, obtaining the P-value distributions and kernel density plot of random outcomes of placebo tests. As is shown in Figure 3, the estimated values are centrally distributed around 0 and follow normal distribution similarly, different from the actual estimated coefficients, which means that randomly generated policy variables do not affect the dependent variable. Consequently, the baseline model passes the placebo test and is unlikely to have problems such as omitted variables, while the model estimate is robust, non-randomly generated, and statistically significant.

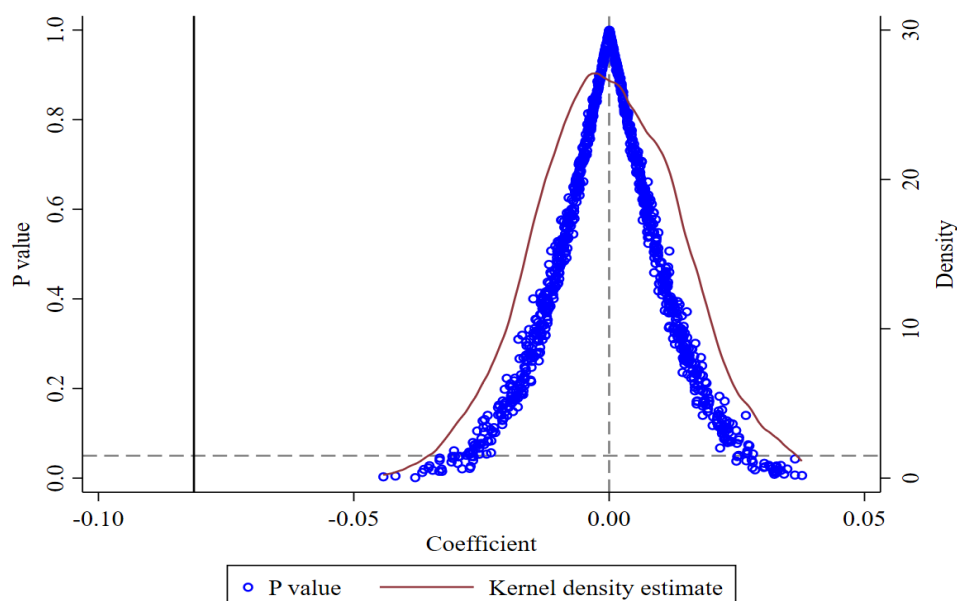


Fig. 3 – Placebo test (1000 times).

Source: own research

#### Changing sample time

With the outbreak of the global COVID-19 pandemic during 2020 and 2021 in our sample period, researchers discovered that the worldwide spread of coronavirus pneumonia resulted in a decline in overall crime rates. It notably reduced most forms of criminal activities, such as physical violence, fraud, and sexual violence, while increasing a few types of crimes, including homicide and cybercrime (Halford et al., 2020). Considering the impact of the COVID-19 pandemic and the lockdown policy on crime during the pandemic, we shrink the sample period from 2014 to 2019, creating Model 1 in Table 3. Furthermore, although we have controlled the

otherness in uploading judgment documents among cities, the overall proportion of judgment of conviction on the China Judicial Documents Website in 2021 is significantly lower than from 2014 to 2020. To further exclude the error in online uploading of judgment documents in 2021, the sample in 2021 was excluded in Model 2.

As is shown in Table 3, the coefficients of the policy variables remain significantly negative in both models about excluding epidemic interference ( $\beta_1 = -0.0518$ ,  $p < 0.1$ ) and the judgment of conviction errors ( $\beta_1 = -0.0587$ ,  $p < 0.1$ ), which proves that the policy can still have a negative effect on crime after removing the above disturbances.

Tailing and adding control variables

To further increase the reliability of the results, this section conducts the robustness tests by changing the control variables, including tail reduction, and adding other possible control variables. On the one hand, the extreme values less than 1% and greater than 99% percentiles are replaced with values in the 1% and 99% percentiles, respectively, to eliminate the impact of extreme value interference on the reliability of results (shown in Table 3 Model 3); on the other hand, for the sake of preventing the problem of omitted variables, other control variables entered into the regression model (shown in Table 3 Model 4), including the average price of commercial housing (Song et al., 2019) and the urban registered unemployment rate (Recher, 2020). The results indicate that the coefficients of the policy variable are significantly negative. Therefore, the regression results pass the robustness test when changing control variables.

Tab. 3 – Robustness test results based on changing periods and control variables.

Variables	Model (1)	Model (2)	Model (3)	Model (4)
	cut2020&2021	cut2021	winsorize	moreControl
Dependent variable: CRIME				
D	-0.0518* (0.0309)	-0.0587* (0.0332)	-0.0696** (0.0344)	-0.0669* (0.0356)
Popdensity	0.5113** (0.2513)	0.0522 (0.0496)	0.0712 (0.0569)	0.0397 (0.0404)
Popsize	0.9203*** (0.2523)	1.0872*** (0.2467)	0.8911*** (0.2447)	0.8827*** (0.2168)
Othercrime	0.7652*** (0.0526)	0.8134*** (0.0468)	0.8230*** (0.0353)	0.8060*** (0.0498)
Gdp	-0.0362 (0.1002)	0.0471 (0.0990)	-0.0088 (0.1017)	0.0073 (0.1050)
Public	0.2204 (0.1449)	0.1901 (0.1368)	0.0843 (0.1458)	0.0627 (0.1183)
Urgap	-0.2643 (0.2561)	-0.1840 (0.2423)	-0.0198 (0.1972)	0.0528 (0.1557)
Houseprice				-0.0640 (0.1008)
Unemploy				0.0159 (0.0206)
Constant	-2.9844 (3.8429)	-2.8704 (3.2548)	-1.9653 (2.8301)	-1.9020 (2.5648)
City fixed effect	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES

N	1,254	1,463	1,670	1,526
R-squared	0.958	0.952	0.951	0.951

Source: own research

#### Time-trend term test

The National Comprehensive Pilot Plan for New-type Urbanization, promulgated in 2014, makes it clear that the selection of pilot areas considers the declared areas' work base and pilot program. Even though the pilot plan has considered different geographic locations and types of cities, the selection of pilot cities for new-type urbanization is still not wholly random, and there are some differences between pilot and non-pilot cities that had existed before the year of the policy implementation. Moreover, considering that controlling post variables that occur after the treatment point may lead to inconsistency in the estimated coefficients (Cinelli et al., 2021), we introduce the time trend term into the baseline model, and replace the control variables in the baseline model with the interaction of the time-trend term and control variables in 2014, to validate the robustness of the central hypothesis further. As is shown in Column (1) to (2) of Table 4, the new-type urbanization pilot policy continues to have a significant effect on reducing crime in the model controlling for the quadratic ( $\beta_1 = -0.0748, p < 0.1$ ) and cubic ( $\beta_1 = -0.0810, p < 0.1$ ) time-trend terms.

#### Replacing dependent variable

We replace the dependent variable to further verify the model's robustness. New explanatory variables are constructed by transforming the court sample's statistical criteria and the crime indicators' measurement, denoted by *Crime2* and *Crimerate*. Another statistical criterion is to add the number of judgment documents in the intermediate people's court, railway court, and maritime court, all at the prefecture level, into its corresponding city (shown in Column (3) of Table 5). Another measurement is to calculate the crime rate. Considering the lost relationship between population size and crime, we divide the volume of crime by the population before taking the logarithm, then conduct regression (shown in Column (4) of Table 4). The results show that the crime variables under different statistical criteria and measures are all robustly regressed in the baseline regression, meaning that the negative impact of the new-type urbanization policy on crime remains significant. By the way, the model with *Crime2* and *Cimerate* both satisfy the parallel trend test.

Tab. 4 – Robustness test results based on adding time trend and changing dependent variables.

Variables	Model (1)	Model (2)	Model (3)	Model (4)
	Dependent variables			
	Crime		Crime2	Cimerate
D	-0.0748* (0.0428)	-0.0810* (0.0432)	-0.0815** (0.0352)	-0.0811** (0.0352)
Constant	2.7107*** (0.8472)	3.3543*** (0.6508)	-4.1733 (2.8236)	-4.1244 (2.8268)
Control variables			YES	YES
Control variables (2014) × t	YES	YES		
Control variables (2014) × t <sup>2</sup>	YES	YES		
Control variables (2014) × t <sup>3</sup>		YES		
City fixed effect	YES	YES	YES	YES
Year fixed effect	YES	YES	YES	YES
N	1,670	1,670	1,670	1,670



R-squared	0.899	0.897	0.950	0.897
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Source: own research

### Replacing the independent variable

Considering the comprehensiveness of urbanization, we construct a composite urbanization indicator as an indicator of the urbanization level in China under the context of new-type urbanization to replace the core policy variables and set up new models to further corroborate the reliability of hypothesis 1. New-type urbanization, China’s urbanization in recent years, has aimed to effectively and comprehensively improve the quality of urbanization development. To reflect the level of urbanization more objectively and comprehensively, we select night-time lighting data acquired via satellite to construct indicators. It is the result of the combined effects of regional population migration, industrial transformation, and urban spatial changes, as a relatively objective reflection of the comprehensive urbanization level of the region.

The initial data is NPP/VIIRS monthly night-time light imagery (cloud mask processed version without any stray light) from the National Oceanic and Atmospheric Administration (NOAA), which does not suffer from DN saturation and has better spatial and radiometric resolution than DMSP/LSMT data. The light size of each smallest pixel unit of the night light image is represented by the DN value.

Firstly, to ensure the comparability and reliability of the data and to exclude the influence of negative noise, summer outliers, reflected moonlight on the lake surface, and other extreme values, it is necessary to obtain the standard DN values of each region for each year. Referring to related studies by scholars in the field of remote sensing, we use ArcGIS to perform a rigorous data preprocessing, acquisition, and calibration process on the initial night-time lighting images, thereby obtaining the standard yearly lighting data (standard DN), denoted by DN in the following equations.

Secondly, according to the way of constructing urbanization level using night lighting (Li et al., 2023), the minimum urban lighting threshold is set to be 1, and considering the lighting intensity and range comprehensively, the relative intensity index of regional lighting (I) and the relative area index of regional lighting (S) are obtained through Equation (5) and Equation (6) respectively. By combining intensity and area, the comprehensive night-time lighting index (CNLI) is obtained by Equation (4) as the comprehensive urbanization level index.

$$CNLI = I \times S \tag{4}$$

$$I = \frac{1}{N_L \times DN_M} \times \sum_{i=1}^{DN_{Max}} (DN_i \times n_i) \tag{5}$$

$$S = \frac{Area_N}{Area} \tag{6}$$

Where, I and S denote the ratio of the sum of the standard DN values for which the area light intensity is not less than 1 to the total area light intensity and the ratio of the sum of the area of areas with a regional light intensity of not less than 1 to the total area of the region, respectively.

Finally, we build a random model, an individual fixed-effects model, a time fixed-effects model, and a two-way fixed-effects model based on the CNLI to further corroborate the research hypothesis 1. As shown in Table 5, the comprehensive urbanization level has a prominent negative effect on crime under four model tests. In these models, the two-way fixed effects model is the best fit ( $R^2 = 0.827$ ), corroborating the reliability of research hypothesis 1.

Tab. 5 – The impact of CNLI on crime.

Variables	Model (1)	Model (2)	Model (3)	Model (4)
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	REM	Individual FEM	Time FEM	Two-way FEM
Dependent variable: CRIME				
CNLI	-5.2701*** (1.5361)	-6.5919*** (2.2631)	-4.5291*** (1.2934)	-3.1579* (1.6326)
Popdensity	0.0361 (0.0316)	-0.0133 (0.0523)	0.0795** (0.0318)	0.0240 (0.0445)
Popsize	0.8825*** (0.0429)	1.1617*** (0.2860)	0.9278*** (0.0366)	1.0857*** (0.2312)
Othercrime	1.0346*** (0.0381)	1.0348*** (0.0390)	0.8150*** (0.0417)	0.8188*** (0.0416)
Gdp	-0.2579*** (0.0726)	-0.2672* (0.1414)	-0.1370** (0.0644)	0.0292 (0.1001)
Public	-0.3779*** (0.0878)	-0.3325** (0.1499)	0.1070 (0.0870)	0.1788 (0.1405)
Urgap	-0.2874* (0.1571)	-0.6195 (0.3770)	-0.0091 (0.0981)	-0.0011 (0.1763)
Constant	7.5486*** (0.8988)	9.1387*** (1.7035)	-0.8981 (1.0624)	-3.9810 (2.7746)
City fixed effect	NO	YES	NO	YES
Year fixed effect	NO	NO	YES	YES
N	1,670	1,670	1,670	1,670
R-squared	0.741	0.745	0.825	0.827

Source: own research

#### 5.4 Regional heterogeneity

As previously divided sample cities into eastern, central, and western, the results of regional heterogeneity analysis are shown in Table 6. The results show that although the crime reduction effect of the policy is insignificant in the central and western regions, it is significantly negative at the 1% level ( $\beta_1 = -0.1346, p < 0.001$ ) in the eastern region. It also can be seen that the coefficient of the independent variable in the eastern is smaller than the total sample cities ( $-0.1346 < -0.0811$ ), and meanwhile, the degree of negative effects in the eastern region is stronger ( $|-0.1346| > |-0.0811|$ ), too. Consequently, it represents the impact of new-type urbanization policy on crime, which mainly occurs in the eastern region.

Tab. 6 – Heterogeneity analysis results of different regions.

Variables	Model (1)	Model (2)	Model (3)
	Eastern	Central	Western
	Dependent variable: CRIME		
D	-0.1346*** (0.0465)	0.0059 (0.0614)	-0.0240 (0.0628)
Popdensity	1.1282** (0.5433)	0.0571 (0.0424)	0.8711* (0.4716)
Popsize	-0.3726 (0.6399)	0.9825*** (0.2954)	0.6270 (0.5151)
Othercrime	0.7992*** (0.0879)	0.8212*** (0.0640)	0.7834*** (0.0426)

Gdp	0.0492 (0.1894)	-0.0631 (0.1732)	-0.0682 (0.2091)
Public	0.1105 (0.1624)	0.0175 (0.2652)	0.5239** (0.2521)
Urgap	0.0800 (0.1808)	-0.2256 (0.3845)	-0.2578 (0.3168)
Constant	-2.9095 (4.0267)	0.8635 (4.6538)	-5.4659 (6.2629)
City fixed effect	YES	YES	YES
Year fixed effect	YES	YES	YES
N	582	624	464
R-squared	0.944	0.955	0.950

Source: own research

### 5.5 Moderating effect

From this, it is clear that the new-type urbanization policy can significantly reduce crime. After that, the moderating effect test and simple slope analysis based on air pollution are carried out according to formula (3) in this part.

#### *Moderating effect test*

To decrease the multicollinearity, we calculate the centralized interaction terms to test the moderating effect, where the dummy variables are not centralized. Table 7 compares the main effect (shown in model 1) and the moderating effect (shown in model 2 and model 3). The result of model 2 in Table 7 indicates that the estimation of the interaction of PM<sub>2.5</sub> and D is significant and positive ( $\beta_3 = 0.1765, p < 0.05$ ) in the opposite direction of the main effect, meaning that air pollution could weaken the impact of the policy on crime. Specifically, the more severe the air pollution, the weaker the negative effect of the policy on crime; the better the air quality, the stronger the negative impact of the policy on crime. Thus, air pollution would undermine the crime-inhibiting effect of the policy.

Tab. 7 – The moderating effect analysis result.

Variables	Model (1)	Model (2)
	Baseline Regression	Moderating Effect Model
	Dependent variable: Crime	
D	-0.0811** (0.0352)	-0.0718** (0.0344)
PM <sub>2.5</sub>		-0.0025 (0.0536)
c_PM <sub>2.5</sub> ×D		0.1765** (0.0761)
Popdensity	0.0273 (0.0405)	0.0459 (0.0374)
Popsize	1.0670*** (0.2309)	1.0680*** (0.2248)
Othercrime	0.8179*** (0.0415)	0.8423*** (0.0363)
Gdp	0.0451	0.0031

	(0.0997)	(0.0925)
Public	0.1659 (0.1375)	0.1459 (0.1348)
Urgap	-0.0117 (0.1791)	0.0236 (0.1591)
Constant	-4.1244 (2.8268)	-3.9676 (2.7076)
City fixed effect	YES	YES
Year fixed effect	YES	YES
N	1,670	1,662
R-squared	0.950	0.951

Source: own research

*Simple slope analysis*

To further assess the moderating effect, we use simple slope analysis to verify the significance of simple slope. The simple slope is the partial derivative function of Equation (3) on the independent variable, interpreted as the moderating effect of air pollution on the relationship between new-type urbanization policy and crime. To verify the significance, we propose the null hypothesis as follows.

$$H_0: \beta_1 + \beta_3 \times PM_{2.5} = 0 \tag{7}$$

Here,  $\beta_1 + \beta_3 \times PM_{2.5}$  is the slope in Equation (3), also expressed as  $b_{simple}$ . When  $b_{simple}$  is not significant, the original hypothesis was rejected and the simple slope test was passed.

Furthermore, the pick-a-point approach is devoted to testing the significance of the simple slope by fixing moderating value and estimating t-statistics (Dawson, 2014). Thus, by constructing t-statistics, simple slope analysis based on the pick-a-point approach is used to assess the impact of the policy on crime for low, middle, and high air pollution (mean, mean±one SD). The t-statistics are:

$$t = \frac{\beta_1 + \beta_3 \times PM_{2.5}}{\sqrt{se_{\beta_1}^2 + 2 \times PM_{2.5} \times cov(\beta_1, \beta_3) + PM_{2.5}^2 \times se_{\beta_3}^2}} \tag{8}$$

Where,  $se_{\beta_1}$ ,  $se_{\beta_3}$  and  $cov(\beta_1, \beta_3)$  represent the standard error and covariance of the regression coefficients  $\beta_1$  and  $\beta_3$  in Equation (3) corresponding to the moderating effect model.

Based on the moderating effect result after centralizing all variables, in which the estimated results of independent variables, moderating variables, and the interaction term are the same as in Model (2) of Table 7, we analyze the simple slope analysis (shown in Figure 4). The result shows the simple slope analysis of air pollution moderating the association between the policy and crime. It suggests that at low levels of air pollution, the negative impact of the policy on crime is greater (mean-SD,  $b_{simple} = -0.112$ ,  $t = -2.466$ ,  $p = 0.014$ ) than at middle levels of air pollution (mean,  $b_{simple} = -0.072$ ,  $t = -2.089$ ,  $p = 0.037$ ). However, the policy is not significantly associated with crime at the high air pollution (mean+SD,  $b_{simple} = -0.032$ ,  $t = -1.063$ ,  $p = 0.288$ ). Thus, severely polluted air attenuates the intensity and significance of the negative impact of new-type urbanization policy on crime in our sample. Hypothesis 2 is further supported.

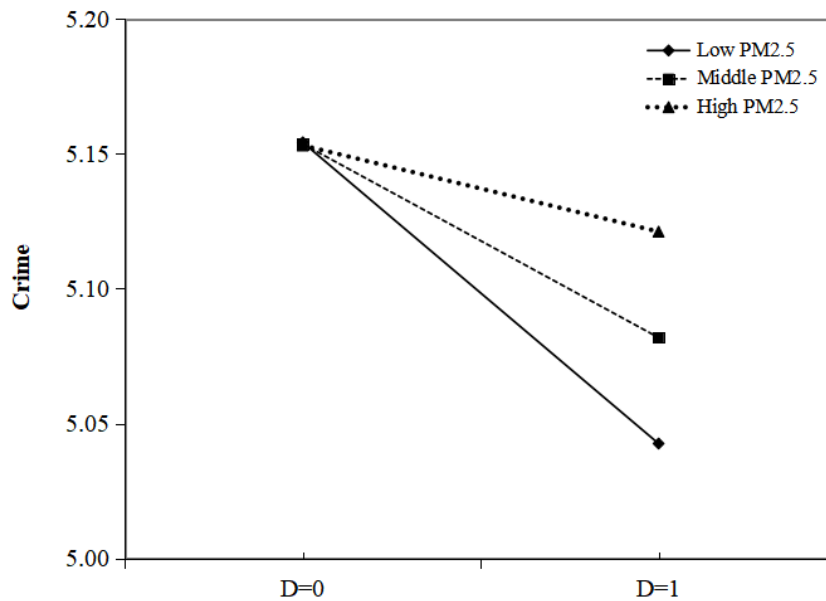


Fig. 4 –The moderating effect of air pollution (take PM<sub>2.5</sub> for example) on the relationship between new-type urbanization policy and crime based on the pick-a-point approach.  
Source: own research

## 6 DISCUSSION

This study analyzes the policy effect of new-type urbanization on crime and its mechanism of air pollution. The results show that the new-type urbanization policy could inhibit crime, and air pollution, as a moderating variable, would weaken the crime reduction effect of the policy.

Importantly, we find that the new-type urbanization policy has the potential to suppress crime, which is demonstrated by the baseline model and a series of robustness tests. This provides support for the notion of the role of high-quality urbanization in fostering regional harmony and the active correlation between spatially friendly new urban development and urban security (Foster et al., 2016; Wang & Wei, 2013). Moreover, we substantiate the trend of social policies reducing crime through measures such as increasing social security, aiding vulnerable groups, and developing urban infrastructure (Powell & Porter, 2023; Otsu et al., 2022; Hidalgo et al., 2021; Fallesen et al., 2018; and Spader et al., 2016).

Furthermore, compared to the western and central regions, the efficacy of the new-type urbanization policy in curbing crime is primarily evident in the eastern region. The eastern part of China is predominantly characterized by coastal cities, which possess a relatively strong economic foundation, advanced information technology, and high levels of intelligence, as well as more refined urban management capabilities and governance standards. The heightened inclusiveness of such areas can amplify the crime-suppressing potential of the new-type urbanization policy, enabling it to effectively harness urban resources, cater to the diverse public security needs of a substantial floating population, and foster social and economic growth while promoting social stability to maximize the effectiveness of the policy on suppressing crime. However, the eastern region, in comparison, is significantly more densely populated. A large city with a substantial population more likely leads to an elevated crime rate (Oliveira, 2021; Glaeser & Sacerdote, 1999). The heterogeneity test results also serve as a valuable reference for developing nations with a large population aiming to adopt an urbanization model that effectively curbs crime in major cities while simultaneously creating social cohesion. Furthermore, Liu et al. (2023) found by the index construction method that the eastern coastal

cities were primarily characterized by a high level of new-type urbanization. Thus, the result of the heterogeneity test is in accordance with objective reality.

Notably, air pollution plays a moderating role in the crime-reducing effect of the new-type urbanization policy. Optimal air quality significantly enhanced the magnitude and coefficient of the crime-reducing effect, whereas poor air quality undermined them. When air pollution is at a high level, the inhibitory policy effect of new-type urbanization on crime will no longer be significant. As one of the factors that induce crime, air pollution could increase people's health costs (Wu et al., 2021), and when the air environment is terrible to a certain extent, the hidden health risks will make more people be forced to bear additional health costs such as high medical expenses. When it is difficult to afford high medical expenses, people usually experience negative emotions such as despair, anxiety, and depression, which may generate criminal motivation (Hernández et al., 2020). As the number of people motivated to commit crimes increases, so does the number of additional groups that need to be covered by measures such as social security provided by the new-type urbanization. When the air environment deteriorates to a certain extent, the crime suppression effect of new-type urbanization is no longer significant due to the limited social resources. On the contrary, when the air quality is good, the human health and moral costs caused by air pollution are reduced. Reducing negative emotions and less pressure on health costs enable people to invest better in constructing new-type urbanization. The people-oriented policy system of new-type urbanization can effectively cover the demand groups and maximize its crime-inhibiting effect. Therefore, the results enrich the influence mechanism of new-type urbanization on crime and accord with the relevant research results of the natural environment and crime.

## 7 CONCLUSION

### 7.1 Conclusion

This study evaluates the impact of new-type urbanization policy on crime and the moderating effect of air pollution on the result, based on the panel data of 209 prefecture-level cities in China from 2014 to 2021, combined with the time-varying difference-in-differences model, the moderating effect model, and a simple slope analysis. By exploring the internal mechanism theoretically and verifying the statistical reliability of the research hypothesis empirically, the answers to the research questions are as follows.

Firstly, based on the literature and criminology theory, this study explores how the people-oriented notion of new-type urbanization affects crime. It found that new-type urbanization emphasizes human and social progress. Its policy could utilize the citizenization of peasant migrants, enhancing the quality of urbanization, and amalgamating urban-rural development, based on the sociology of crime, to mitigate social conflicts, consequently inhibiting crime.

Secondly, by utilizing the new-type urbanization policy as a quasi-natural experiment, we investigate whether implementing this pilot policy has effectively mitigated crime levels in the pilot cities. Empirical evidence confirms that the new-type urbanization policy substantially inhibits crime, effectively reducing crime rates in the pilot cities. This conclusion remains valid even after conducting a series of robustness tests. Additionally, regional heterogeneity exists in the crime suppression effect of new-type urbanization. The significance test confirms its effectiveness in the eastern region, whereas the central and western regions do not demonstrate significant results, which suggests that the crime suppression effect of the policy is more pronounced in areas with a more developed economy and a higher level of new-type urbanization.

Finally, the further mechanism tests identify a moderating factor, air pollution, that influences the policy's suppression effect on crime. The results indicate that air pollution could significantly diminish the crime suppression effect of the new-type urbanization policy. Moreover, in the presence of high levels of air pollution, the policy effect of the new-type urbanization on reducing crime becomes insignificant. Consequently, enhancing air quality governance can facilitate the role of urbanization in crime control while simultaneously promoting green, sustainable, and social safety development.

## 7.2 Policy implications

These conclusions have important policy implications for policymakers implementing new-type urbanization in China and constructing urbanization around developing countries to improve urban security competitiveness. Firstly, it is crucial to reinforce the fundamental principle of being people-oriented in-depth, as well as to collectively prioritize social and human progress for new-type urbanization. Enhancing urban inclusive capacity, focusing on welfare, and safeguarding citizens are essential to reducing and eliminating social contradiction. In order to implement the ideal vision, the policymaker should persistently advance the equitable provision of fundamental urban public services, further delve into the reform of the household registration system, and implement policy measures to ensure essential public education for migrant children.

Secondly, the development of new-type urbanization in the central and western regions should be strengthened. Furthermore, it is necessary to implement new-type urbanization plans based on local conditions. The eastern region should leverage its economic foundation and public resource advantages of coastal areas to prioritize enhancing the quality of population citizenship and addressing the needs of the migrants, as well as harmonizing urban and rural development simultaneously. The governments could establish a model safe city within the framework of new-type urbanization in the eastern region, fostering a new paradigm of comprehensive rule of law and normalized urbanization. In central and western regions, the policy work should shift to primarily promoting urban construction and enhancing urban governance to prepare for the increasing demands of the migrants resulting from urbanization and facilitate their integration into the cities.

Finally, the government should coordinate the joint development of urbanization and environmental regulation strategies by establishing novel low-carbon cities in both production and daily life and consistently enhancing their air quality, thereby constructing green cities and collaboratively establishing secure cities that embrace sustainable development.

Overall, social policies' impact could extend beyond their intended purposes, and well-crafted social policies may also generate positive externalities for the public good. In the process of urbanization, laying a solid urban foundation and ensuring social security for the labor force could serve as effective policy formulation strategies to enhance urban security competitiveness under the negative externalities of the urban scale.

## 7.3 Limitations and Prospects

Although this paper has made certain contributions to the associated fields, deficiencies and areas that require further expansion still exist. First and foremost, we primarily examine the crime of violating citizens' personal and democratic rights in China as an illustrative example to investigate the distinctive characteristics of crime and its correlation with the new-type urbanization policy. However, while this case serves as a representative example, it does not encompass the relationship between crimes such as property infringement and market destruction. Therefore, future research could explore the connection between new-type

urbanization and different types of crime by diversifying crime categories or specifying crime. Secondly, although the DID model partially mitigates endogenous issues among variables, it fails to capture the varying intensity of new-type urbanization across different regions. Despite using a comprehensive index of urbanization level based on light measurement to address deficiencies in index measurement, this measure still falls short in deconstructing the various essences of new-type urbanization. Consequently, future research could focus on the relationship between the specific scientific connotation of new-type urbanization and crime by constructing new-type indicators.

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